Environmental Transparency in Earnings Calls and Its Impact on Cost of Capital

Abstract

This study investigates the impact of environmental transparency in earnings conference calls (ECCs) on a firm's cost of capital. We analyze 130,434 ECC transcripts from 3,046 U.S.-listed firms between 2007 and 2020 using a hybrid methodology combining bigram keyword searches and a large language model (LLM) to identify and classify environmental disclosures as either environmental risks, impacting firm performance or externalities with broader societal implications. Our findings indicate a notable rise in environmental discussions during ECCs, particularly in the Q&A sections, where analyst-driven inquiries lead to more spontaneous managerial responses. Our results reveal that environmental disclosures, especially those regarding externalities, are associated with a lower cost of capital, enhancing investor confidence. Furthermore, the impact of these disclosures is most significant in firms with lower levels of institutional ownership and those with higher ESG-controversy scores, suggesting that transparency plays a vital role in reducing perceived risks, especially for firms with potentially negative environmental reputations. This study underscores the importance of proactive environmental transparency in ECCs to optimize firms' financing conditions and ensure alignment with evolving regulatory and stakeholder expectations.

Keywords: Narrative disclosure, Earnings conference calls (ECCs), Environmental transparency, Environmental risk, Environmental externalities, Cost of capital.

1. Introduction

In response to increasing stakeholder demands for improved environmental and social performance, firms have significantly expanded their disclosure of activities related to corporate social responsibility (CSR), with a particular focus on their environmental impact (Marquis, 2016). Institutional investors and advocacy groups, such as the Global Reporting Initiative (GRI), Climate Disclosure Standards Board, and Corporate Reporting Dialogue, are driving firms to respond to these normative pressures by enhancing transparency. As a result, sustainability has become a central component of corporate strategy, with over 90% of CEOs recognizing its importance for long-term value creation (Accenture and UN Global Compact, 2010). This shift has led to more companies reporting their environmental and social efforts through established sustainability frameworks (Global Reporting Initiative, 2013; Sustainability Accounting Standards Board, 2011). Financial analysts, as information intermediaries, are expected to evaluate, understand, and interpret the environmental disclosures by firms they cover and the implications of these for firm risk. This attention is required because of the complexity of assessing the implications of environmental performance and the potential that these disclosures amount to greenwashing. Empirical evidence indicates that analysts integrate environmental performance into their research recommendations (Eccles et al., 2011; Ioannou and Serafeim, 2015).

However, there is a notable dissonance between the growing emphasis on sustainability in formal corporate reports and the limited content in earnings conference calls (ECCs) related to environmental issues. These calls are a crucial forum for direct interaction between analysts and corporate managers and are highly influential for investors. There are thus important questions about whether analysts actively inquire about environmental issues or whether management is reluctant to discuss these topics during ECCs. This study examines the interactions between financial analysts and corporate managers during ECCs to assess analysts' demand for environmental disclosures, the impact of the disclosures made by managers, and the influence of the "spontaneous" managerial responses elicited through analyst questions on the cost of capital.

While existing studies often treat environmental disclosure as a single category, this disclo-

sure may highlight different aspects of a firm's environmental impact, depending on whether the focus is on risks to the company or the broader societal and environmental consequences of its activities. Shareholder-focused environmental disclosures typically emphasize risks that directly affect the firm's financial performance, such as regulatory compliance, litigation, and the physical impacts of climate change (Eccles et al., 2014; Khan et al., 2016). This approach highlights how environmental risks may threaten a firm's market value and long-term competitiveness. In contrast, a stakeholder-oriented perspective addresses the broader environmental externalities of a firm's operations — such as pollution, resource depletion, and contributions to climate change — which may not pose an immediate financial risk but have significant consequences for society, governments, NGOs, and local communities (Bebbington and Larrinaga, 2014; Unerman et al., 2018). Given the distinct nature of these disclosures, it is important to assess them separately. The shareholder-focused approach highlights immediate financial risks directly affecting the firm. The stakeholder-oriented perspective examines broader environmental externalities, such as the firm's impacts on nature and society, which may not pose immediate risks but are important for understanding the long-term sustainability impacts of a firm's operations.

A large body of research shows how financial reporting transparency is linked to capital market benefits by decreasing cash flow uncertainty and shaping investor expectations. This relationship appears to extend to environmental disclosures, with several studies indicating that transparent environmental disclosure is associated with a lower cost of equity capital. Studies such as Aerts et al. (2008) and Dhaliwal et al. (2011) find that environmental disclosures can lower information risk, leading to a reduced cost of capital. However, the assumption that greater transparency uniformly reduces the cost of capital is not consistently supported. Some studies argue that the impact of transparency on the cost of capital depends on whether the disclosures are positive or negative, with favorable information lowering costs and unfavorable information potentially raising them (Johnstone, 2016). This is supported in the context of environmental disclosures, with several studies reporting either no significant relationship (Clarkson et al., 2013; Plumlee et al., 2015) or even a positive association (Richardson and Welker, 2001; Berkman et al., 2024) between environmental disclosures and the cost of capital.

We address our research questions through computerized textual analysis of 130,434 ECC transcripts from 3,046 U.S.-listed firms from 2007 to 2020. Our methodology measures environmental disclosure in ECCs by distinguishing between environmental risks, which affect financial performance, and environmental externalities, which have broader societal impacts. First, we use a bigram keyword search to identify environmental disclosures in both the introduction and Q&A sessions of ECCs. We address limitations of keyword searches — such as false positives and lack of context sensitivity — by refining the search using GPT-3.5-turbo, which has been shown to improve contextual interpretation and reduce false positives (Gu et al., 2023).

By combining the above approaches, we ensure comprehensive identification of environmental disclosures, with ChatGPT further classifying the discussions as concerning either environmental risks or externalities. We show a notable increase in the discussion of environmental issues during ECCs held from 2007 to 2020. In 2007, environmental topics accounted for 2.07% of the conversation, rising to 4.10% by 2020. The most significant growth occurred in the Q&A sections, where environmental topics raised in questions increased 2.4 times and nearly doubled for responses. Additionally, the percentage of ECCs mentioning environmental topics grew from 20.09% in 2007 to 28% in 2020, reflecting the growing importance of environmental issues in corporate communications.

Next, we investigate the economic consequences of environmental disclosures during ECCs and find a negative relationship between the extent of such disclosures and the cost of capital. In addition, in the short term, an increase in environmental disclosure during ECCs leads to significant positive market responses; this further supports the conclusion that greater transparency regarding environmental issues reduces the cost of capital as investors reward firms with better financing terms in response. Across different sections of the ECC — introduction, questions, and answers— all types of environmental disclosure are associated with a reduction in the cost of capital.

The voluntary disclosures by management in the introduction have the strongest and most statistically significant impact, suggesting that proactive transparency increases investor confidence. Questions from analysts and responses from management regarding environmental

issues also contribute to lowering the cost of capital. Our further analysis shows distinct effects based on the type of disclosure. While disclosures of general environmental risk do not significantly impact the cost of capital, disclosures of environmental externalities consistently reduce the cost of capital, whether presented in the introduction or the Q&A, reflecting their stronger influence on investor confidence. The impact of environmental disclosures on the cost of capital also varies depending on a firm's information environment. In firms with higher information asymmetry, indicated by low levels of IO, environmental disclosures — especially in the introduction and during analysts' questions — have a stronger effect in reducing the cost of capital. This suggests that less informed investors rely more heavily on these disclosures to assess risk.

Our results remain robust even when addressing potential bias from selective disclosure, where management may highlight positive environmental achievements while downplaying negative factors, such as environmental investigations. We mitigate this concern by isolating firms that have faced publicly known adverse environmental events and firms that offer the most voluntary disclosures of environmental information. In both cases, we find that the reduction in the cost of capital persists. However, this effect is significantly more pronounced for firms confronting a negative context, as measured by environmental, social, and governance (ESG) controversies; the reduction in the cost of capital for firms disclosing positive achievements is only marginally significant.

Our study makes several contributions to the literature. First, it enhances our understanding of the impact of environmental discussions during ECCs on a firm's cost of capital. Existing studies indicate that effective communication can reduce a firm's cost of capital (Graham et al., 2005). There is also well-documented academic interest in the relationship between financial transparency and the cost of capital (Diamond and Verrecchia, 1991; Botosan, 1997; Leuz and Verrecchia, 2000; Botosan and Plumlee, 2002; Lambert et al., 2007). We build on this body of work by examining the relationship between the extent of environmental disclosure in ECCs and firm value.

While the relationship between corporate environmental disclosures and various financial outcomes has been studied extensively, much of this research focuses on aggregate reporting

measures or external sustainability reports. Unlike static reports, ECCs offer a real-time, interactive platform in which environmental issues are directly discussed by senior management in response to stakeholder inquiries, potentially providing further insight into corporate environmental strategies. Our findings demonstrate that increased environmental disclosure in ECCs is associated with a reduction in the cost of capital, highlighting the role of transparency in mitigating perceived risks and enhancing firms' financing conditions.

Our study also holds significant relevance for practitioners and regulators, particularly given the increasing focus on ESG disclosures and environmental transparency. With the U.S. Securities and Exchange Commission (SEC) having provided updated guidance on climate-related risk disclosures to enhance their relevance and value (U.S. Securities and Exchange Commission, 2021), it is critical to understand the distinct aspects of environmental disclosure. To the best of our knowledge, our study is among the first to examine environmental disclosures by separating these into environmental risks, which directly affect the firm, and environmental externalities, which reflect broader societal impacts, a distinction that is consistent with regulators' discussions of double materiality.

The existing literature often treats environmental disclosure as a single concept, overlooking the subtle distinctions between these two categories. By employing a novel approach that separates ECC content into risk and externality categories, we demonstrate that both types of disclosures reduce the cost of capital, with externalities having a stronger effect. Our findings offer valuable insight for regulatory efforts to improve the comprehensiveness and utility of environmental disclosures, ensuring they meet the evolving expectations of stakeholders and regulators while enhancing corporate transparency and accountability.

Lastly, our study advances the literature on the computerized content analysis of disclosures by introducing a novel methodology that incorporates LLMs. There has thus far been limited application of natural language processing (NLP) to directly address specific questions about firms' ESG practices and outcomes or environmental disclosure specifically (Mehra et al., 2022). This may be because of the difficulty of developing custom algorithms to extract relevant environmental information from text data. Recent advancements in LLMs like ChatGPT offer novel opportunities for information extraction. Our contribution lies in effectively combining

traditional NLP approaches with emerging LLM technologies to optimize text extraction and interpretation in the context of environmental disclosure. This dual method allows for more precise and reliable extraction and interpretation of environmental disclosures.

2. Literature Review

The progression of environmental disclosure is well documented in the accounting literature, with a notable shift from voluntary to more structured reporting over the past few decades. Early studies such as Ingram and Frazier (1980) note the voluntary nature of environmental reporting at the time, which was often linked to positive environmental performance or mitigating public pressure. With the increasing recognition of the importance of sustainability, the notion of triple-bottom-line reporting – emphasizing social, environmental, and financial performance – has gained traction. Gray et al. (1995) provide a critical review of early developments, suggesting that disclosures were often symbolic rather than substantive. More recently, the establishment of guidelines by the GRI and similar bodies and the push for integrated reporting have prompted a wave of research into the standardization and comparability of disclosures (Adams, 2002; de Villiers et al., 2014).

Financial analysts play a significant role in the capital markets by providing information and investment recommendations on which investors rely, and there is a substantial literature finding that analyst stock recommendations provide value-relevant information (Barber et al., 2010; Bradley et al., 2014). The widespread use of CSR reports and the availability of ESG performance metrics published by external groups require that financial analysts examine and understand the environmental performance of the firms they cover. Research suggests that financial analysts scrutinize CSR reports and find environmental information useful. For example, Ioannou and Serafeim (2010) find evidence that sell-side analysts issue more optimistic recommendations for companies with higher sustainability scores, and Eccles et al. (2011) find that analysts consider the financial implications of greenhouse gas (GHG) emissions in their investment recommendations. Ioannou and Serafeim (2015) find that top-ranking analysts are the first to incorporate CSR ratings into their investment recommendations. However, due to the inherent complexity of environmental disclosure, interpreting and translating those ratings

into stock recommendations is a difficult task. Griffin et al. (2020) document an increase in analysts' information-processing costs when they process a wider array of environmental performance ratings. More specifically, they find that as the number of environmental performance ratings assessed increases, analysts cover fewer firms in their portfolio and provide fewer and less timely earnings-per-share (EPS) forecast revisions.

Given the growing importance of environmental issues for firm management and financial analysts, ECCs are a valuable site for observing how these matters are addressed. For several reasons, EECs serve as an effective venue for measuring information demand and management's willingness to disclose. ECCs typically begin with an introduction during which managers have the opportunity to voluntarily disclose information, including the firm's stance on environmental issues. Assessment of this segment allows for the capture of voluntary disclosures by managers of information they are willing to share proactively. The subsequent Q&A session is an opportunity for analysts to question managers directly about topics of specific interest, including environmental and ESG concerns, helping to clarify ambiguities and gain deeper insights into the firm's environmental performance. Analysts can uncover additional information not fully covered in formal CSR reports, and managers may feel pressured to respond transparently due to concerns over negative market reaction (Gow et al., 2019). Despite these opportunities offerd by ECCs, a notable disconnect remains: while sustainability has gained prominence as a topic in corporate reports, ECC discussions are still largely focused on short-term financial performance (Eccles and Serafeim, 2013). Although research shows an increase in sustainability disclosures in ECCs, they remain relatively limited (Dzielinski et al., 2022).

Analysts' incentives to inquire about environmental performance and management's willingness to provide such information can vary on their other, competing interested. Analysts incur high processing costs when dealing with extensive environmental disclosures (Griffin et al., 2020) and may seek to reduce these by obtaining clear and direct information from management. Analysts might also choose to minimize these processing costs and avoid delaying the price discovery process by not incorporating environmental information into their evaluation models and thus not feeling the need to inquire about environmental performance. Similarly, management faces its own set of conflicting incentives. Providing detailed environ-

mental information can decrease the cost of equity capital. Investors value transparency and robust disclosures, which can lower the perceived risk (Graham et al., 2005; Plumlee et al., 2015). However, managers might opt to downplay environmental disclosure to avoid signaling a shift in the firm's focus away from maximizing investment returns. This interplay affects the extent of management's environmental transparency, which, in turn, impacts the firm's cost of capital.

A considerable body of accounting research links transparency in financial reporting to various capital-market benefits, including a reduction in the cost of equity (Botosan, 1997; Sengupta, 1998; Lambert et al., 2007). The theoretical study by Lambert et al. (2007) demonstrates that accounting transparency can influence the cost of equity by reducing cash-flow uncertainty and shaping investor expectations regarding future cash flows. This relationship appears to extend to environmental disclosures. Several studies find that transparency in environmental disclosure is associated with a reduction in information risk, higher firm value, and a lower cost of equity capital (Dhaliwal et al., 2011; García-Sánchez and Noguera-Gámez, 2017). Specifically, Dhaliwal et al. (2011) investigate whether the initiation of voluntary CSR disclosure via a stand-alone report affects a firm's cost of capital. They find that firms with a high cost of capital are more likely to issue a stand-alone CSR report and that the cost of capital decreases for firms that initiate reports with CSR performance above the industry mean. Similarly, García-Sánchez and Noguera-Gámez (2017) find that transparency in sustainability practices, particularly in countries where stakeholder rights are emphasized, can lead to a decrease in the cost of capital.

However, the assumption that greater transparency invariably leads to a lower cost of capital has been challenged. Johnstone (2016) argues that the effect of accounting information on the cost of capital depends not only on its precision but also on whether it is favorable or unfavorable. Favorable information, which increases expected future payoffs, generally reduces the cost of capital. Conversely, this cost may increase if transparency leads to greater certainty that future payoffs will be low and highly dependent on market-wide risks. In the context of environmental disclosures, increased transparency may draw attention to existing uncertainty and risks, potentially leading to a higher cost of capital. The accounting literature offers mixed

findings regarding the impact of environmental disclosure on the cost of capital. While some studies report a reduction in the cost of capital following increased environmental transparency, as mentioned above, others find no significant relationship or identify a positive relationship, indicating that environmental disclosure may, under certain conditions, increase the cost of capital. For instance, Clarkson et al. (2013) do not find a significant relationship between the quality of environmental disclosure and the cost of capital, although they note that firms with higher-quality environmental disclosures reported higher future returns on assets. Plumlee et al. (2015) also find no direct relationship between the cost of capital and overall environmental disclosure, as measured by their self-constructed index. However, when they examine specific aspects of the quality of environmental disclosure, such as type (hard or soft) and nature (positive, neutral, or negative), they identify an inverse relationship between the cost of capital and certain types of environmental disclosure. Finally, Berkman et al. (2024) find a positive association between the extensiveness of climate-risk-related disclosures in 10-K filings and the cost of capital. The long-term payoff profile of environmentally responsible projects could contribute to increased risk, thereby affecting the cost of capital. Taking into consideration the inconclusive results concerning the relationship between environmental disclosure and the cost of capital, our research question is as follows:

RQ: Do environmental disclosures during ECCs influence firms' cost of capital?

Most studies approach environmental disclosure as a uniform concept. However, there is growing recognition of the need to differentiate between disclosures that address environmental risks to the company and those that concern environmental externalities. Environmental risk refers to factors that directly affect a firm's financial performance, such as regulatory compliance, litigation, and climate-related liabilities. Environmental externalities encompass the wider societal and environmental impacts of a firm's activities, such as pollution, resource depletion, and contributions to climate change. In the U.S., while regulatory frameworks such as those promoted by the SEC are beginning to emphasize more comprehensive ESG reporting (SEC, 2022), the distinction between environmental risks and externalities remains an important issue. Organizations like the Sustainability Accounting Standards Board (SASB) and the

GRI encourage companies to account for both the direct financial impacts and the wider societal consequences of their operations.

ECCs offer a valuable platform to evaluate how financial analysts engage with these distinctions. The content of ECCs reflects topics of mutual concern for firms and financial analysts, indicating the relevance of these issues to the process of stock valuation. The proportion of time dedicated to specific topics during these calls may indicate their significance in the valuation process. By analyzing the environmental questions posed by financial analysts during ECCs, it is possible to discern whether their focus is primarily on environmental risks — such as the effects of environmental factors on profitability and stock valuation — or on externalities, which include the wider societal and environmental impacts of a firm's operations.

3. Empirical Design

We test the relationship between the extent of environmental disclosure in ECCs and the cost of capital and, to this end, estimate the following equation drawing from prior research (Dhaliwal et al., 2011; Plumlee et al., 2015):

$$\text{CoC}_{i,q} = \hat{\alpha}_i + \hat{\beta}_i \cdot \text{EnvDisclosure}_{i,q} + \sum_{j=1}^{J} \hat{\delta}_j \cdot \text{Controls}_{j,i,q}, \tag{1}$$

where $CoC_{i,q}$ is the implied cost of equity capital two months after the fiscal year-end, calculated as per the Easton (2004) PEG (Price Earnings Growth) model (see Section 3.2 below) for firm i in quarter q. $EnvDisclosure_{i,q}$ reflects environmental disclosures as a proportion of the entire ECC; the separate components of the ECC are denoted as *EnvDisclosure_intro*, *EnvDisclosure_questions* and *EnvDisclosure_answers*, and the separate components of environmental information are categorized as *EnvDisclosure_Risk*, reflecing environmental risk to the firm, and *EnvDisclosure_Externalities*, capturing environmental impacts and externalities (see Section 3.1 below).

Controls$_{j,i,q}$ is a set of control variables, including *HighEnvScore*, a dummy variable that is equal to 1 if the firm's environmental score from Eikon is higher than the industry median, and

0 otherwise,[1] and *High_CO2_Emitter*, a dummy variable equal to 1 if the firm's CO2 emissions in tonnes, as measured by Refinitiv, are above the industry median.[2].

Additional control variables include *Size*, measured as the natural logarithm of total assets at the end of the fiscal year, *Book-to-Market*, defined as the ratio of the book value of equity to the market value of equity, and *Leverage*, defined as the ratio of total debt to total assets. *Beta* is estimated from the market model using daily CRSP stock returns. *Forecast Dispersion* is the standard deviation of analysts' earnings forecasts for quarter $t + 1$, outstanding 3 days after the ECC for quarter t, divided by the absolute value of the mean consensus forecast outstanding 3 days after the conference call for quarter t, and multiplied by 100. We use industry- and quarter-year-fixed effects to control for any industry- or time-specific ECC characteristics. Additionally, we estimate Equation (1) with robust standard errors clustered at the firm level. All variables are defined in Appendix A.

Our initial sample consists of all quarterly ECC transcripts of U.S.-listed firms from 2007 to 2020 obtained from Finnhub Stock API.[3]. The quarterly observations are supplemented with firm fundamentals and stock market data from CRSP and Compustat, IBES data on the analysts covering the firms, and the dates and times of the ECCs from Refinitiv. While we measure environmental disclosures across all quarterly ECCs, we estimate our regressions using only disclosures from fourth-quarter ECCs. This methodological choice is grounded in the recognition that environmental disclosures tend to exhibit a degree of stickiness, with incremental changes from quarter to quarter being relatively small. Analyzing these disclosures on a quarterly basis may lead to redundancy. In addition, their impact on a firm's financial performance and cost of capital is likely to manifest more significantly over a longer horizon. The literature supports this approach, as studies measuring the impact of environmental disclosure on the cost of capital typically use firm-year observations (Dhaliwal et al., 2011; Plumlee et al., 2015).

[1]The environmental score is part of Eikon's ESG disclosure data and measures a company's environmental performance based on various metrics related to sustainability, resource use, emissions, and environmental innovation.

[2]Refinitiv measures CO2 emissions in tonnes based on company-reported data or estimates where data is unavailable. The measure includes Scope 1 (direct emissions from company operations), Scope 2 (indirect emissions from purchased energy), and, in some cases, Scope 3 (other indirect emissions along the value chain), ensuring a comprehensive view of a firm's carbon footprint relative to its industry peers.

[3]https://finnhub.io/

Table 1 details our sample construction.

[Table 1 about here.]

3.1. Measuring environmental disclosures in ECCs

We measure environmental disclosures in ECCs in several steps. First, we parse ECC transcripts into speech segments based on a change in speakers, ensuring each segment pertains to one speaker and includes their title and affiliation. We then divide each transcript into two parts: an introduction by managers and a Q&A session. The Q&A session starts with the first segment featuring an analyst, with all prior segments being treated as part of the introduction.

In the Q&A session, we tag segments as either questions (by analysts) or answers (by managers). We exclude speakers with titles such as "operator" or "editor". Next, we analyze the top one hundred most common titles, identifying and classifying those associated with managerial roles.[4]

Lastly, we examine a sample of 2,000 ECCs to identify management-team names and affiliations not captured in the preceding steps and search for these across the entire database. We then convert all characters to lowercase and remove punctuation such as periods, colons, commas, and parentheses. Next, we tokenize and lemmatize the text, splitting it into a list of base-form words for each speech segment. Lastly, we combine some tokens into common multi-word expressions of two or three words to handle n-grams. [5]

Our second step involves a comprehensive list of environmental keywords, presented in Appendix B. This list is based on the extensive list of environmental keywords that Frövenholt and Wirdéus (2023) derive from a large corpus of European firms' ECC transcripts and

[4]Titles classified as managerial include chief, president, CEO, CFO, VP, COO, director, IR, relations, chairman, secretary, treasurer, CIO, controller, corporate communications, CAO, CCO, CSO, officer, CTO, founder, CMO, CRO, account, board, operations, manager, head, assistant, human.

[5]We derive common multi-word expressions from the Python library Genism (https://pypi.org/project/gensim/)

other relevant documents, such as sustainability reports and regulatory filings.[6] We utilize all the bigrams developed by Frövenholt and Wirdéus (2023) and other keywords used by prior research to identify segments containing at least one environmental keyword and retrieve the accompanying question or answer. This allows us to create a corpus of question-answer pairs from ECCs, where at least one pair includes an environment-related keyword.

While keyword searches can effectively identify relevant environmental terms, as previous studies make clear (Loughran and Mcdonald, 2016; Bochkay et al., 2020), one of the main drawbacks of a bag-of-words textual analysis is the high rate of false positives arising from the ambiguous use of environmental keywords. For example, the keyword "clean up" is one of the top five most-used environmental keywords in ECCs. However, manual checks revealed that it can be used in a financial sense, for example, "clean up inventory", or in an environmental context, for example, "clean up the river bed". We address this issue by using commercially available LLMs, specifically ChatGPT-3.5 Turbo, to evaluate the relevance of the environmental keywords in the ECC context.

We first use a refined prompt to allow the language model to determine whether a speech segment concerns environmental matters. For each segment, ChatGPT provides a classification of "Yes" if it mentions environmental matters, "No" if it does not, "Uncertain - Content" if the context is unclear, or "Uncertain - Format" if the response format is unexpected. In addition, we capture the explanation or rationale for the classification of each speech segment.

For speech segments classified as relevant to environmental matters, we conduct further analysis by providing ChatGPT-3.5 Turbo with a new prompt to classify the text according to whether it pertains to environmental risk or externalities.[7] Similar to the approach above, we prompt ChatGPT not only to classify the text according to these categories but also to provide

[6]Frövenholt and Wirdéus (2023) began with a list of environmental bigram keywords related to environmental issues, including terms such as "greenhouse gas," "gas emissions", "renewable energy", "air pollution", and "water usage". All climate change bigrams identified by Sautner et al. (2023) were incorporated. The authors refine this list by manually reviewing random reports to extract new relevant environmental bigrams. This process involved repeatedly extracting and categorizing 100 paragraphs from 500 randomly selected reports based on their relevance to environmental matters. They then manually analyzed these paragraphs to add additional bigrams from those already categorized as being related to the environment, identifying and categorizing previously uncategorized relevant bigrams and confirming the accuracy of the classifications. Bigrams with a high frequency or a significant number of occurrences were then validated through manual review before being added to the environmental category.

[7]The refined prompts developed through prompt engineering for each task are shown in Appendix C.

an explanation for each classification. We ensure the accuracy of the initial relevance assessment and the subsequent classifications by manually reviewing and validating the classification of over 1,000 speech segments. Examples of classifications based on keywords, ChatGPT assessment, and classifications of environmental risk and externalities are provided in Appendix D.

3.2. Measuring the cost of capital

The cost of equity capital represents the rate of return implied by current prices and future cash flows and is thus not directly observable. Prior research offers several methods to estimate the ex-ante cost of equity capital (Botosan and Plumlee, 2002; Gebhardt et al., 2001; Gordon and Gordon, 1997; Ohlson et al., 2005). These methods are fundamentally reliant on analyst forecast data to match the current stock price with a series of expected future (abnormal) cash flows. Botosan and Plumlee (2005) compare these approaches by analyzing the relationship between cost-of-capital estimates and firm-specific risks, including market risk, leverage, information risk, firm size, and growth. They conclude that the target price method from Botosan and Plumlee (2002) and the PEG ratio method from Easton (2004) are more reliable than other methods.

Building on prior research, we apply the PEG ration method in Easton (2004) to estimate the firm-specific ex-ante cost of equity capital. This estimation requires data on price and earnings growth, with the cost of equity capital calculated as the square root of the inverse of the PEG ratio:

$$r = \sqrt{\frac{\mathrm{EPS}_2 - \mathrm{EPS}_1}{P_0}}, \tag{2}$$

where r is the cost of equity capital; *EPS1* is the 1-year ahead mean analysts' earnings forecast per share; *EPS2* is the 2-year ahead mean analysts' earnings forecast per share; *P0* is the price per share two months after the ECC.

4. Results

4.1. Descriptive statistics

4.1.1. Environmental disclosures in ECCs

As outlined in Section 3.1, our initial approach to identifying speeches containing environmental disclosures during ECCs involved a bag-of-words search using environmental keywords established in prior research. This search yielded a total of 79,870 speeches containing at least one environmental keyword. The subsequent analysis, where these speeches were further processed using ChatGPT, determined that 62,297 instances (52%) were unrelated to environmental matters or lacked sufficient context to confirm their relevance to environmental topics. Conversely, 58,450 speeches (48%) were confirmed to be related to environmental matters. Detailed examples of ChatGPT's classification outcomes — categorized as related to environmental matters ("Yes"), unrelated ("No"), or contextually ambiguous ("Uncertain Content") — together with the corresponding rationale for such categorization are provided in Appendix D.

For the speeches containing environmental keywords and classified as related to the environment, we examine the average number of mentions of the top five environmental phrases by year throughout our sample period. Figure 1 illustrates the evolution of these mentions over time, providing insight into how the focus on specific environmental topics has shifted. Consistent mentions of "natural gas" and "renewable energy" are observed throughout, likely driven by the prominence of the oil and gas industry in the disclosures.

In recent years, there has been a noticeable increase in discussions surrounding "clean energy", which began to gain traction in 2012, and there has been a steady rise since then. A similar trend is observed for "greenhouse gas", discussions of which have significantly increased in the last three years. This surge may reflect growing regulatory pressures and public concern over climate change. Conversely, discussions on "energy efficiency", which were previously prevalent, have declined markedly in the past two years. This decline could be the result of a shift in focus toward broader and more emergent topics, such as clean energy and greenhouse gas emissions, potentially overshadowing the emphasis on energy efficiency.

[Figure 1 about here.]

We explore the change in environmental disclosures within ECCs over the past several years and in Table 2 present the average percentage of environmental disclosure for each section of the ECC — introduction, questions, and answers — by year. In 2007, environmental content made up 1.61% of the introduction, with 0.13% and 0.33% of the questions and answers sections, respectively, comprising such content. By 2020, a significant increase in environmental disclosure is seen across all sections. The introductory section's environmental content increased to 2.79%, representing a 73% growth. However, the most remarkable growth occurred in the questions and answers sections. The percentage of environmental disclosure in the questions section more than tripled to 0.44% and more than doubled in the answers section, rising to 0.87%. While there has been growth in the interactive sections of ECCs addressing environmental topics, the share remains relatively low. This suggests that, although stakeholders are increasingly probing companies on their environmental practices, and companies more frequently address these concerns, the overall level of engagement remains modest.

[Table 2 about here.]

Table 3 shows the proportion of ECCs containing any mention of environmental matters, which shows the broader adoption of environmental topics across firms. In 2007, only 17.24% of firms' ECC introductions included any mention of environmental topics, with even fewer mentions in the question (3.24%) and answer (8.83%) portions. By 2020, these proportions had increased to 24.2% for introductions, 7.07% for questions, and 11.20% for answers. This shows a clear increase in the environmental discussions within ECCs, as observed in Table 2, and a significant rise in the number of firms addressing environmental issues in any way during these calls.

[Table 3 about here.]

Figure 2 and Figure 3 show that the increase in environmental disclosure in ECCs has not followed a steady upward trajectory. Specifically, we observe a notable rise in environmental discussions during 2010 and 2011, followed by a decline to levels similar to those seen before 2010. The noteworthy rise in 2010 and 2011 likely reflects heightened concern stemming from two major environmental disasters at that time: the Deepwater Horizon oil spill in 2010 (one

of the largest in U.S. history) and the Fukushima Daiichi nuclear disaster in 2011. Both events drew significant global attention to environmental risks and corporate responsibility, leading to a temporary spike in ECC discussions on these topics. The subsequent decline in disclosure is likely a return to more typical levels as the immediate impacts of these crises subsided.

There has been a sustained and significant increase in environmental discourse in the latter part of the decade, beginning after 2018. This can be linked to increasing global attention to climate change, particularly following the conclusion of the Paris Agreement and the heightened focus on climate action at events like the COP24 conference held in Katowice, Poland, in December 2018. COP24 was crucial in advancing the goals of the Paris Agreement and emphasized the need for enhanced transparency in environmental reporting and corporate sustainability practices. This likely contributed to the renewed emphasis on environmental disclosure in subsequent years.

[Figure 2 about here.]

[Figure 3 about here.]

4.1.2. Trends in Disclosure of Environmental Risk and Externalities in ECCs

As outlined in Section 3.1, the final step in our evaluation of ECC environmental disclosures involves applying an analytical approach that distinguishes between environmental risk and externalities in the speeches identified as relating to environmental matters. This approach highlights the risks environmental issues pose to firms' financial performance and the broader environmental and societal externalities arising from their operations. Specifically, environmentally relevant speeches were categorized along two dimensions: Environmental risk, where firms disclose the potential financial impact of environmental matters on their performance, and environmental externalities, where firms disclose their impact on the environment and society. Detailed examples of ChatGPT's classification outcomes—categorized – as "environmental risk", "environmental externalities", or "neither" — are provided in Appendix D.

Figure 4 illustrates the development of disclosures of environmental risk and externalities over time. Panel 4a, Panels 4b and 4c present separately the changes in these disclosures for the introductory, questions, and answers sessions in ECCs. In Panel 4a, introductory content

focused on environmental risk consistently dominated environmental disclosure from 2007 until 2018. This trend reflects the traditional emphasis on how environmental issues affect firm performance and financials, aligning with the long-standing prioritization of risks to the firm in regulatory and investor communications.

There has been a noticeable shift from 2018, when there was a marked increase in disclosure of externalities, and these eventually surpassed risk-focused disclosures. This shift suggests a growing recognition among U.S. firms of the importance of a firm's broader environmental and social impacts. The surge in disclosure of externalities after 2018 may be attributable to several factors. Notably, ESG criteria are increasingly influencing investment decisions, and there is growing pressure from stakeholders, including investors, consumers, and advocacy groups.

Various frameworks, such as the SASB (SASB, 2018) and the Task Force on Climate-related Financial Disclosures (TCFD) (TCFD, 2017), have been developed in response to the rising demand for transparency and accountability in how companies manage and report on their environmental and societal impacts. Global concerns about climate change, resource scarcity, and social inequality have led to a consensus that traditional financial reporting alone is insufficient to capture the full spectrum of risks and opportunities encountered by businesses. These frameworks aim to standardize and enhance the quality of disclosures related to environmental externalities, helping firms align their practices with global standards and expectations. The adoption of such frameworks by U.S. firms from 2017 and 2018 onwards is a reflection of their response to the evolving global pressures and the increasing integration of sustainability into the core of corporate strategy and governance.

Panel 4b explores the trends in the proportion of questions related to environmental risk and externalities. Unlike disclosures in the introduction sections, environmental risk remains the predominant theme throughout the period, with notable peaks in 2012 and again after 2018, reflecting a sustained focus on transparency regarding the impact of environmental issues on firm performance. Analysts are crucial to enhancing transparency. By probing how environmental issues affect firm performance, they encourage companies to make more detailed and transparent disclosures. The peak in 2012 likely corresponds to the increased emphasis on environmental disclosures following the issue of the U.S. SEC 2010 guidance (SEC, 2010) on

climate change. This guidance required companies to disclose material impacts related to climate risks in their regulatory filings. By 2012, this had led to heightened scrutiny from analysts, who were keen to understand how these disclosures affected firms' financial performance, particularly as companies navigated the ongoing economic recovery from the 2008 financial crisis. The post-2018 peak can be attributed to different dynamics. By this time, there was a growing emphasis globally on sustainability and ESG factors, driven by increased regulatory scrutiny, such as the recommendations of the TCFD (TCFD, 2017) and the adoption of the SASB standards (SASB, 2018), as mentioned above. Market volatility and specific challenges, such as the U.S.-China trade tensions, may also have prompted analysts to seek more detailed information on how these broader environmental and societal issues impacted firm financials (Baker et al., 2016; Lu et al., 2020). The lack of a substantial increase in externality-related questions, even after 2018, suggests that while their importance is acknowledged in reporting, they have not yet become a central theme in the inquiries made by financial analysts. This divergence highlights the potential gap between corporate disclosures and the topics that are prioritized in stakeholder interactions. It also underscores the continuing need for ECCs to foster transparency by addressing both financial and environmental dimensions.

Lastly, in Panel 4c, we examine the trends in companies' ECC answers, mirroring our analysis of the questions. As with the questions, environmental risk dominates the responses throughout the period. However, a notable rise in externalities-related answers is observed after 2018. This suggests that while analysts may not explicitly enquire about externalities, companies are proactive in referring to these considerations in their responses, thereby enhancing transparency and firms' alignment with the evolving regulatory landscape and societal expectations. The rise in externalities-related answers after 2018 may be in response to the same factors that influenced the increase in externalities in introductory sections, particularly the regulatory pressures (TCFD, 2017; SASB, 2018) and growing societal awareness of sustainability and corporate responsibility.

4.1.3. Descriptive statistics for regression data

Table 4 sets out the summary statistics for the variables used in our analyses. Panel A offers an overview of our environmental disclosure variables for the fiscal year, including all ECCs

for that period. Specifically, for each firm, which typically holds four ECCs (one per quarter) per year, we calculate the average portion of these calls related to environmental disclosure to determine annual environmental disclosure. We adopt this approach because environmental performance measures, unlike financial metrics, tend to change more gradually and are less likely to exhibit significant quarter-to-quarter fluctuation.

On average, 3.1% of the discussions reflected in ECC transcripts for a firm in a given year are related to environmental issues. Notably, introductions contain a higher concentration of environmental disclosure (EnvDisclosure_intro: 2.5%) compared to questions (EnvDisclosure_q: 0.4%) and answers (EnvDisclosure_a: 0.1%). Environmental disclosures are categorized as falling into two main components: environmental risk and environmental externalities. Most environmental disclosure pertains to environmental risk (EnvDisc_Risk: 0.9%) rather than environmental externalities (EnvDisc_Externalities: 0.4%).

In Panel B, the value of *CoC* (cost of capital) indicates that the sample firms' implied cost of capital averages 10%. The *HighEnvScore* variable shows that approximately 13.3% of firms have an environmental score higher than the industry median, while the *High_CO2_Emitter* variable indicates that around 7.4% of firms have CO2 emissions that are higher than the industry median. The remaining control variables, *Size*, *Book-to-Market*, *Beta*, *Leverage*, and *Forecast Dispersion*, are in line with those reported in previous studies (e.g., Bochkay et al., 2020).

[Table 4 about here.]

Table 5 reports Pearson correlations among the variables used in the main analyses.

[Table 5 about here.]

As shown in Table 5, the Pearson correlation coefficients, along with the results of an untabulated variance inflation factor analysis conducted after each regression, confirm that our results do not suffer from multicollinearity.

4.2. Environmental disclosure and cost of capital

Table 6 presents the results concerning the impact of environmental discussion in ECCs on firms' cost of capital. The dependent variable used in the analysis is the implied cost of

equity capital, measured two months after the fiscal year-end using Easton (2004) PEG model. The key variables include the overall environmental disclosure in the conference call (*EnvDisclosure*), as well as its specific sections — the introduction (*EnvDisclosure_intro*), questions (*EnvDisclosure_q*), and answers (*EnvDisclosure_a*).

The results show that a one-percentage-point increase in *EnvDisclosure* (Column 1) is associated, on average, with a 0.026 unit reduction in firms' cost of capital. Likewise, a one-percentage-point increase in *EnvDisclosure_intro* (Column 2) corresponds to a 0.033 unit decrease, while a one-percentage-point increase in *EnvDisclosure_q* (Column 3) is linked to a 0.076 unit decrease in the cost of capital, though this result is only marginally statistically significant. In contrast, *EnvDisclosure_a* (Column 4) exhibits an insignificant relationship with the cost of capital. This lack of significance may be due to management reiterating information from the introduction, diminishing the incremental value of the answers during the discussion. Overall, the findings suggest that environmental disclosures, particularly those in the introduction, are significantly associated with lower cost of capital. Control variables such as *HighEnvScore*, *High_CO2_Emitter*, *Size*, *Book-to-Market*, *Beta*, and *Leverage* also display statistically significant effects, consistent with prior research and supporting the robustness of these results.

[Table 6 about here.]

We link firms' environmental disclosure during ECCs with short-run market consequences and ensure that the observed cost of capital effects are attributable to disclosure during the ECC by reporting market reaction results in Table 6, Panel B. The results show that a higher level of environmental disclosure during ECCs is associated with significant and positive market reactions in the short term, as evidenced by the cumulative abnormal returns (CAR[-1,2]).[8] Specifically, greater environmental disclosure during ECCs (Column 1) and, in particular, in the Q&A section (Column 3 and 4), is significantly linked with higher CARs, indicating that the market values these disclosures. Overall, the evidence in Table 6 demonstrates that greater environmental transparency during ECCs is significantly associated with a reduction in the cost

[8]We also test alternative event windows (CAR[-1,1] and CAR[-1,3]), and the results are consistent, with no significant differences in the market reaction.

of capital. This suggests that investors reward firms for disclosing environmental information by offering better financing terms.

We next examine how the cost of capital changes in response to firms' disclosures of risks arising from environmental factors (environmental risk) and the impact of the firm's operations on the environment (environmental externalities). Table 7 presents the results of the analysis regarding the impact of environmental risk and externalities disclosure on firms' cost of capital. The findings in Panel A indicate that environmental-risk disclosures (*EnvDisclosure_Risk*) do not have a statistically significant impact on the cost of capital in any category. This includes general risk disclosures and those made during the Q&A portions (*EnvDisclosure_Risk_q* and *EnvDisclosure_Risk_a*). [9] One possible explanation for the lack of significant results is that environmental risk, being closely linked to a firm's operations and financial health, may already be conveyed through other disclosure channels, such as financial reports and sustainability statements. As a result, additional disclosures during earnings calls may not provide new information that materially influences investor perceptions or the cost of capital.

Conversely, Panel B shows that externality-related disclosures have a more noticeable effect on the cost of capital. Specifically, overall externalities disclosure (*EnvDisclosure_Externalities*, Column 1) is associated with a 0.048-unit decrease in the cost of capital, while disclosures in the introductory sections (*EnvDisclosure_Externality_intro*, Column 2) lead to a marginally significant decrease of 0.037 units. In the Q&A portion (*EnvDisclosure_Externalities_a*, Column 3), externality-related disclosures correspond to a relatively larger reduction of 0.228 units.[10] Unlike environmental-risk disclosures, which are closely tied to financial performance and tend to attract more investor attention, externalities are less often a focus because they exist outside of the firm. As a result, these disclosures during ECCs provide new information to investors. It's also worth noting that in our sample, analysts did not ask specific questions about externalities, suggesting that the observed impact comes from management's proactive disclosure.

[Table 7 about here.]

[9] We run the same regressions using CAR[-1,2] as the dependent variable. Similar to the findings for the cost of capital (*CoC*), we observe only a marginally significant impact on CAR at the 10% level.

[10] We run the same regression using CAR[-1,2] as the dependent variable and find significant results only for disclosures made in the answers portion of the ECCs.

5. Environmental disclosures impact on cost of capital in Negative circumstances

In ECCs, discussions on environmental topics are often influenced by management, who are more likely to highlight positive environmental achievements, such as reductions in the firm's carbon footprint, while avoiding negative issues, such as investigations into environmental damage caused by the firm. This selective disclosure can lead to bias in the data, skewing it toward favorable environmental outcomes and limiting the ability to accurately assess the relationship between environmental disclosures and the cost of capital, particularly in cases involving negative environmental news.

We address this potential bias by focusing on instances where firms have been exposed to publicly known negative environmental events, using the ESG controversy score from Eikon Refinitiv as a proxy to identify firms under public scrutiny as a result of environmental concerns. The ESG controversy score is a metric that tracks a company's involvement in controversies, including those related to environmental issues, based on global media coverage. We divide the sample based on whether firms have received an ESG controversy score in the past year and run Equation 1 on the subsample of firms assigned an ESG controversy score.

In Table 8, Panel A, we show that overall environmental disclosure (*EnvDisclosure*, Column 1) is associated with a 0.067-unit reduction in the cost of capital for firms facing ESG controversies, indicating that general environmental transparency can help lower perceived financial risk. Disclosures made in the introduction of the earnings calls (*EnvDisclosure_intro*, Column 2) also have a marginally significant effect, with a 0.064-unit reduction in the cost of capital. This suggests that proactively addressing environmental concerns at the start of the call has some positive impact, though this is less substantial than the impact of disclosures made in the more interactive sections of the call. The most significant effect comes from environmental disclosures made during the Q&A portion, specifically in response to analysts' questions (EnvDisclosure_q, Column 3), which led to a 0.470-unit reduction in the cost of capital. This highlights the importance of engaging with analysts in real-time. Their questions likely prompt management to address specific concerns that may not have been fully covered earlier, providing fresh insights that significantly mitigate investors' risk perceptions.

The responses by management during the Q&A session (*EnvDisclosure_a*, Column 4) also

contribute to a notable reduction in the cost of capital (0.160 units), reinforcing the enhancing effect of this interactive dialogue. The interaction between analysts' questions and management's answers during the Q&A fosters more detailed and dynamic discussions of environmental issues. This is especially critical in this sample, where all firms are implicated in public ESG controversies. In such cases, transparent and direct engagement helps address specific concerns, reducing perceived risk and enhancing investor confidence.

Panels B and C present the results for firms involved in ESG controversies, specifically for disclosure of environmental risk and externalities. The patterns observed in Panel A are also reflected in these panels, with the effects being more pronounced for externalities.

For firms facing environmental risks, environmental-risk disclosures in the ECC as a whole and, in particular, disclosures prompted by analysts' questions are significantly associated with a reduction in the cost of capital. This effect may be attributable to the new insights or critical perspectives introduced by analysts' questions, which are likely to address key investor concerns. In the case of externalities, the results demonstrate strong significance for overall disclosures, as well as for those made in the introduction and in the course of management responses. As noted earlier, analysts do not typically prompt externality-related disclosures during ECCs. Instead, it appears that proactive disclosure on the part of management contributes meaningfully to reducing the firm's perceived risk and, consequently, its cost of capital.

[Table 8 about here.]

Overall, our findings mitigate concerns of selective positive disclosure bias by showing that both proactive and real-time discussions of environmental issues play a significant role in reducing the cost of capital when firms face negative environmental scrutiny by the public. This suggests that even when firms are under pressure due to public controversies, their willingness to engage transparently across different sections of the call has a meaningful impact on financial outcomes.

6. Robustness Test for Voluntary Environmental Disclosure and Environmental Performance

In the analysis above, we mitigated potential bias toward positive environmental outcomes by focusing on firms involved in ESG controversies and facing negative environmental scrutiny. Next, we shift our attention to firms that have not experienced negative environmental events but instead voluntarily disclose significant environmental information, particularly during the introductory section of their ECCs. We assess whether the relationship between environmental disclosures and the cost of capital remains consistent when firms proactively highlight their positive environmental achievements in the absence of external pressure or public scrutiny. By comparing these results to those from firms facing negative environmental scrutiny, we can assess whether the importance of environmental disclosure varies depending on the context. Specifically, we seek to determine whether proactive environmental disclosures, made voluntarily without the presence of public controversies or external pressures, hold the same weight for investors. In cases where there is no negative event driving the disclosure, investors may not view environmental transparency as critical, potentially diminishing its impact on the cost of capital. This analysis offers insight into whether the financial benefits of environmental disclosure are context-specific, with stronger effects when firms are responding to negative scrutiny rather than highlighting positive environmental achievements in the absence of external pressure. For this test, we narrow the sample to include only firms that meet two criteria: above-median levels of environmental disclosure during the ECC introductions and not facing any ESG controversies.

Panel A of Table 9 shows the results for the subsample of firms with above-median environmental disclosures during ECC introductions and no ESG controversies show a significant negative relationship between environmental disclosures and the cost of capital. Based on the results in Table 9, Panel A, even for firms without ESG controversies, certain forms of voluntary environmental disclosure can have financial benefits, though their significance varies. Total environmental disclosure across the entire ECC (*EnvDisclosure*, Column 1), is associated with a marginally significant reduction in the cost of capital (-0.0187). This suggests that while disclosing environmental information throughout the call may help lower perceived financial

risk, the overall effect is not strongly significant. However, when environmental disclosures are made during the ECC introduction (*EnvDisclosure_intro*, Column 2), the reduction in the cost of capital is both larger and statistically significant (-0.0279). This indicates that proactively addressing environmental issues in the introductory section has a more substantial impact on investor confidence. Disclosures made later in the call, during the Q&A or in the course of management's answers, appear to have a much smaller impact.

Lastly, environmental disclosures are often linked to firm-specific characteristics that may explain differing reactions to such disclosure. For example, changes in the cost of capital may result from the act of disclosing carbon emissions but also from variations in the firm's actual carbon performance. We introduce a *High_CO2_Emitter* variable that differentiates between high- and low-emission firms to account for this, incorporating an interaction term between this variable and environmental disclosures. This approach allows us to evaluate whether the impact of environmental disclosures on the cost of capital differs depending on a firm's pollution levels. By isolating this factor, we can better assess whether the financial benefits of environmental transparency are consistent across varying levels of environmental impact, or if firms with higher emissions experience more pronounced reductions in the cost of capital due to their heightened exposure to environmental risk.

Panel B of Table 9 shows that firms experience a reduction in their cost of capital when they disclose environmental information, regardless of their underlying environmental performance. The coefficient for *EnvDisclosure* is consistently negative and significant across all specifications, indicating that transparency in environmental issues lowers the cost of capital. However, the interaction term between *EnvDisclosure* and *High_CO2_Emitter* is insignificant in all columns; this indicates that the reduction in the cost of capital following environmental disclosure is not significantly affected by the firm's level of CO2 emissions. In other words, high-polluting firms do not gain additional financial benefits (or penalties) from environmental disclosure compared to others; the effect of disclosure appears consistent regardless of the firm's actual level of emissions.

[Table 9 about here.]

Overall, these findings underscore the importance of environmental transparency in reduc-

ing financial costs across different types of firms, irrespective of their environmental performance or exposure to scrutiny.

7. Investor Type and Environmental-disclosure Impact on Cost of Capital

Investors exhibit varying degrees of sophistication, with insiders, institutional investors, and analysts typically possessing more information than other market participants. This information asymmetry is largely attributed to the superior capacity or resources of institutional investors to gather and process information, as noted by Shleifer and Vishny (1986), or the relatively limited cognitive or analytical capabilities of retail investors, as suggested by Merton (1987). Empirical research consistently demonstrates that institutional investors have access to more extensive information, including insights not yet publicly disclosed, enabling them to make more informed decisions ahead of other market participants Bushee and Goodman (2007). This advantage extends to environmental information, where institutional investors are more likely to receive early warnings or have the analytical resources necessary to anticipate the impact of environmental events on firm performance (Cho et al., 2013; Wei et al., 2020). Surveys provide further evidence of this information advantage. For instance, The Canadian Institute of Chartered Accountants indicates that institutional investors have access to CSR information directly from management, in addition to reports from research firms, consultants, and non-governmental organizations (CICA, 2010).

Conversely, retail investors mostly rely on public communication channels (Cohen et al., 2010). The impact of information asymmetry is more pronounced for private and retail investors, who depend more heavily on public disclosures for their decision-making processes. This disparity is further supported by research suggesting that institutional investors often react to negative environmental events before they are formally announced, mitigating the immediate market impact of related disclosures through strategic trading (Wei et al., 2020). Given the varying degrees of knowledge and analytical capacity among different types of investors, firms predominantly owned by retail investors may experience a more significant impact from public environmental disclosures. Retail investors, who rely heavily on clear and concise public information for decision-making, are likely to react strongly to these disclosures. This can lead

to a substantial adjustment in the firm's perceived risk profile, reducing the uncertainty associated with the firm's future cash flows and, in turn, lowering the cost of capital. In contrast, institutional investors, who have relatively more resources and expertise, are better equipped to process and analyze complex and lengthy disclosures, such as sustainability reports. As a result, in firms with high IO (*IO*), the market may have already incorporated much of this information into their stock price through sophisticated analysis; as a result, there is a less pronounced impact on the cost of capital when new environmental information is disclosed. Thus, by focusing on firms with low levels of IO, we can more effectively capture the impact of public environmental disclosures on the cost of capital, providing deeper insights into how investor sophistication and information-processing capabilities influence market reactions to environmental transparency.

In Table 10, we explore the moderating effect of low IO on the relationship between environmental disclosure and the cost of capital. We analyze the impact of environmental-risk disclosures in Panel B and environmental-externality disclosures in Panel B. The low-IO dummy identifies firms in the bottom 25th percentile of institutional investor holdings. By isolating firms with low IO, we focus on environments where information is less likely to have been preemptively disseminated or traded upon; IOs typically have earlier access to such information. This approach allows us to more accurately assess the impact of public environmental disclosures on the cost of capital in contexts with greater information asymmetry and where the market reaction is likely to be more pronounced.

Panel A of Table 10 presents the effect of low IO on the relationship between environmental-risk disclosure and the cost of capital. The interaction between environmental-risk disclosures and low IO is negative and significant for disclosures made in analysts' questions (*EnvDisclosure_Risk_q*) and management responses (*EnvDisclosure_Risk_a*), with coefficients of -0.667 and -0.320, respectively. This suggests that firms with lower IO experience a stronger reduction in the cost of capital when environmental risks are disclosed, particularly during real-time interactions with analysts and in management's subsequent responses.

The more pronounced impact of environmental-risk disclosures during these sections may be due to retail investors, who tend to react more strongly to such disclosures when they occur

in dynamic, unscripted portions of earnings calls. Institutional investors are better equipped to process and anticipate environmental risks, often having access to earlier warnings and superior analytical tools. Retail investors may thus be expected to respond more dramatically when these risks are highlighted in the Q&A sessions.

Finally, in Panel B of Table 10, we present the effect of low IO on the relationship between environmental-externality disclosures and the cost of capital. The interaction between low IO and disclosure of environmental externalities is statistically significant across all ECC sections. In Column 1, the total disclosure of environmental externalities shows a significant interaction effect of -0.160, indicating that firms with lower IO experience a stronger reduction in the cost of capital when they disclose externalities.

Similarly, disclosures made during the introduction (*EnvDisclosure_Externalities_intro*, Column 2) result in a significant interaction of -0.170, suggesting that proactive communication about externalities at the start of the ECC also plays an important role in reducing perceived risk for firms with lower IO. The most substantial effect is observed in Column 3, where management responses during the Q&A session (*EnvDisclosure_Externalities_a*) show a highly significant interaction of -0.549. This suggests that real-time, interactive disclosures in response to analysts' questions have the strongest impact on reducing the cost of capital for firms with low IO.

Overall, these results indicate that environmental-externality disclosures significantly reduce the cost of capital for firms with lower IO, with all sections of the ECC (total, introduction, and Q&A) contributing meaningfully to this effect. However, the largest impact occurs during the Q&A session, where new information is often revealed in management responses.

[Table 10 about here.]

8. Conclusion

This study contributes to the literature on environmental disclosures during ECCs and how these impact firms' financial performance, specifically through impacts on the cost of capital. Our analysis of interactions between financial analysts and corporate managers shows that

transparency around environmental topics — particularly regarding broader societal externalities — leads to a measurable decrease in the cost of capital.

These disclosures reassure investors about the long-term sustainability of firms and also appear to mitigate perceived risks, thereby improving financing conditions. Our results indicate that in ECCs, environmental externalities, rather than immediate financial risks, have a greater impact on reducing the cost of capital, especially for firms with lower levels of IO, underscoring the reliance of less informed investors on such disclosure to assess corporate risk.

Our approach of segmenting environmental disclosure into "risk" and "externality" categories offers a new perspective and aligns with regulatory moves toward double materiality. By demonstrating the distinct market impacts of these categories, our study offers insights that can aid regulators and practitioners in crafting and evaluating requirements for ESG disclosure that better serve stakeholder and investor interests.

Furthermore, this research advances the field of computerized content analysis by integrating traditional NLP with LLMs to enhance the reliability and precision of environmental content extraction. This dual-method approach addresses limitations in current ESG-data analysis and highlights the value of advanced methodologies for future research on environmental disclosure.

In conclusion, our findings underscore the strategic importance of environmental transparency as a component of corporate communication, particularly in live and interactive forums like ECCs. By enhancing investor confidence and meeting stakeholder expectations, environmental disclosures serve a crucial function by aligning corporate actions with broader sustainability goals and ultimately supporting long-term value creation and market resilience.

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Table 1: Sample construction

	ECC quarter-year observations
Initial sample	130,434
Less: firms or quarters missing in Compustat	11,474
Less: firms or quarters missing in IBES	20,853
Less: firms without CoC data	33,837
Less: non-fiscal-year-end ECCs	49,020
Less: firms without CAR data	458
Sample for regression analysis[†]	14,792

This table presents the sample selection procedure. The baseline sample in our main analysis comprises 130,434 ECCs. All variables are as defined in Appendix A.

[†]Merging with Eikon environmental score and CO2 data (environmental disclosure) does not lead to a reduction in sample size because we use dummies to identify firms with the highest environmental score and highest CO2 emissions. Firms that do not report CO2 emissions or have no score are coded with a dummy of 0 for *HighEnvScore* or *High_CO2_Emitter*.

Table 2: Average environmental disclosure per each section of ECC

	Introduction	Questions	Answers
2007	1.61%	0.13%	0.33%
2008	2.45%	0.16%	0.44%
2009	3.08%	0.19%	0.44%
2010	4.04%	0.27%	0.63%
2011	3.21%	0.17%	0.39%
2012	2.69%	0.26%	0.33%
2013	2.26%	0.13%	0.36%
2014	2.45%	0.19%	0.39%
2015	2.36%	0.16%	0.41%
2016	2.37%	0.21%	0.44%
2017	1.86%	0.19%	0.46%
2018	1.34%	0.11%	0.25%
2019	2.59%	0.30%	0.61%
2020	2.79%	0.44%	0.87%

This table provides the average proportion of environmental disclosures for introductions, questions, and answers in ECCs from 2007 to 2020.

Table 3: Proportion of ECCs containing any environmental disclosure in ECCs

	ECCs	Introduction	Questions	Answers
2007	555	17.48%	3.24%	8.83%
2008	2310	26.88%	4.55%	13.51%
2009	1588	28.40%	5.23%	11.34%
2010	1557	32.31%	7.00%	17.41%
2011	1646	33.54%	4.62%	10.69%
2012	1184	28.21%	6.25%	9.12%
2013	2359	23.57%	3.05%	8.14%
2014	4283	22.18%	4.25%	8.47%
2015	4129	18.84%	3.39%	7.90%
2016	3339	20.28%	3.47%	7.70%
2017	2483	17.76%	4.31%	7.93%
2018	1347	14.63%	2.67%	5.79%
2019	2053	21.14%	5.21%	9.99%
2020	2661	24.20%	7.07%	11.20%

This table provides the proportion of ECCs containing any environmental disclosures for introductions, questions, and answers from 2007 to 2020.

Table 4: Descriptive Statistics

	Obs.	Mean	St.Dev.	Min	P25	P50	P75	Max
Panel A: Conference call variables								
EnvDisclosure	14792	0.031	0.083	-	-	-	-	0.472
EnvDisclosure_intro	14792	0.025	0.067	-	-	-	-	0.384
EnvDisclosure_q	14792	0.004	0.009	-	-	-	-	0.063
EnvDisclosure_a	14792	0.009	0.017	-	-	-	-	0.103
EnvDisc_Risk	14792	0.009	0.033	-	-	-	-	0.214
EnvDisc_Risk_intro	14792	0.006	0.024	-	-	-	-	0.163
EnvDisc_Risk_q	14792	0.001	0.005	-	-	-	-	0.042
EnvDisc_Risk_a	14792	0.002	0.011	-	-	-	-	0.071
EnvDisc_Externalities	14792	0.004	0.021	-	-	-	-	0.152
EnvDisc_Externalities_intro	14792	0.004	0.019	-	-	-	-	0.141
EnvDisc_Externalities_q	14792	0.000	0.000	-	-	-	-	0.031
EnvDisc_Externalities_a	14792	0.000	0.004	-	-	-	-	0.031
Panel B: Firm Variables								
CoC	14792	0.100	0.054	0.000	0.071	0.089	0.113	0.430
CAR[-1,2]	14792	0.005	0.075	-0.220	-0.036	0.004	0.046	0.230
HighEnvScore	14792	0.133	0.339	0.000	-	-	-	1.000
High_CO2_Emitter	14792	0.074	0.261	0.000	-	-	-	1.000
Size	14792	8.121	1.778	4.179	6.887	8.023	9.230	13.080
Book to Market	14792	0.457	0.350	-0.124	0.206	0.388	0.641	1.750
Beta	14792	0.557	0.455	-0.053	0.400	0.785	1.113	2.165
Leverage	14792	0.372	0.197	0.000	0.194	0.393	0.540	1.005
Forecast Dispersion	14792	12.404	24.166	0.001	1.786	4.808	11.429	152.603
Surprise	14792	0.000	0.005	-0.024	-0.004	0.000	0.002	0.030
Delta ROA	14792	-0.001	0.063	-0.072	-0.005	0.000	0.012	0.173
Loss	14792	0.031	0.173	0.000	-	-	-	1.000

This table contains summary statistics for the variables used in the empirical analyses. All variables are winsorized at the 1st and 99th percentiles. All variables are as defined in Appendix A.

Table 5: Pairwise Correlations

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)
(1)	EnvDisclosure	1.000																						
(2)	EnvDisclosure_intro	**0.955**	1.000																					
(3)	EnvDisclosure_q	**0.510**	**0.324**	1.000																				
(4)	EnvDisclosure_a	**0.653**	**0.450**	**0.576**	1.000																			
(5)	EnvDisclosure_Risk	**0.689**	**0.602**	**0.483**	**0.622**	1.000																		
(6)	EnvDisclosure_Risk_intro	**0.520**	**0.534**	**0.201**	**0.297**	**0.863**	1.000																	
(7)	EnvDisclosure_Risk_q	**0.390**	**0.249**	**0.746**	**0.434**	**0.452**	**0.143**	1.000																
(8)	EnvDisclosure_Risk_a	**0.558**	**0.397**	**0.470**	**0.827**	**0.644**	**0.274**	**0.377**	1.000															
(9)	EnvDisclosure_Externalities	**0.530**	**0.483**	**0.362**	**0.409**	**0.272**	**0.114**	**0.287**	**0.296**	1.000														
(10)	EnvDisclosure_Externalities_intro	**0.488**	**0.476**	**0.276**	**0.320**	**0.236**	**0.100**	**0.228**	**0.268**	**0.963**	1.000													
(11)	EnvDisclosure_Externalities_a	**0.355**	**0.235**	**0.434**	**0.493**	**0.255**	**0.113**	**0.334**	**0.228**	**0.477**	**0.281**	1.000												
(12)	CoC	**(0.052)**	**(0.049)**	**(0.029)**	**(0.039)**	**(0.034)**	**(0.024)**	**(0.017)**	**(0.033)**	**(0.056)**	**(0.051)**	**(0.032)**	1.000											
(13)	CAR[-1,2]	(0.002)	(0.006)	0.012	0.006	(0.001)	(0.005)	0.005	0.001	(0.012)	(0.015)	0.000	**(0.061)**	1.000										
(14)	HighEnvScore	**0.028**	**0.024**	0.015	**0.027**	0.008	0.000	0.004	*0.021*	**0.040**	**0.037**	**0.028**	**(0.083)**	(0.014)	1.000									
(15)	High CO2 Emitters	**0.060**	**0.054**	**0.037**	**0.052**	**0.045**	**0.032**	**0.026**	**0.038**	**0.065**	**0.061**	**0.039**	**(0.040)**	**(0.026)**	**0.533**	1.000								
(16)	Size	**0.123**	**0.119**	**0.067**	**0.080**	**0.069**	**0.043**	**0.055**	**0.073**	**0.105**	**0.100**	**0.060**	**(0.127)**	**(0.030)**	**0.285**	**0.283**	1.000							
(17)	Book to Market	**0.128**	**0.137**	**0.040**	**0.057**	**0.099**	**0.094**	**0.034**	**0.061**	**0.040**	**0.041**	0.013	**0.181**	0.010	**(0.089)**	**(0.063)**	**0.138**	1.000						
(18)	Beta	(0.013)	*(0.016)*	(0.005)	(0.003)	*(0.016)*	*(0.018)*	(0.011)	(0.005)	*(0.018)*	**(0.021)**	0.006	**0.105**	0.010	*(0.017)*	(0.007)	(0.008)	0.011	1.000					
(19)	Leverage	**0.064**	**0.062**	**0.033**	**0.040**	**0.040**	**0.027**	**0.031**	**0.035**	**0.051**	**0.048**	**0.029**	*0.018*	0.011	**0.075**	**0.088**	(0.008)	**(0.354)**	0.002	1.000				
(20)	Forecast Dispersion	0.014	*0.021*	(0.004)	(0.002)	0.007	0.014	(0.004)	(0.005)	0.000	0.001	(0.003)	**0.264**	**(0.031)**	**(0.057)**	**(0.038)**	**(0.130)**	**0.101**	0.014	**0.061**	1.000			
(21)	Surprise	(0.008)	(0.013)	0.005	0.005	(0.007)	(0.013)	0.008	0.006	(0.009)	(0.006)	(0.010)	0.011	**0.186**	0.006	0.007	**(0.026)**	**(0.023)**	0.004	0.004	**(0.040)**	1.000		
(22)	Delta ROA	(0.009)	(0.007)	(0.005)	(0.012)	(0.015)	(0.015)	(0.004)	(0.013)	(0.014)	(0.011)	(0.008)	0.007	**0.082**	**(0.035)**	**(0.030)**	(0.030)	(0.009)	**0.014**	**(0.044)**	(0.013)	**0.140**	1.000	
(23)	Loss	*0.019*	0.021	(0.002)	(0.007)	0.009	0.013	(0.003)	(0.006)	0.013	0.011	(0.000)	**0.123**	**(0.051)**	**(0.041)**	**(0.027)**	**(0.061)**	**0.075**	0.015	**0.035**	**0.142**	**(0.343)**	**(0.159)**	1.000

Pearson correlations. All variables are as defined in Appendix A.

Table 6: Economic Consequences of Environmental Disclosure in ECCs

Panel A: Environmental Disclosure and the Cost of Capital

	(1)	(2)	(3)	(4)
(Dep Variable: Cost of Capital)				
EnvDisclosure	-0.0256***			
	(0.00807)			
EnvDisclosure_intro		-0.0326***		
		(0.01000)		
EnvDisclosure_q			-0.0755*	
			(0.0457)	
EnvDisclosure_a				-0.0459
				(0.0281)
HighEnvScore	-0.00653***	-0.00652***	-0.00662***	-0.00660***
	(0.00179)	(0.00179)	(0.00180)	(0.00180)
High_CO2_Emitter	0.00794***	0.00792***	0.00789***	0.00791***
	(0.00276)	(0.00276)	(0.00276)	(0.00276)
Size	-0.00386***	-0.00386***	-0.00391***	-0.00391***
	(0.000534)	(0.000533)	(0.000536)	(0.000535)
Book to Market	0.0316***	0.0316***	0.0315***	0.0315***
	(0.00290)	(0.00290)	(0.00289)	(0.00289)
Beta	0.00567***	0.00567***	0.00567***	0.00566***
	(0.00102)	(0.00102)	(0.00102)	(0.00102)
Leverage	0.0201***	0.0201***	0.0202***	0.0202***
	(0.00443)	(0.00443)	(0.00444)	(0.00444)
Post-forecast Dispersion	0.000462***	0.000462***	0.000462***	0.000462***
	(0.000356)	(0.000356)	(0.000356)	(0.000356)
Intercept	0.101***	0.101***	0.100***	0.100***
	(0.00433)	(0.00433)	(0.00434)	(0.00434)
Observations	14792	14792	14792	14792
R^2	0.187	0.187	0.187	0.187

Standard errors are shown in parentheses. Statistical significance at the 1%, 5%, and 10% levels are denoted by ***, **, and *, respectively.

Panel B: Environmental Disclosure and Market Reaction

	(1)	(2)	(3)	(4)
Dep Variable: CAR[-1,2]				
EnvDisclosure	0.0179**			
	(0.00877)			
EnvDisclosure_intro		0.0134		
		(0.0109)		
EnvDisclosure_q			0.194***	
			(0.0607)	
EnvDisclosure_a				0.0914***
				(0.0338)
HighEnvScore	0.00150	0.00152	0.00159	0.00155
	(0.00180)	(0.00179)	(0.00179)	(0.00179)
High_CO2_Emitter	-0.00686***	-0.00683***	-0.00688***	-0.00690***
	(0.00228)	(0.00228)	(0.00227)	(0.00227)
Surprise	2.690***	2.691***	2.690***	2.691***
	(0.173)	(0.173)	(0.173)	(0.173)
Delta ROA	0.237***	0.237***	0.237***	0.238***
	(0.0410)	(0.0410)	(0.0410)	(0.0410)
Size	-0.000354	-0.000335	-0.000345	-0.000342
	(0.000407)	(0.000407)	(0.000406)	(0.000407)
Book to Market	0.00504**	0.00504**	0.00511**	0.00511**
	(0.00236)	(0.00236)	(0.00235)	(0.00235)
Leverage	0.00671**	0.00672**	0.00672**	0.00672**
	(0.00338)	(0.00338)	(0.00338)	(0.00338)
Loss	0.00908*	0.00909*	0.00908*	0.00909*
	(0.00482)	(0.00482)	(0.00482)	(0.00482)
Intercept	0.00114	0.00122	0.00125	0.00117
	(0.00366)	(0.00365)	(0.00366)	(0.00366)
Observations	14792	14792	14792	14792
R^2	0.048	0.048	0.048	0.048

Standard errors are shown in parentheses. Statistical significance at the 1%, 5%, and 10% levels are denoted by ***, **, and *, respectively.

Table 7: Environmental Risk and Externalities and Cost of Capital

Panel A: Environmental-Risk Disclosure

(Dep Variable: Cost of Capital)	(1)	(2)	(3)	(4)
EnvDisclosure_Risk	-0.0120			
	(0.0157)			
EnvDisclosure_Risk_intro		-0.0103		
		(0.0188)		
EnvDisclosure_Risk_q			-0.0370	
			(0.0876)	
EnvDisclosure_Risk_a				-0.0403
				(0.0416)
Intercept	0.100***	0.100***	0.100***	0.100***
	(0.00434)	(0.00434)	(0.00434)	(0.00434)
Controls	Yes	Yes	Yes	Yes
Quarter-Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
St. Errors clustered at firm level	Yes	Yes	Yes	Yes
Observations	14792	14792	14792	14792
R^2	0.187	0.187	0.187	0.187

Panel B: Externalities Disclosure

(Dep Variable: Cost of Capital)	(1)	(2)	(3)
EnvDisclosure_Externalities	-0.0480**		
	(0.0199)		
EnvDisclosure_Externality_intro		-0.0370*	
		(0.0221)	
EnvDisclosure_Externalities_a			-0.228**
			(0.107)
Intercept	0.100***	0.100***	0.100***
	(0.00433)	(0.00433)	(0.00433)
Controls	Yes	Yes	Yes
Quarter-Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
St. Errors clustered at firm level	Yes	Yes	Yes
Observations	14792	14792	14792
R^2	0.187	0.187	0.187

Standard errors are clustered at the firm level and shown in parentheses. Statistical significance at the 1%, 5%, and 10% levels are denoted by ***, **, and *, respectively. We use quarter-year- and industry-fixed effects. All regressions include a set of controls.

Table 8: Environmental Disclosure and Cost of Capital for Firms with ESG Controversies

Panel A: Environmental Disclosure

(Dep Variable: Cost of Capital)	**(1)**	**(2)**	**(3)**	**(4)**
EnvDisclosure	-0.067***			
	(0.026)			
EnvDisclosure_intro		-0.064*		
		(0.035)		
EnvDisclosure_q			-0.470***	
			(0.124)	
EnvDisclosure_a				-0.160**
				(0.066)
Intercept	0.030	0.030	0.031	0.031
	(0.026)	(0.026)	(0.026)	(0.026)
Controls	Yes	Yes	Yes	Yes
Quarter-Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
St. Errors clustered at firm level	Yes	Yes	Yes	Yes
Observations	1088	1088	1088	1088
R^2	0.268	0.265	0.268	0.262

Panel B: Environmental Risk

(Dep Variable: Cost of Capital)	**(1)**	**(2)**	**(3)**	**(4)**
EnvDisclosure_Risk	-0.096**			
	(0.044)			
EnvDisclosure_Risk_intro		-0.075		
		(0.055)		
EnvDisclosure_Risk_q			-0.623***	
			(0.197)	
EnvDisclosure_Risk_a				-0.105
				(0.092)
Intercept	0.032	0.032	0.032	0.0307
	(0.026)	(0.026)	(0.026)	(0.026)
Controls	Yes	Yes	Yes	Yes
Quarter-Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
St. Errors clustered at firm level	Yes	Yes	Yes	Yes
Observations	1088	1088	1088	1088
R^2	0.263	0.261	0.265	0.260

Standard errors are clustered at the firm level and shown in parentheses. Statistical significance at the 1%, 5%, and 10% levels are denoted by ***, **, and *, respectively. We use quarter-year- and industry-fixed effects. All regressions include a set of controls.

Panel C: Environmental Externalities Emissions

(Dep Variable: Cost of Capital)	**1**	**2**	**3**
EnvDisclosure_Externalities	-0.140**		
	(0.056)		
EnvDisclosure_Externality_intro		-0.107**	
		(0.054)	
EnvDisclosure_Externalities_a			-0.889**
			(0.401)
Intercept	0.030	0.030	0.031
	(0.026)	(0.026)	(0.026)
Controls	Yes	Yes	Yes
Quarter-Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
St. Errors clustered at firm level	Yes	Yes	Yes
Observations	1088	1088	1088
R^2	0.264	0.262	0.266

Standard errors are clustered at the firm level and shown in parentheses. Statistical significance at the 1%, 5%, and 10% levels are denoted by ***, **, and *, respectively. We use quarter-year- and industry-fixed effects. All regressions include a set of controls.

Table 9: Robustness Test for Voluntary Disclosure and Level of Environmental Performance

Panel A: Firms Without ESG Controversies (High Environmental Disclosure)

(Dep Variable: Cost of Capital)	(1)	(2)	(3)	(4)
EnvDisclosure	-0.0187*			
	(0.0104)			
EnvDisclosure_intro		-0.0279**		
		(0.0127)		
EnvDisclosure_q			-0.00199	
			(0.0593)	
EnvDisclosure_a				-0.0205
				(0.0343)
Intercept	0.102***	0.103***	0.0994***	0.0996***
	(0.00970)	(0.00982)	(0.00956)	(0.00958)
Controls	Yes	Yes	Yes	Yes
Quarter-Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
St. Errors clustered at firm level	Yes	Yes	Yes	Yes
Observations	2649	2649	2649	2649
R^2	0.272	0.272	0.271	0.271

Panel B: Firms with High CO2 Emissions

(Dep Variable: Cost of Capital)	(1)	(2)	(3)	(4)
EnvDisclosure	-0.0279***	-0.0353***	-0.0857*	-0.0551*
	(0.00801)	(0.00982)	(0.0466)	(0.0295)
High_CO2_Emitter	0.00669**	0.00668***	0.00761***	0.00726***
	(0.00261)	(0.00254)	(0.00277)	(0.00273)
EnvDisclosureHigh CO2	0.0241	0.0308	0.0954	0.0852
	(0.0298)	(0.0396)	(0.202)	(0.104)
Intercept	0.101***	0.101***	0.100***	0.100***
	(0.00433)	(0.00433)	(0.00433)	(0.00433)
Controls	Yes	Yes	Yes	Yes
Quarter-Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
St. Errors clustered at firm level	Yes	Yes	Yes	Yes
Observations	14792	14792	14792	14792
R^2	0.188	0.188	0.187	0.187

Standard errors are clustered at the firm level and shown in parentheses. Statistical significance at the 1%, 5%, and 10% levels are denoted by ***, **, and *, respectively. We use quarter-, year- and industry-fixed effects. All regressions include a set of controls.

Table 10: Investor Type and Environmental-Disclosure Impact on Cost of Capital

Panel A: Environmental Risk

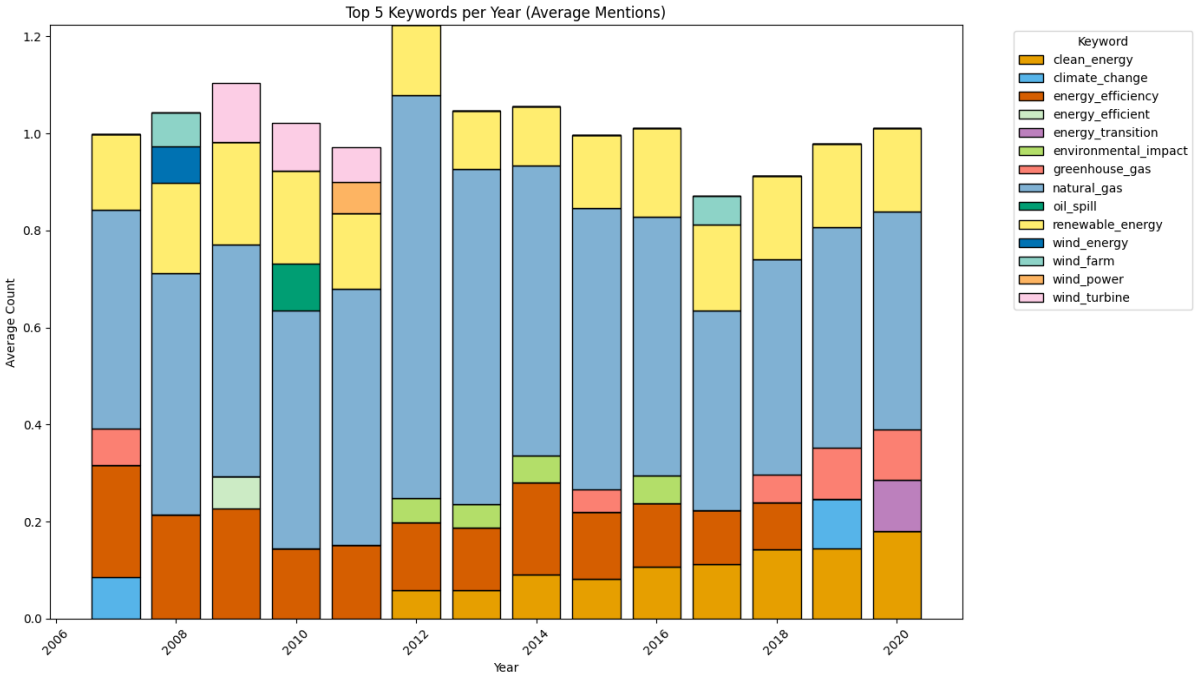
(Dep Variable: Cost of Capital)	EnvDisclosure_Risk	EnvDisclosure_Risk_intro	EnvDisclosure_Risk_q	EnvDisclosure_Risk_a
EnvDisclosure	-0.004	-0.004	0.013	-0.008
	(0.017)	(0.019)	(0.094)	(0.044)
Low IO	0.014***	0.014***	0.014***	0.014***
	(0.003)	(0.003)	(0.003)	(0.003)
EnvDisclosure#Low IO	-0.083	-0.053	-0.667***	-0.320**
	(0.058)	(0.083)	(0.179)	(0.132)
Intercept	0.095***	0.095***	0.095***	0.095***
	(0.004)	(0.004)	(0.004)	(0.004)
Controls	Yes	Yes	Yes	Yes
Quarter-Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
St. Errors clustered at firm level	Yes	Yes	Yes	Yes
Observations	14792	14792	14792	14792
R^2	0.193	0.193	0.193	0.193

Panel B: Environmental Externalities

(Dep Variable: Cost of Capital)	EnvDisclosure_Externalities	EnvDisclosure_Externalities_intro	EnvDisclosure_Externalities_a
EnvDisclosure	-0.038*	-0.027	-0.193*
	(0.021)	(0.023)	(0.114)
Low IO	0.014***	0.014***	0.014***
	(0.003)	(0.003)	(0.003)
EnvDisclosure#Low IO	-0.160***	-0.170***	-0.549**
	(0.054)	(0.064)	(0.231)
Intercept	0.095***	0.095***	0.095***
	(0.004)	(0.004)	(0.004)
Controls	Yes	Yes	Yes
Quarter Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
St. Errors clustered at firm level	Yes	Yes	Yes
Observations	14792	14792	14792
R^2	0.194	0.193	0.193

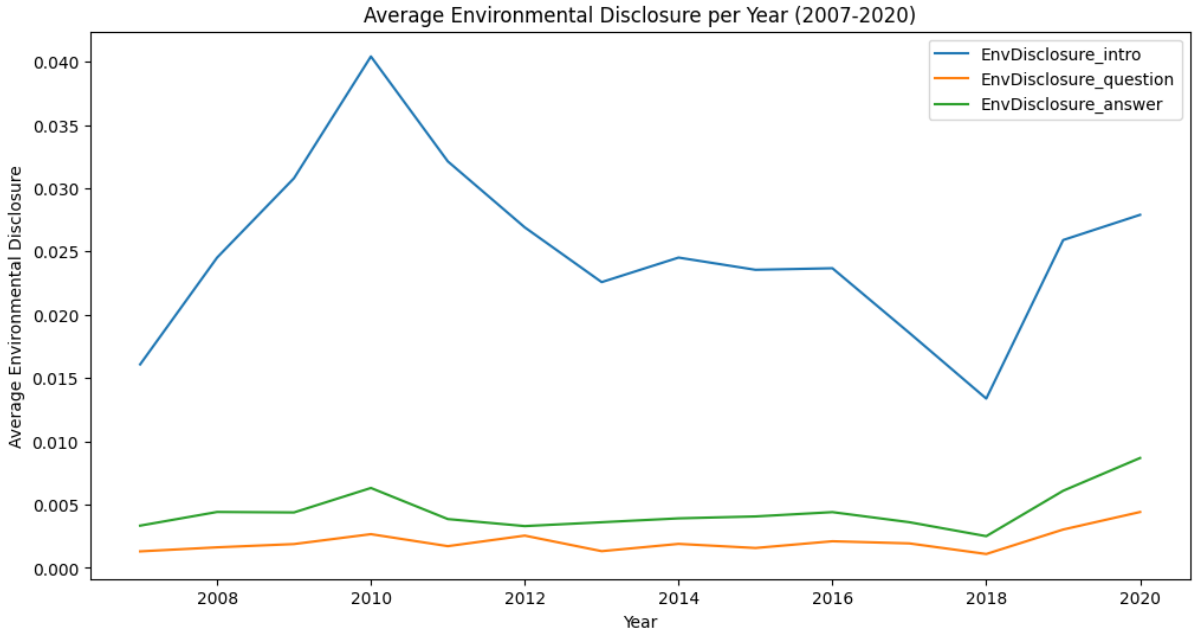
Standard errors are clustered at the firm level and shown in parentheses. Statistical significance at the 1%, 5%, and 10% levels are denoted by ***, **, and *, respectively. We use quarter-year- and industry-fixed effects. All regressions include a set of controls.

Figure 1: Yearly distribution of top environmental keywords 2007-2020



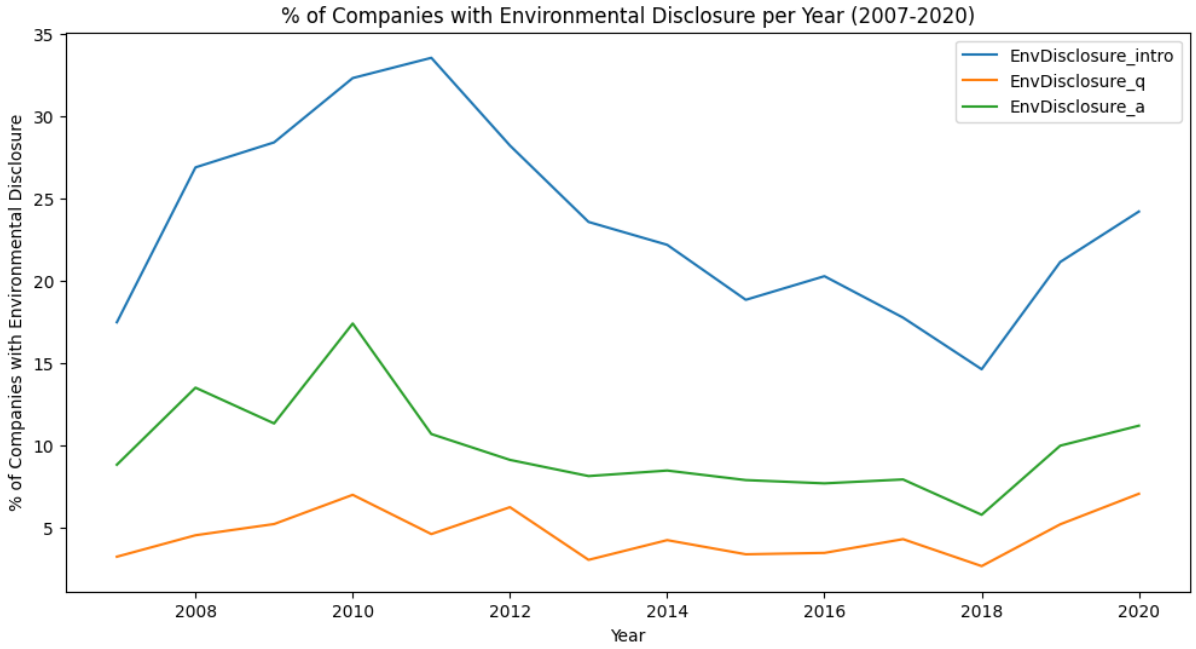
This figure illustrates the annual distribution of the top five environmental keywords from 2007 to 2020. Each color represents a different keyword, showing the frequency of mentions per year in a stacked bar format.

Figure 2: Yearly distribution of average proportion of environmental disclosure in ECCs



This figure illustrates the annual average proportion of environmental disclosures for introductions, questions, and answers in ECCs from 2007 to 2020.

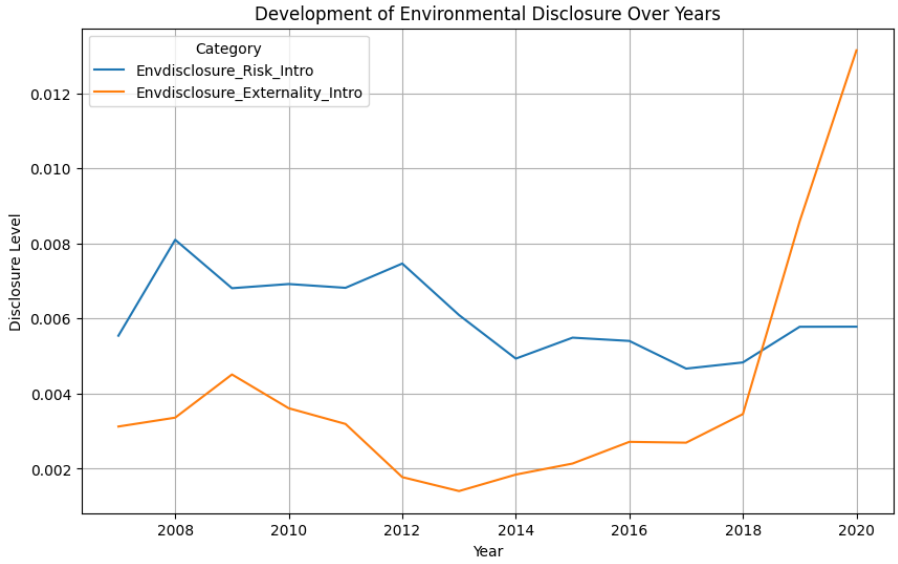
Figure 3: Yearly distribution of proportion of ECCs containing any environmental disclosure



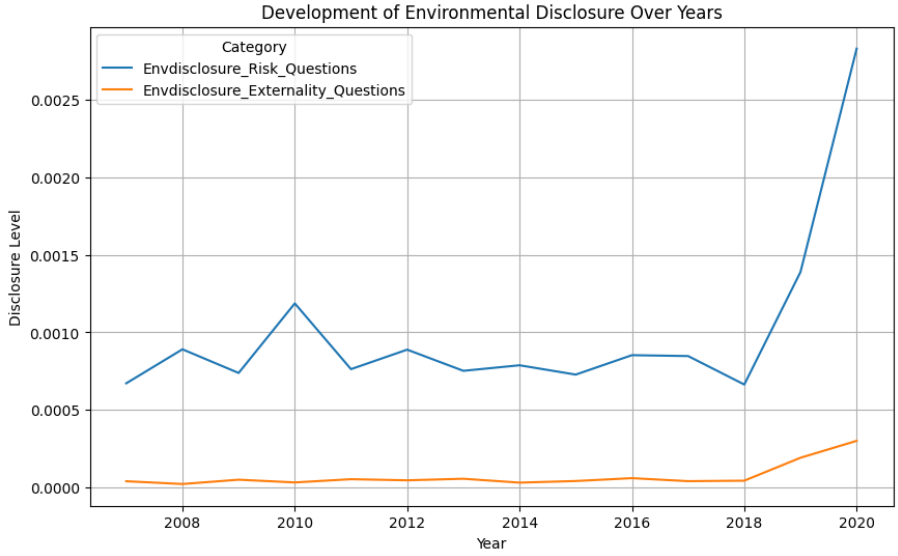
This figure illustrates the proportion of ECCs containing any environmental disclosures in introductions, questions, and answers from 2007 to 2020.

Figure 4: Yearly distribution of the average proportion of environmental risk and externalities disclosure in ECCs

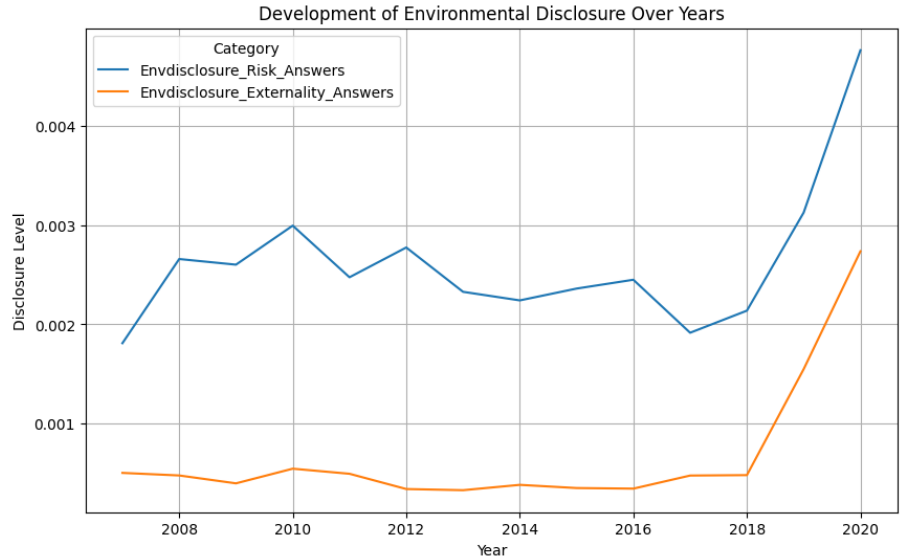
(a) Panel A



(b) Panel B



(c) Panel C



This figure illustrates the annual average proportion of environmental disclosures for introductions, question, and answers in ECCs from 2007 to 2020.

Appendices

Appendix A. Variable Definitions

Table A.1: Variable Definitions

Panel A: Environmental Disclosure Variables

Label	Definition	Provider
EnvDisclosure	Proportion of environmental disclosure in the ECC as a whole.	Authors' calculation
EnvDisclosure_intro	Proportion of environmental disclosure in the prepared remarks section of ECCs.	Authors' calculation
EnvDisclosure_q	Proportion of environmental disclosure in ECC questions.	Authors' calculation
EnvDisclosure_a	Proportion of environmental disclosure in ECC answers.	Authors' calculation
EnvDisclosure_Risk	Proportion of environmental disclosure in ECCs that addresses the negative impact of environmental factors on the firm's operations and financial performance.	Authors' calculation
EnvDisclosure _Risk_intro	Proportion of environmental disclosure relating to environmental risk in the introductory section of ECCs.	Authors' calculation
EnvDisclosure_Risk_q	Proportion of environmental disclosure relating to environmental risk in ECC questions.	Authors' calculation
EnvDisclosure_Risk_a	Proportion of environmental disclosure relating to environmental risk in ECC answers.	Authors' calculation
EnvDisclosure _Externalities	Proportion of environmental disclosure relating to the impact of the firm's activities on externalities during ECCs.	Authors' calculation
EnvDisclosure _Externalities_intro	Proportion of environmental disclosure relating to the impact of the firm's activities on externalities in the introductory section of ECCs.	Authors' calculation
EnvDisclosure _Externalities_q	Proportion of environmental disclosure relating to the impact of the firm's activities on externalities in ECC questions.	Authors' calculation
EnvDisclosure _Externalities_a	Proportion of environmental disclosure relating to the impact of the firm's activities on externalities in ECC answers.	Authors' calculation

Table A.2: Table A.1: Variable Definitions

Panel B: Other variables

Label	Definition	Provider
Coc	Implied cost of equity capital (in percentage) in the 2 months after fiscal year-end, estimated using Easton's (2004) PEG model.	IBES/CRISP
HighEnvScore	A dummy variable equal to 1 if the firm's environmental score from Eikon is higher than the industry median, and 0 otherwise. The environmental score is part of Eikon's ESG disclosure data, which measures a company's environmental performance based on various metrics related to sustainability, resource use, emissions, and environmental innovation.	Refinitive
High_CO2_Emitter	A dummy variable equal to 1 if the firm's CO2 emissions in tonnes, as measured by Refinitiv, are above the industry median. Refinitiv captures emissions through company-reported data or estimates, covering Scope 1 (direct) and Scope 2 (indirect) emissions.	Refinitiv
Size	Natural logarithm of total assets in thousands of firm i in quarter t.	Compustat
Beta	Market beta, estimated from the market model using the daily CRSP stock returns.	Beta Suite by WRDS
Leverage	The sum of long-term debt and current liabilities, divided by total assets.	Compustat
Book to Market	Book to Market is defined as the book value of equity divided by the market value of equity.	Compustat
Forecast Dispersion	The standard deviation of analysts' forecasts for earnings in quarter $t + 1$ outstanding 3 days after the ECCs for quarter t, divided by the absolute value of the mean consensus forecast outstanding 3 days after the conference call for quarter t, multiplied by 100.	IBES
Institutional Ownership	Percentage of shares held by institutional investors at the end of the most recent reporting period. Values above 100% are trimmed.	S&P Capital IQ
ESG controversy score	A score from 100 to 0 to track a company's involvement in controversies, including those related to environmental issues, based on global media coverage.	Refinitiv

Appendix B. Environmental Keywords List

achieve co2
achieve co2e
achieve co2eq
air emission
air pollution
air quality
airborne emission
allowance co2
allowance co2e
allowance co2eq
allowance price
amount co2
amount co2e
amount co2eq
analysis co2
analysis co2e
analysis co2eq
annual emission
approve landfill
assess climate
associate co2
associate co2e
associate co2eq
associate emission
atmospheric emission
authorize landfill
average co2
average co2e
average co2eq
avoid emission
base carbon
base emission
baseline emission
bioenergy production
biofuel important
biofuel production
biogas biomethane
biogas clean
biogas produce
biogas upgrading
biogenic co2
biogenic emission
biomass fire
biomass fuel
biomass organic
biomass power
biomass source
biomass technology
biomass wasteconvert
biomass
buy co2
buy co2e
buy co2eq
carbon code
carbon compliance
carbon dioxide
carbon disclosure
carbon economy
carbon efficiency
carbon electricity
carbon emission
carbon energy
carbon equivalent
carbon footprint
carbon impact
carbon intensity
carbon neutral
carbon neutrality
carbon offset
carbon policy
carbon price
carbon pricing
carbon reduction
carbon retain
carbon stock
carbon tax
carry co2
carry co2e
carry co2eq
cdp climate
cellulosic biomass

chain emission
chemical hazard
circular economy
clean cost
clean energy
clean requirement
clean site
clean up
clean water
climate action
climate change
climate concern
climate emergency
climate energy
climate footprint
climate impact
climate issue
climate neutral
climate neutrality
climate policy
climate protection
climate relate
climate strategy
climate sustainability
climate target
co2 air
co2 allowance
co2 avoid
co2 balance
co2 capture
co2 carbon
co2 certificate
co2 concentration
co2 consumption
co2 cost
co2 decarbonisation
co2 decarbonization
co2 development
co2 efficiency
co2 emission
co2 emit
co2 emitter
co2 eq
co2 equivalent
co2 fleet
co2 footprint
co2 greenhouse
co2 harmful
co2 impact
co2 intensity
co2 intensive
co2 kg
co2 kiloton
co2 kwh
co2 level
co2 limit
co2 measurement
co2 methanisation
co2 monitoring
co2 neutral
co2 neutrality
co2 optimising
co2 output
co2 performance
co2 pipeline
co2 price
co2 protective
co2 reduce
co2 reduction
co2 regulation
co2 relate
co2 release
co2 relevant
co2 save
co2 saving
co2 scope
co2 standard
co2 strategy
co2 target
co2 taxis
co2 ton
co2 tonne
co2 transaction
co2 transport
co2 unit
co2 usage
co2e air

co2e allowance
co2e avoid
co2e balance
co2e capture
co2e carbon
co2e certificate
co2e concentration
co2e consumption
co2e cost
co2e decarbonisation
co2e decarbonization
co2e development
co2e efficiency
co2e emission
co2e emit
co2e emitter
co2e equivalent
co2e footprint
co2e greenhouse
co2e harmful
co2e impact
co2e intensity
co2e intensive
co2e kg
co2e kiloton
co2e kwh
co2e level
co2e limit
co2e measurement
co2e monitoring
co2e neutral
co2e neutrality
co2e optimising
co2e output
co2e performance
co2e pipeline
co2e price
co2e protective
co2e reduce
co2e reduction
co2e regulation
co2e relate
co2e release
co2e relevant
co2e saving
co2e scope
co2e standard
co2e strategy
co2e target
co2e ton
co2e tonne
co2e transaction
co2e transport
co2e unit
co2e usage
co2eq air
co2eq allowance
co2eq avoid
co2eq balance
co2eq capture
co2eq carbon
co2eq certificate
co2eq concentration
co2eq consumption
co2eq cost
co2eq decarbonisation
co2eq decarbonization
co2eq development
co2eq efficiency
co2eq emission
co2eq emit
co2eq emitter
co2eq equivalent
co2eq footprint
co2eq greenhouse
co2eq harmful
co2eq impact
co2eq intensity
co2eq intensive
co2eq kg
co2eq kiloton
co2eq kwh
co2eq level
co2eq limit
co2eq measurement
co2eq monitoring
co2eq neutral

co2eq neutrality
co2eq optimising
co2eq output
co2eq performance
co2eq pipeline
co2eq price
co2eq protective
co2eq reduce
co2eq reduction
co2eq regulation
co2eq relate
co2eq release
co2eq relevant
co2eq saving
co2eq scope
co2eq standard
co2eq strategy
co2eq target
co2eq ton
co2eq tonne
co2eq transaction
co2eq transport
co2eq unit
co2eq usage
come renewable
compensate emission
comply emission
consumption co2
consumption co2e
consumption co2eq
consumption emission
consumption energy
consumption km
consumption measure
consumption reduction
consumption vehicle
consumption water
contamination pollutant
continue electrification
contribute climate
contribute decarbonization
contribute energy
convert biomass
convert methanol
corresponding emission
cut co2
cut co2e
cut co2eq
cut emission
decarbonization energy
decarbonization initiative
decarbonization transport
decarbonization ambition
decarbonization energy
decline co2
decline co2e
decline co2eq
decrease co2
decrease co2e
decrease co2eq
degree recyclability
determine emission
develop co2
develop co2e
develop co2eq
digitalization electrification
dioxide emission
dioxide equivalent
direct emission
direct ghg
discharge emission
disposal landfill
downstream emission
downstream emissions
drive electrification
driving emission
durability longevity
eco-friendly
efficiency electrification
efficiency environmental
electrical consumption
electricity consumption
electrification digitalization
electrification effort
electrification grow
electrification market
electrification strategy

electrification trend
emission air
emission allowance
emission atmosphere
emission calculation
emission carbon
emission certificate
emission co2
emission co2e
emission co2eq
emission coal
emission compare
emission control
emission decline
emission dependence
emission development
emission electricity
emission emission
emission energy
emission factor
emission fee
emission footprint
emission free
emission future
emission g
emission greenhouse
emission group
emission guide
emission impact
emission inbound
emission include
emission increase
emission intensity
emission issue
emission level
emission like
emission limit
emission link
emission measure
emission measurement
emission monitor
emission occur
emission operation
emission percent
emission pollutant
emission price
emission product
emission program
emission rate
emission reduce
emission reduction
emission regulation
emission relate
emission remain
emission report
emission requirement
emission saving
emission scenario
emission scope
emission source
emission standard
emission supply
emission target
emission tco2e
emission threshold
emission tonne
emission trading
emission upstream
emission waste
emission year
emit atmosphere
emit co2
emit co2e
emit co2eq
enable decarbonization
encourage recycling
energy consumption
energy efficiency
energy efficient
energy emission
energy environment
energy hydrogen
energy indirect
energy inefficiency
energy intensity
energy intensive
energy management

energy reduction
energy renewable
energy save
energy saving
energy source
energy transition
energy usage
energy use
energy water
energy wind
engine emission
enhance reparability
environment climate
environmental authorization
environmental awareness
environmental certification
environmental clean
environmental compatibility
environmental compliance
environmental concern
environmental conservation
environmental deviation
environmental footprint
environmental goal
environmental harm
environmental impact
environmental incident
environmental issue
environmental law
environmental license
environmental management
environmental performance
environmental permit
environmental perspective
environmental policy
environmental preservation
environmental problem
environmental protection
environmental regulation
environmental requirement
environmental risk
environmental strategy
environmental sustainability
environmental topic
environmentally friendly
excess emission
exhaust emission
exhaust gas
factory footprint
field biomass
fight climate
focus decarbonization
fossil free
fossil fuel
fuel biogas
fuel consumption
fully electric
future co2
future co2e
future co2eq
g co2
g co2e
g co2eq
gas emission
gas ghg
gas protocol
gaseous emission
generate waste
ghg emission
ghg protocol
global climate
global emission
global warm
global warming
green bond
green certificate
green energy
green technology
greenhouse gas
groundwater contamination
group environmental
hazardous material
hazardous substances
hazardous waste
high emission
high recyclability
hydrogen methanol

hydrogen production
impact climate
impact decarbonization
impact decarbonization
impact environment
improve co2
improve co2e
improve co2eq
improve combustion
improve durability
improve emission
improve energy
improve environmental
improvement energy
inbound transport
include decarbonization
include emission
increase co2
increase co2e
increase co2eq
increase electrification
increase emission
increase recyclability
increase renewable
increase reparability
indirect co2
indirect co2e
indirect co2eq
indirect emission
industrial waste
iso energy
key emission
kg co2
kg co2e
kg co2eq
kiloton co2
kiloton co2e
kiloton co2eq
kilotonne co2
kilotonne co2e
kilotonne co2eq
kt co2
kt co2e
kt co2eq
labor standard
labor standard
landfill area
landfill avoidance
landfill disposal
landfill material
landfill reduce
landfill site
landfill target
landfill tonne
level emission
lifecycle perspective
liquefy biogas
liquid methane
local emission
long durability
low carbon
low co2
low co2e
low co2eq
low emission
low environmental
lower emission
manage climate
manufacturing waste
material efficiency
material recycling
maximum emission
maximum recyclability
measure co2
measure co2e
measure co2eq
measurement emission
meet co2
meet co2e
meet co2eq
methane capture
methane emission
methane oxygen
methane production
methanol energy
methanol fuel
methanol hydrogen

methanol mixture
minimize environmental
minimize consumption
minimize emission
minimize environmental
minimize landfill
mt co2
mt co2e
mt co2eq
natural gas
natural resource
negative environmental
net carbon
net co2
net co2e
net co2eq
net emission
neutralise co2
neutralise co2e
neutralise co2eq
neutralize co2
neutralize co2e
neutralize co2eq
new energy
nitrogen oxide
noise emission
non hazardous
non renewable
offset emission
oil spill
operational emission
outbound transport
overall emission
oxide particulate
oxygen methane
Paris agreement
pollution clean
pollution co2
pollution co2e
pollution co2eq
pollution control
pollution emission
pollution prevention
pollution reduction
pollution risk
power wind
predict co2
predict co2e
predict co2eq
price co2
price co2e
price co2eq
price emission
pricing co2
pricing co2e
pricing co2eq
produce biomethane
product durability
production biomethane
project co2
project co2e
project co2eq
promote durability
promote recyclability
protect environment
provide biogas
purchase emission
purchase energy
purchase renewable
raw biogas
recover waste
recyclability environmental
recyclability material
recyclability product
recyclability recoverability
recyclability reparability
recyclable waste
recycle recover
recycle waste
recycle yield
recycled material
recycling rate
recycling reuse
reduce carbon
reduce climate
reduce co2
reduce co2e

reduce co2eq
reduce emission
reduce energy
reduce environmental
reduce exhaust
reduce fuel
reduce gas
reduce greenhouse
reduce hazardous
reduce travel
reduce waste
reduced emission
reduction co2
reduction co2e
reduction co2eq
reduction emission
reduction energy
reduction environmental
reduction ghg
reduction greenhouse
reduction target
relative emission
release methanol
renewable electricity
renewable energy
renewable power
renewable resource
renewable source
repairability durability
reparability recyclability
replace fossil
report emission
require environmental
resource efficiency
responsibly lifecycle
restriction co2
restriction co2e
restriction co2eq
restriction emission
restriction hazardous
result climate
reusability recyclability
reuse recover
reuse waste
risk climate
save co2
save co2e
save co2eq
save energy
save water
saving ktco2e
scope co2
scope co2e
scope co2eq
scope emission
scope ghg
scope greenhouse
send landfill
share renewable
site clean
soil pollution
solar cell
solar energy
solar panel
solar park
solar power
solar wind
source electricity
source emission
standard co2
standard co2e
standard co2eq
storage co2
storage co2e
storage co2eq
support electrification
sustainability division
sustainability information
sustainability relate
sustainable biofuel
sustainable electricity
sustainable energy
sustainable financing
sustainable innovation
t co2e
tackle methane
target reduce

tco2e tonne
technology decarbonization
technology electrification
technology transport
ton co2
ton co2e
ton co2eq
tonne co2
tonne co2e
tonne co2eq
tonne waste
total carbon
total emission
total energy
total environmental
total landfill
total waste
toxic emission
trading allowance
transition circular
transition electrification
transport electrification
transport emission
trend electrification
unnecessary travel
upgrade biogas
upstream emission
use biogas
use biomass
use co2
use co2e
use co2eq
use renewable
utilize biomass
waste collection
waste disposal
waste emission
waste generate
waste handling
waste kg
waste landfill
waste management
waste material
waste pollution
waste produce
waste production
waste recycle
waste recycling
waste reduction
waste ton
waste tonne
waste water
water consumption
water emission
water recycle
water resource
water usage
water use
water waste
weight reduction
wind energy
wind farm
wind park
wind power
wind solar
wind turbine
zero carbon

Appendix C. ChatGPT Prompts

We first employ ChatGPT to evaluate each segment to determine whether a speech segment is related to environmental matters. We specifically focus on segments that contain at least one environmental keyword. However, to ensure a comprehensive assessment, we also include the corresponding question or answer associated with any segment that contains an environmental keyword, even if the corresponding text does not contain a keyword. For instance, if a question contains an environmental keyword, we provide ChatGPT with both the question and its corresponding answer for evaluation, and vice versa. This approach allows us to capture the full context and ensure that all relevant environmental matters are considered.

ChatGPT assesses whether each segment mentions environmental topics or technologies, regardless of the primary focus. For each segment, ChatGPT provides a rating of "Yes" if it mentions environmental matters, "No" if it does not, "Uncertain - Content" if the context is unclear, or "Uncertain - Format" if the response format is unexpected. We set the temperature parameter at 0.3 for this step. The temperature parameter controls the randomness of the model's output; higher values (up to 1) make the output more diverse and creative, while lower values (closer to 0) make it more focused and deterministic. By setting the temperature to 0.3, we aim to ensure that the model's responses are focused and precise yet still capable of capturing the nuances of environmental disclosure. Additionally, the model provides a rationale for the rating assigned to help explain its assessment of each segment. To determine whether a speech segment is related to environmental matters, ChatGPT was asked:

instruction = *"You are an AI capable of understanding text analysis. I will provide a question followed by one or several answers. Your task is to evaluate each question and each answer separately and determine whether they are related to environmental matters. Respond with 'Yes' if they mention environmental topics or technologies, regardless of the primary focus. Respond with 'No' if they do not mention environmental matters. If the context is unclear, respond with 'Uncertain - Content'. If it is uncertain due to unexpected response format, specify 'Uncertain - Format.' Provide your reasoning for each. Format your response as follows: Rating: [Yes/No/Uncertain - Content/Uncertain - Format] Explanation: [Your explanation here]*"

In the subsequent step, we guide ChatGPT in classifying each text segment into one of

three categories based on the concept of double materiality within the context of environmental disclosures: financial materiality, environmental and social materiality, or neither. The model determines the classification by analyzing whether the segment primarily addresses the financial implications of environmental issues, the broader environmental and social impacts, or neither. For each classification, the model provides a concise explanation, highlighting the key elements that informed its decision. We maintain the temperature parameter at 0.2 during this step to ensure the model's responses remain focused and precise.

To determine the classification based on the double materiality concept, ChatGPT was asked the following:

instruction = *"You are an AI capable of understanding text analysis. I will provide a text, and your task is to classify its primary focus into one of three categories: Financial Materiality, Social and Environmental Materiality, or Neither, within the context of environmental disclosure. If the text does not address any environmental issues, classify it as Neither. Financial Materiality refers to aspects that directly impact the financial condition or operational performance of the entity, specifically in relation to environmental issues. This includes: - Risks, opportunities, and financial outcomes directly linked to environmental issues. - Financial implications of regulatory changes, market shifts, and investor expectations related to environmental issues. - Cost savings, revenue generation, or financial performance improvements derived from environmental initiatives. Note: General financial discussions not directly linked to environmental issues should be classified as Neither. Social and Environmental Materiality encompasses the entity's impact on the environment and society. This includes: - Ecological sustainability, such as carbon footprint, resource use, and waste management. - Social welfare, including labor practices, community engagement, and human rights. - Policies, initiatives, and outcomes related to improving environmental and social conditions. For category: - Financial Materiality: If the text primarily addresses how environmental and social issues affect the entity's financial performance, classify it under Financial Materiality. Start the answer with the category and then provide a brief explanation of the key points that led to this category, highlighting specific segments or phrases that indicate a connection to environmental issues. - Social and Environmental Materiality: If the text focuses more on the entity's impacts*

on environmental and social aspects, classify it under Social and Environmental Materiality. Summarize the key elements that support this category, citing parts of the text that discuss social and environmental impacts, policies, or initiatives. Look for terms like "environmental impact", "social impact", "community", "sustainability policy", or "social responsibility". - Neither: If the text does not address any environmental issues, classify it as Neither. Format your response as follows: category: [Financial Materiality/Social and Environmental Materiality/Neither] Explanation: [Your explanation here]"

Appendix D. Classification Examples

JAS - Earnings call Q1 2009

Speech: "['Several things that Ken Haverkost and his team have been working on one has to do with how we project weekly sales and then allocate store labor based on those sales projections. We had a tendency to be a little optimistic in the past on some of those forecasts, so we put some new methodology in place to make sure we're more accurate and, therefore, don't waste labor hours. Secondly, there are some major changes in the way we handle backstock inventory at the store level. Instead of reserving that inventory on high shelves and needing ladders to get up and down to pull down that stock and replenish the shelves, we're converting to a process where we keep that on rolling racks in the back room, and we can more readily refill the shelves. Then, thirdly, just on changes in the way we allocate hours for physical inventory preparation. Historically, we allocated a significant number of hours to *clean up* the stores and prepare for physical inventories, and the way we're running our stores on a day-to-day basis now, that was wasted labor hours that we didn't need to allocate, so we've taken that out.']"

Classification: "No"

Explanation: "The provided text discusses changes in sales projections, store labor allocation, inventory management, and physical inventory preparation within a retail context. It does not mention any specific environmental topics or technologies".

SEP - Earnings call Q3 2015

Speech: "['Okay. Thanks. Lastly, this is just kind of a macro question, not necessarily about your assets and maybe just Marcellus build out in general we're seeing some massive drive Utica wells and if this continues I would think *natural gas* prices stay lower for longer possibly pricing out some producers who might not have that exposure so maybe it becomes less producer each with more market share now. I would think some of the producers are not going to make it especially given leverage and balance sheet issues at what point should we be worried about some of the counter parties on all the pipelines that are currently being developed to get out of the region. I understand a lot of your build out is underpinned by utilities but there is an element of supply push at the region so would be curious as to your thought and maybe some insight into the landscape out there are there outlets for some of these producers if the

pipeline has broken ground yet?']"

Classification: "No"

Explanation: "The question is focused on the economic aspects of natural gas production, market dynamics, and pipeline infrastructure in the Marcellus region. It does not directly mention environmental matters or technologies related to the environment."

AHGP - Earnings call Q2 2015

speech: "['Not in the near term. I think if government wants to continue to subsidize that sector longer term it could have some impact but its not significant. I strongly believe that *natural gas* and coal are going to be the backbone of electricity generation they are going to be 70%; 63% to 68% – 65% to 68% for some time to come. So yeah you may see some capacity additions but its not. It doesn't move the needle its very small to the total grid. The power is intermittent and I think the gains they made have been made to the areas of the country where they got the most demand and for the rest of the country I just don't see it competing with *fossil fuels*.']"

Classification: Uncertain-Content

Explanation:"The response does not directly mention environmental matters or technologies related to the environment. It discusses the future of electricity generation and the dominance of natural gas and coal, but does not explicitly address environmental impacts or solutions."

AUY - Earnings call Q1 2010

Speech: "['Gualcamayo actually the main improvements on cost there is going to be the size of the trucks actually we brought these trucks by the beginning of the year actually the end of last year. And now they are really prepare all the benches to accept this truck with a more productive to productive rate. And also they are going to open the benches there in a different way to really have much more access bench-by-bench. Another initiative that they have in the bench that is not where they don't have ore they're going to have 20 meters bench and that would improve all the drilling all the blasting and also the movements of *waste material*. That's our base the two things that we are going to do there in Gualcamayo asset.']"

Classification: Uncertain-Content

Explanation:"The provided text does not explicitly mention environmental matters or technologies related to the environment. It focuses on improvements in cost, truck size, productivity, and operational processes at the Gualcamayo asset. Without further context or details on any environmental considerations, it is unclear if this text is related to environmental matters."

ZXAIY - Earnings call Q3 2017

Speech: "['Due to Chinese government's stringent environmental control measures and a lot of steel mills have been forced to shut down. Lot of them are steel mills actually based in Hubei Shandong Province which are very near our production one of our production center. As we mentioned earlier most of the steel carbon steel are produced in Hubei Shangdong Hunan provinces and those are provinces are geographically close to the city of Beijing where central government are very adamant about the environmental issues and improvement. And so as a result of that and due to the cut down and shutdown of the steel mill in those provinces it's in China having a shortage of the supply–demand imbalance which now we are buying steel from Hubei province one of the location which is quite far. So the market dynamics are triggering a steel price especially the rim steel price increased significantly increased and putting a lot of pressure among us as the largest wheel producer in China for commercial vehicle market. On the price side our OEM customers are – they are well aware of this raw material increase situation as they are probably one of the largest sector to procure steel for their vehicles.

And so [the] general trend is definitely moving towards the lighter wheel lighter weighted products. So we are heavily campaigning our solutions such as aluminum products such as tubeless wheel. Those are light weight solutions but also meet their requirement for these trends durability. 2017 marked a very special year as the not only the steel price increase more than doubled but also the frequency of the price increase throughout the year is very high. And so due to this combination of this not only us as a major supplier to the truck producers but also the truck maker themselves are having trouble passing on the raw material increase to the end customer. So we are taking the steps to solve that.']"

Classification: Yes

Explanation: "The text discusses the impact of environmental control measures in China leading to the shutdown of steel mills, which affects steel production and prices. It also men-

tions the trend towards lighter weight products like aluminum to meet environmental requirements and market demands."

Classification_DM: Financial Materiality

Explanation_DM: "The text primarily focuses on the financial implications of environmental issues, specifically related to the shutdown of steel mills in provinces like Hubei and Shandong due to stringent environmental control measures by the Chinese government. It discusses the impact of this shutdown on the supply–demand balance, leading to a shortage of steel supply and price increases. The company, as a major wheel producer in China, is facing pressure due to the rising steel prices and is adapting by promoting lighter weight solutions like aluminum products to align with market trends. The mention of steel price increases, market dynamics, supply–demand imbalances, and the company's efforts to address these challenges highlight the FM of the environmental issues discussed in the text."

YTEN - Earnings call Q2 2011

Speech: "['One last question, you mentioned the ash that's produced and [that] it can be used in concrete. But in that ash obviously is some toxic stuff and now it's potentially toxic stuff that's in concrete. I know it's all solidified and all but is there a longer-term environmental issue? If someone starts to drill into this concrete does it release a lot of this toxic stuff?"]

Classification: Yes

Explanation: "The question mentions the environmental issue of potentially toxic substances in concrete and the concern about releasing these toxins when drilling into the concrete. This is related to environmental matters."

Classification_DM: Environmental and Social Materiality

Explanation_DM: "The text primarily focuses on the potential environmental impact of using ash in concrete, specifically addressing concerns about the presence of toxic substances in the ash and the possibility of these being released when drilling into the concrete. This discussion highlights environmental considerations related to waste management, potential pollution risks, and the long-term implications of using such materials in construction."