Attitudes towards climate change and bank climate disclosures: Evidence from Europe

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Abstract

This paper examines whether public attitudes towards climate change influence banks' climate-related disclosures. Using country-level data on climate concerns from three waves of the European Social Survey and textual measures of climate disclosures of European banks, we document that stronger public perceptions of climate risk are generally associated with more extensive climate disclosures. Banks headquartered in countries where residents express greater concern about climate change are associated with higher levels of climate disclosure and the disclosures are of higher quality. We further show that national culture moderates the relationship between climate attitudes and banks' climate disclosure. Specifically, the positive association between public concerns about climate and disclosure intensity is stronger in countries characterized by higher levels of femininity, uncertainty avoidance, and long-term orientation. Overall, our findings suggest that public attitudes and societal expectations may act as informal institutional drivers of climate disclosure in the banking industry.

Keywords: Climate risk disclosure, voluntary disclosure, banking, climate change, culture

1. Introduction

The significant exacerbation of climate change due to human activity in recent decades poses numerous threats to the sustainability and viability of both human and ecological systems. Despite the scientific consensus on the reality of climate change and several of its predicted harmful effects, public perceptions of climate risks vary, and are based on several demographic factors (Capstick et al., 2014; Ratter et al., 2012). Previous literature indicates that public opinion fluctuates on key issues – including the reality of climate change and whether it is a cause for concern (Stanford University, 2010) – and can influence the trajectory of climate change through personal action and policy development (Shwom et al., 2010; Stern & Dietz, 2008). A related but heretofore underexplored area of study is the effect of public attitudes to climate change on the environmental actions of financial institutions. In this paper, we investigate whether these attitudes are related to bank climate-related disclosures across Europe.

The field of climate finance is nascent, and the body of empirical evidence on the role of finance in directing actions towards environmental goals is relatively limited in scope. Nevertheless, a review of the recent research suggests that redirection of the flow of capital to sustainable agriculture and industry, and renewable energy may provide the impetus needed for businesses and investors to shift gears to a greener economy (Calvet et al., 2022; OECD, 2017). The importance of this channel of climate action is underscored in the frameworks developed by international organizations, including the 2015 Paris Agreement[1], the Task Force on Climate-related Financial Disclosures (TCFD, 2015-2017)[2], the Network for Greening the Financial Systems (NGFS, 2017)[3], and the UNEP Finance Initiative[4]. At the time of their study, Calvet et al. (2022) reported that decisive action by central banks to encourage the consideration of climate risks and carbon footprints was likely on the horizon. Since then, developments in financial policy have reflected this stronger shift towards the enforcement of environmental targets. In 2022, the European Central Bank (ECB) began favouring environmentally friendly debt issuers[5], and in 2024, banks that did not meet expectations on the disclosure and management of climate risks were issued notices of fines[6].

[1] Article 2.1c of the Paris Agreement calls for "making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development."
[2] Organized by the Financial Stability Board, the TCFD promoted transparency and provided a framework for disclosing climate-related risks.
[3] Coalition of financial institutions that focuses on the importance of climate risk in financial decision-making and economic policy.
[4] The United Nations Environmental Programme Financial Initiative coordinates with financial institutions to help incorporate sustainability and research in climate finance.
[5] European Central Bank press release: ECB provides details on how it aims to decarbonise its corporate bond holdings
[6] Reuters, September 2024: ECB started issuing fine notices to banks not meeting climate expectations | Reuters

Pressure to address climate risks also comes from non-regulatory stakeholders, including institutional investors (Krueger et al., 2020; Eccles and Klimenko, 2019; Dyck et al., 2019), climate-aware customers (Kurowski et al., 2022), credit rating agencies (Ciummo et al., 2022), and insurance providers (Nobanee et al., 2022). In turn, institutional involvement in environmental action may be communicated through various mediums of disclosure, including annual reports, ESG reports, independent surveys, and earnings calls (Ge et al., 2025; Ilhan et al., 2023; Han et al., 2025). Evidence suggests that institutions operating under stronger stakeholder expectations of environmental action may be more likely to make disclosures, and be more forthcoming in these disclosures (García-Sánchez et al., 2020). This is consistent with the institutional and legitimacy theories of corporate social responsibility, which are commonly applied in explaining the success of socially responsible activity in business (Deegan, 2002; Boiral, 2013; DasGupta, 2022; Dimic et al., 2024, etc.).

Public opinion exerts influence on the sustainability of banks through several mechanisms. Bank climate-related disclosures may be propelled by strategic intent, such as establishing competitive advantages, and avoiding risks and costs related to reputation. Proactive management of climate risks has been associated with higher bank performance, agility and resilience (Battiston et al., 2017), while polluting banks have experienced reputational losses amongst investors, NGOs, and the public (Herbohn et al., 2019). Moreover, the damage to reputation from carbon-intensive practices can compromise performance and stability, as banks with higher environmental reputation risks have been shown to attract lower deposits, have reduced liquidity creation (Choi et al., 2023), and have higher liability costs (Galletta et al., 2023). Given the importance of public, institutional, and regulatory perceptions of banking practices, variations in climate change awareness across geographical regions may at least partly predict variations in bank climate-related disclosures.

Another, simpler explanation for a positive relationship between public attitudes towards climate change and bank climate-related disclosures is that the behaviours and decisions of organization leaders, such as bank executives and board members, are influenced by their personal values, as proposed by the Upper Echelons Theory (Hambrick and Mason, 1984). These personal values are in turn a reflection of the beliefs and values prevalent in their social environment or region. This line of reasoning justifies the use of variables measured at the region-level as proxies for organizational characteristics and causes for firm-specific outcomes, especially in studies on religiosity (Hilary and Hui, 2009; Gharbi et al., 2021), tolerance for corruption (Athanasouli and Goujard, 2015), and political ideology (Cohen et al., 2019). Similarly, a higher level of public concern or awareness about climate change should be reflected in the personal attitudes of organization members, leading to a higher likelihood of climate related disclosures and more thorough disclosures.

Assuming that the link between climate change awareness and bank disclosures is driven in a large part by either reputation management or a reflection of public attitudes in organization leaders, this relationship can be moderated by cultural values, adding variability in the expected coefficients across socially distinct populations. Cultural values, frequently studied in prior literature using six dimensions developed by Geert Hofstede (1980, 2001), have been shown to affect how organizational choices shape reputation. Specifically, Ruiz and García (2019) find that uncertainty avoidance plays a significant role in how a bank's workplace and leadership impact its reputation. Groenland (2002), and Cintamür and Yüksel (2018) also highlight the potential of cultural differences as explanatory variables in organizational reputation. In addition, national and organizational culture have been found to moderate the effects of leaders on organizational efficiency, job satisfaction, leader effectiveness, and other subordinate-related outcomes (Zhang et al., 2022; Atkas et al. 2011). Given that culture can introduce variation in incentives to respond to or reflect public climate concerns, the effects of public attitudes to climate change may depend on the relative prominence of various cultural values. Therefore, evidence from prior literature supports the need to investigate culture as a moderating factor in the relationship between public attitudes and bank disclosures.

In this study, we empirically investigate the link between public attitudes towards climate change, and the climate-related disclosures of 119 banks across 28 European countries over the period 2015-2024. Our primary measures of country-specific attitudes towards climate change are responses to questions related to climate change in the European Social Survey, included in the 2016, 2020, and 2023 rounds. Response values are interpolated for the intermediate years using survey years as the centre points of observation. We compute bank climate disclosure as the proportion of statements related to climate in annual reports, ESG reports, and in both annual and ESG reports combined. Results of our regressions indicate that public environmental concern measured through responses to the questions *"How worried are you about climate change?"* and *"Climate change is mostly caused by human activity"* are a significant positive predictor of the intensity of bank climate-related disclosures, while responses to the question *"I feel personal responsibility about climate change*" show weak effects. Public concern is also associated with higher quality climate disclosure; in particular, the disclosures cover more topics and are easier to read.

Additionally, we examine whether country culture, as represented by Hofstede's (1980, 2001) cultural dimensions, and alternatively by Schwarz's (2008) model and House et al.'s (2004) GLOBE project on national culture, moderates the relationship between public attitudes toward climate change and banks' climate-related disclosures. Our analysis reveals that banks in *feminine* and *long-term-oriented* cultures exhibit a stronger responsiveness to

public climate concern, resulting in longer disclosures. *Uncertainty avoidance*, which reflects a society's low tolerance for ambiguity, consistently fosters more extensive disclosures, with public awareness further amplifying this effect. These results align partly with previous studies on the impact of culture on environmental proactivity and sustainability disclosures (Ozkan et al., 2023; Wang et al., 2021).

This paper contributes to the existing research on climate finance in several important ways. Firstly, it addresses a noticeable gap in the literature by establishing a direct link between the quality and quantity of bank climate disclosures and the attitudes towards climate change in the population, demonstrating that banks communicate a greater commitment to environmental protection if this sentiment is more widely reflected in the general public. Secondly, by utilizing responses to multiple survey questions on climate change, we provide a comprehensive view into the effects of public sentiment, which shows that bank disclosures depend on the degree of public concern. Thirdly, we add to the growing body of literature on the role of country culture in institutional decisions and outcomes by showing that it moderates the relationship between public attitudes towards climate change and bank climate disclosures.

The rest of this paper is organized as follows. Chapter 2 presents an overview and discussion of relevant literature, leading to the development of our hypotheses. Chapter 3 introduces the methodology, including measurement of variables and regressions models, data and descriptive statistics. Chapter 4 presents the main regression results and additional tests. Finally, Chapter 5 provides some concluding remarks.

2. Prior literature and hypothesis development

Disclosures pertaining to climate change are encouraged by financial and non-financial regulatory bodies, international organizations, and non-institutional stakeholders because in global efforts to mitigate climate change, they promote transparency, reduce information asymmetry, and signal a commitment to sustainable practices and long-term goals (Matsumura et al., 2024). However, they also carry costs to the discloser, mainly in the form of expenses of the transition to environmentally friendly policies, and risks associated with comparably less favourable disclosures. Competent management will prioritize disclosures if they are a net benefit to the institution. Banks aligned with low-carbon policies would realistically be more transparent and forthcoming about their alignment, producing higher levels of climate-specific disclosures. Ultimately, the commitment to address climate change and manage climate risks may be a function of the various financial, strategic and reputational

benefits and costs related to the transition to a low-carbon framework (Reboredo and Ugolini, 2022; Nguyen et al., 2023).

The inclination and extent of transition may be influenced by factors in the bank's operating environment. Bolton and Kacperczyk (2023) find high carbon emissions to be a significant inhibitor of market performance, and show that the country's level of economic development and political inclusivity actively moderate these carbon premia. Giese et al. (2021), who also study variations in stock returns driven by climate transition risk, report that carbon-efficient companies tend to outperform in developed countries, but underperform in emerging markets. This is attributed to differences in country-level policies and regulations related to climate change, such as the ambitiousness of their environmental targets and intended contributions. The climate-consciousness of elected authorities and political bodies in developed countries, which comprise a largely democratic sample, should reflect the inclinations of their populations. The evidence therefore further strengthens our premise that public attitudes to climate change can ostensibly influence institutional environmental policies and climate-related disclosures.

Environmental concern among the general public has not been sufficiently explored as a factor of influence in climate finance, and the methodology and evidence is still in its formative phase. Public sentiment on climate change in related literature across disciplines is gauged through national and international surveys and opinion polls with largely similar themes but moderate to high variation in size, time, frequency, and scope. The key issues examined in the majority of extant research can be summarized as i) the reality of climate change; ii) the extent of worry or concern for the effects of climate change; and iii) the weight of human activity as the perceived cause of climate change (Afzali et al., 2024; Dechezleprêtre et al., 2025; Corner et al., 2011; von Borgstede et al., 2013; Whitmarsh, 2011, etc.). The data used in this paper is obtained from publicly available responses to the European Social Survey, which includes questions addressing these key issues for three spaced years (2016, 2020, 2023), allowing us to perform longitudinal analyses. For these reasons, we also focus on the aforementioned primary measures of climate change perception and awareness.

In addition to evidence suggesting they are closely associated with other country-level economic and political conditions, justifications for the influence of public attitudes towards climate change on bank climate disclosures may also be found in theory. Specifically, the legitimacy theory (Dowling and Pfeffer, 1975; Suchman, 1995) proposes that the fulfilment of social and inter-organizational expectations may help institutions establish credibility in their operating environments, and gain and maintain access to potential resources. With shifts in social norms and values, organizations would subsequently adopt practices that align with popular views. In a similar vein, the institutional theory (Meyer and Rowan, 1977; DiMaggio

and Powell, 1983) suggests that organizations can engage in practices that align with broadly held views and norms shared by institutional and non-institutional stakeholders not necessarily for profit but to achieve other supportive boons including legal stability and strategic agility. Several studies discuss the utility of these theories in explaining transparency in reporting and sustainability disclosures (Hummel and Schlick, 2016; Kılıç et al., 2020; Mobus, 2005; Zeng et al., 2012, etc.).

More directly related to our study, Caby, Ziane and Lamarque (2020) investigate various bank- and country-level variables as determinants of bank disclosures and initiatives related to climate change for a sample of 117 banks across 40 countries. Specifically, at the country level, they find that country development (categorized as advanced or emerging), country financial development (the proportion of GDP attributed to the financial industry), and the Environmental Performance Index (which measures country performance in environmental protections and sustainability) are positive and significant predictors of banks' disclosures related to climate initiatives. Importantly, these exogenous factors may be closely related to environmental awareness. According to previous literature, a country's financial and social development can both affect its population's attitudes towards climate change (Franzen and Vogl 2013; Nawrotzki, 2012), while studies on the effects of environmental quality offer mixed findings (Franzen and Vogl, 2013; Howe et al., 2013). Altogether, the evidence suggests the existence of a significant relationship between economic and socio-demographic characteristics and bank climate disclosures, and highlights the role of public environmental concern as a plausible medium.

Based on the theory and empirical evidence provided thus far, we hypothesize that banks headquartered in countries where people are more concerned about climate change and its human causes exhibit higher levels of climate-related disclosures.

H1: Public environmental concerns are positively associated with the level of bank climate-related disclosures.

We further argue that the relationship between public attitudes to climate change and bank climate disclosures is not uniform across the sample, and is instead moderated by cultural values. Developed through empirical research on cross-cultural differences in work values and partially augmented over time, the Hofstede model identifies key dimensions along which national cultures vary, and has been instrumental in studying how culture shapes attitudes, decision-making, and institutional practices (Hofstede, 1980; 1991; 2001). Hofstede

measures six dimensions of cultural values, namely the *Power Distance Index* (the extent to which hierarchical inequality is accepted), *Individualism vs. Collectivism* (the degree of emphasis on personal autonomy as opposed to group cohesion), *Uncertainty Avoidance* (societal tolerance for ambiguity and change), *Masculinity vs. Femininity* (preferences for competitiveness vs. care and cooperation), *Long-term Orientation vs. Short-term Orientation* (focus on future rewards instead of tradition and stability), and *Indulgence vs. Restraint* (the degree to which societies permit gratification of desires). We augment our exploration of culture's influence on climate change awareness and disclosures by also employing Schwarz's (2008) cultural model, and the GLOBE project on national culture (House et al., 2004). Similar areas of study have recently benefited from examining how culture shapes the performance and decision-making of institutions. For example, Shin, Moon and Kang (2023) find that certain cultural values, as defined by Hofstede's cultural dimensions, can make ESG more financially rewarding for firms, and additional research, while producing conflicting results, has contributed to the growing evidence on culture's influence in organizations and their outcomes (DasGupta and Roy, 2023; Shi and Veenstra, 2021).

In the literature on banking, culture has been shown to affect risk-taking (Mourouzidou-Damtsa et al., 2019), lending and deposits (Mourouzidou-Damtsa et al., 2020; Zheng et al., 2013), earnings quality (Kanagaretnam et al., 2011), and bank failures (Berger et al., 2021). With respect to organizational sustainability, the effects of culture on climate proactivity, corporate social responsibility, and sustainability and carbon disclosures has also been extensively evidenced in recent literature (Wang et al., 2021; Perkins et al., 2022; Agyei-Mensah and Buertey, 2019; Ozkan et al., 2022). Closely related to our research and further motivating its exploration in our analyses, culture has also been shown to positively affect bank transparency and disclosure (Hooi, 2007), and more specifically, bank sustainability disclosures (Nicolò et al., 2024). Nicolò, Zanellato, Esposito and Tiron-Tudor's (2024) study focuses on the Eastern European region in its investigation of the influence of country culture on bank sustainability disclosures, and finds that multiple cultural dimensions, including uncertainty avoidance and long-term orientation, increase disclosure levels. The evidence largely supports a significant link between culture and bank disclosures, and we further extend the current literature by considering a novel question: would culture moderate the effects of public attitudes towards climate change on climate-related disclosures?

While public concern about environmental issues may generate social pressure for greater transparency, the effectiveness of such pressure is likely to vary depending on underlying cultural norms and values. For instance, societies characterized by high levels of collectivism may place greater emphasis on shared environmental responsibility, strengthening the link between public environmental concern and institutional

responsiveness, whereas in more individualistic cultures, banks may be less inclined to respond to public sentiment unless compelled by market or regulatory mechanisms. Similarly, in countries with high power distance, hierarchical structures may limit the influence of public opinion on organizational practices, potentially weakening the relationship between public environmental concern and disclosure. Moreover, in countries with high uncertainty avoidance, traditionalism and resistance to change may reduce public appetites for transition to new, greener practices, potentially weakening the channels through which climate awareness affects disclosure practices.

In addition to the legitimacy theory and institutional theory of organizations, the bulk of academic research on the effects of culture and cultural values in accounting and finance also draws fundamental support from Freeman's (1984) widely adopted stakeholder theory. The stakeholder theory increases the scope of organizational focus beyond its financial responsibilities, and includes less powerful stakeholders from employees to the broader community within its sphere of accountability. The stakeholder theory can also be applied to cases where ethically or sustainably motivated actions can lead to positive financial outcomes (Fernando et al., 2017; Reinhardt et al., 2008). Therefore, it reinforces incentives for banks and other profit-seeking institutions to address concerns voiced in their immediate operating environment.

Following the presented theory and evidence on culture's separate effects on institutional outcomes in general, and banking and bank disclosures in particular, we hypothesize that some or all of the documented cultural values would moderate the effects of public attitudes to climate change on bank climate disclosures.

H2: Cultural values moderate the relationship between public environmental concerns and bank climate-related disclosures.

3. Research design

3.1. Measurement of climate related disclosures

Our dependent variables include the length and characteristics of climate-related disclosures in banks' annual and ESG reports. To capture these disclosures, we strictly adhere to the procedures outlined by Sautner et al. (2023), which utilize the search algorithm developed by King et al. (2017). Sautner et al. (2023) choose not to use a pre-defined set of keywords for

identifying climate-related disclosures because discussions on climate change often intersect with other topics such as regulations, technology, and taxes. Additionally, discussions on climate change rapidly evolve in response to regulatory changes and technological innovations. Sautner et al. (2023), following King et al. (2017), use an initial set of bigrams to find additional bigrams capable of detecting climate-related disclosures. These new bigrams are identified using supervised machine learning techniques and are employed to capture sentences that address climate-related issues. As this is a challenging task, we employ several alternative approaches as additional tests to make sure that our inferences are not driven by textual methods. In particular, we use the *ClimateBERT* model (Webersinke et al., 2021), a language model specifically trained for climate related text. We also apply keyword lists from Li et al. (2024) and Sautner et al. (2023) to capture relevant sentences. Further details on these alternative approaches can be found in the Appendix 2.

The annual reports are sourced from the LSEG database, with any missing reports manually retrieved from banks' websites. Non-English reports are excluded.[7] Since banks may publish sustainability reports separately from annual reports, analyzing only the latter could skew our data if sustainability information is contained in separate documents. Therefore, we also examine climate-related discussions in ESG reports. We begin this process by downloading all PDF files containing the word "climate" from the LSEG database under the "ESG" category. This includes ESG web-based reporting, corporate governance reports, articles of association, sustainability reports, codes of conduct, and documents pertaining to environmental policy, audit committee, and stakeholder engagement. We then apply the created bigrams to identify sentences containing climate-related discussions. As a result, we have two sets of disclosures: one extracted from annual reports and another from ESG reports. Subsequently, these disclosures are compiled into a comprehensive set of overall disclosures.

The length of climate-related disclosures is defined as the number of sentences containing the specified bigrams. Additionally, we obtain the word count of these disclosures to test the robustness of our results. We then construct the dependent variables *DISC_AR, DISC_ESG, DISC_BOTH*, and *DISC_OVR*. *DISC_AR* and *DISC_ESG* indicate the presence of climate-related disclosures in annual reports and ESG reports, respectively. *DISC_BOTH* identifies firms that report climate-related information in both document types, while *DISC_OVR* indicates whether climate-related disclosures appear in either annual or ESG reports. We also construct *NSENT_AR, NSENT_ESG*, *NSENT_BOTH*, and *NSENT_OVR* by taking the natural logarithm of the number of sentences captured within annual reports, ESG reports, both combined, and either, respectively.

[7] In additional analysis, we control for countries' English Proficiency and Linguistic Distance (between national language and English) to adjust for the bias caused by this.

We operationalize disclosure quality using a composite measure consisting of three components: specificity—captured by number density and the number of topics discussed; stickiness and boilerplate—the similarity between the current year's disclosure and that of the previous year for each bank, and the similarity of each bank's disclosure with that of other banks in the same year, respectively; and readability—the ease with which the text can be processed. To assess readability, we apply the Gunning Fog Index following prior literature (Bushee et al., 2018; Bifulco et al., 2025). Because higher Fog Index values indicate lower readability, we multiply the measure by –1 so that higher values correspond to clearer and more readable disclosures.

In addition, we capture the negative sentiment and uncertainty of the disclosures. To measure sentiment, we use the Loughran-McDonald Sentiment Word Lists (Loughran & McDonald, 2016), counting the frequency of words classified as negative, positive, or uncertain. These frequencies are then divided by the total word count in disclosures to derive sentiment scores. We create the variable *NEGATIVE* by subtracting the positive sentiment score from the negative sentiment score, and dividing this difference by the sum of positive and negative sentiment scores, across combined ESG and annual reports. The variable *UNCERTAINTY* is calculated by dividing the frequency of words related to uncertainty by the total word count in the disclosures. Detailed formulas and procedures for measuring the dependent variables are provided in Appendix 2.

3.2. Measurement of climate attitudes

To measure public attitudes toward climate change, we use data from the European Social Survey (ESS). Established in 2001, the ESS is a cross-country survey designed to capture the attitudes, beliefs, and behavior patterns of populations in more than 30 European countries (ESS, 2025). Conducted biennially, the ESS has completed 11 rounds, covering 23 distinct themes. Climate change, introduced in round 8 in 2016, is one of these themes and comprises 32 questions.

In this paper, we focus on three questions from the climate change module that were repeated in the 2016, 2020, and 2023 rounds. These questions are: "*How worried are you about climate change?*"; "*To what extent do you feel a personal responsibility to try to reduce climate change?*"; and "*Do you think that climate change is caused by natural processes, human activity, or both?*". Higher values in the responses to these questions suggest that people are more concerned about climate change, feel a stronger responsibility to mitigate it, and believe it is primarily caused by human activities.

As the survey results are only available for the years 2016, 2020, and 2023, we follow prior studies (Hartlieb & Eierle, 2024; Kim & Orphanides, 2012) and interpolate values for the missing years using a linear interpolation method. This approach is appropriate given that the average responses to these questions show a steady increase over time. For instance, the average response to the question "*To what extent do you feel a personal responsibility to try to reduce climate change?*" increased from 5.61 in 2016 to 6.04 in 2020 and to 6.07 in 2023. Furthermore, both the variation in climate change awareness over time and the differences in response values between countries remain relatively stable, evidenced by the correlation coefficients of 0.88 between the 2016-2020 responses and 0.95 between the 2020-2023 responses for the same question.

3.3. Econometric model

We test the first hypothesis using the following regression model:

$$f(Y_{b,t}) = \alpha_0 + \alpha_1 CC\_ATTITUDES_{c,t} + \sum_{l=1}^{m} \gamma_l CONTROL_{l,c,b,t} + \varepsilon_{b,t} \quad (1)$$

where f is the logit link function when the dependent variable ($Y_{b,t}$) represents a binary variable measuring the incidence of climate-related disclosures in bank annual reports (*DISC_AR*), ESG reports *(DISC_ESG),* or across both annual and ESG reports (*DISC_BOTH*), and the linear function when dependent variables are continuous variables measuring length as the number of sentences (*NSENT_AR, NSENT_ESG, NSENT_BOTH*), disclosure attributes, and sentiment. Attributes comprise the density of numbers in climate-related disclosures (*NUM_DENSITY*), the number of topics covered in climate disclosures (*NUM_TOPIC*), the similarity of the bank's disclosure with those of other banks in the same year (*BOILERPLATE*), the similarity of the bank's disclosure with its disclosures over previous years (*STICKINESS*), and the complexity of the disclosures (*READABILITY*). Disclosure sentiment is represented by the proportion of negative words in the disclosure (*NEGATIVE*), and the level of uncertainty in the disclosure (*UNCERTAINTY*).

$CC\_ATTITUDES_{c,t}$ represents one of three variables measuring aspects of public attitudes toward climate change, each corresponding to a survey question: *WORRY* (concern about climate change), *RESP* (sense of personal responsibility to reduce climate change), and *HUMAN* (belief about whether climate change is caused by natural processes, human activity, or both). For brevity, in some analyses we use the variable *AWARE*, defined as the average of the standardized values of *WORRY*, *RESP*, and *HUMAN*, to capture overall public attitudes toward climate change. $CONTROL_{l,c,b,t}$ referes to several country- and bank-specific control

variables. The regressions also include year fixed effects. The subscripts *c*, *b*, and *t* denote country, bank, and year, respectively.

To test the second hypothesis regarding the moderating effects of country-specific cultural values on the relationship between climate attitudes and climate disclosures, we estimate the following equation:

$$f(Y_{c,b,t}) = \alpha_0 + \alpha_1 CC\_ATTITUDES_{c,t} + \sum_{j=1}^{6} \alpha_j CULTURE_{j,c} + \sum_{j=1}^{6} \beta_j (CULTURE_{j,c} \times CC\_ATTITUDES_{c,t}) + \sum_{l=1}^{m} \gamma_l CONTROL_{l,c,b,t} + \varepsilon_{c,b,t} \quad (2)$$

where $CULTURE_{j,c}$ consists of six variables, and their coefficients (α_j) represent the impact of various cultural values on climate-related disclosures at average levels of public attitudes toward climate change ($CC\_ATTITUDES_{c,t}$). The coefficients of the interaction term (β_j) measure how climate-related disclosures vary with public attitudes to climate change when cultural values differ from the average.

The list of control variables in both regressions is as follows. At the country level, we account for institutional quality with the variable *GOV_QUALITY*, calculated as the average of ranks from six World Bank governance indicators: voice and accountability, government effectiveness, control of corruption, political stability, rule of law, and regulatory quality. We control for the country's score on the Environmental Performance Index (*EPI*) developed by the Yale Center for Environmental Law & Policy (Block et al., 2024). The Yale EPI is a comprehensive metric that "*combines 58 indicators across 11 issue categories, encompassing climate change mitigation, air pollution, waste management, the sustainability of fisheries and agriculture, deforestation, and biodiversity protection*" (Block et al., 2024). It ranges from 0 to 100, with higher values indicating better environmental policy targets. Firms in countries with higher EPI scores are expected to include more discussions about climate change in their reports (Cahan et al., 2016). Demographic factors, notably education levels, are likely to affect both public attitudes and bank disclosure levels. We therefore also control for the country's performance on the Human Development Index (*HDI*), retrieved from the UNDP Website. These three control variables are highly correlated; therefore, we include the orthogonalized components of *EPI* and *HDI* in the model to address issues of multicollinearity.

We also control for the quality of country-level investor protections, which have been positively linked to both the quantity and quality of disclosures (Barton & Waymire, 2004).

The variable for investor protections (*INVESTOR_PT*) is measured annually and obtained from the World Bank database. Institutional quality can influence CSR disclosure and performance, as it exerts pressure on firms to increase compliance and transparency (Yu et al., 2021). Rounding off the list of variables that characterize the bank's institutional environment is *NONEEA*, which is a binary variable indicating the country's exclusion from the European Economic Area. Abnormal temperature has been evidenced to drive a bank's overall credit risks (Ge et al., 2024), and thus may affect bank climate-related disclosures. It can also influence national climate attitudes. We calculate abnormal temperature at the country level following the methodology of Ge et al. (2024) and use this as a control variable (*ABTEMP*).

Additionally, we control for the country's level of financial development using the IMF (International Monetary Fund) Financial Development Index (*FINDEV*). Countries with more advanced financial sectors tend to exhibit higher climate change awareness and have larger banks, which typically provide more disclosures. The last set of control variables at the country level are *LN_GDP*, *GDP_GR*, *IND_GDP*, and *TOP3*, representing the level of economic activity, the growth in economic activity, the contribution of the industrial sector to total GDP, and the concentration of three largest banks in the country, respectively. These values are obtained from the World Bank database. As the industrial sector's role in total GDP increases, banks are likely to have more polluting borrowers in their portfolios and consequently bear higher climate-related risks. Furthermore, the presence of industrial firms in a country may also correlate with public climate attitudes.

At the bank level, we control for bank size (*SIZE*) using the natural logarithm of total assets, and profitability (*ROA*), calculated as income after taxes divided by total assets. Larger firms typically provide more disclosures due to their prominence, increased public scrutiny, and lower relative disclosure costs. We also account for firm risk using stock beta (*BETA*) as a proxy for systematic risk (Dobler et al., 2011; Linsley & Shrives, 2006). Systematic risk, indicated by beta, is expected to correlate positively with disclosures (Dobler et al., 2011; Linsley & Shrives, 2006; Miihkinen, 2012).

We also include a set of variables specific to bank operations: the loan-to-asset ratio (*LOAN_ASSET*), the ratio of non-performing loans to total loans (*NONPFLOAN*), the funding structure measured by the ratio of deposits to total assets (*DEPOSIT_ASSET*), and the income structure measured by the ratio of non-interest income to total revenue (*INCOME_STR*). To account for incentives for disclosing risks, we control for the market-to-book ratio (*MB*) and revenue growth (*REV_GR*). High market-to-book ratios suggest stronger growth prospects and therefore greater incentives to disclose (Gul & Leung, 2004; Lim et al., 2007; Miihkinen, 2012). Additionally, we control for the need for external financing (*FINANCE*), because it may add incentives to disclose more information (Francis et al., 2005; Lang & Lundholm, 1993).

FINANCE is defined as the total debt and equity issuance over three consecutive years, scaled by total assets.

Due to data limitations, we do not control for board characteristics in the main regression analysis. Instead, we separately control for the bank's governance score, obtained from the LSEG database, and report the results of this reduced sample regression in the section on additional tests.

All estimations include year-fixed effects. The t-statistics are computed based on robust standard errors clustered by country and year.[8] The variables used in the study are defined in Appendix 1.

3.4. Sample selection, summary statistics, and correlation coefficients

3.4.1. Sample selection

Our sample consists of listed banks headquartered in European countries from 2015 to 2024. Using the LSEG database, we perform an initial screening based on four criteria: (1) publicly-listed status; (2) European headquarters; (3) industry classification as 'Banks'; and (4) availability of revenue from business activities for the most recent fiscal year. Following this, we obtain a narrower sample of 257 banks. We identify 169 institutions that publish annual reports in English, and collect 1,567 annual reports via the LSEG database and bank websites. We exclude 640 observations lacking data for the European Social Survey and Hofstede's cultural dimensions. Our final sample forms an unbalanced panel of 927 observations, covering 119 unique banks across 28 countries[9].

3.4.2. Descriptive statistics

Panel A of Table 1 presents the descriptive statistics for the full sample, whereas Panel B offers a detailed breakdown by country.

[8] Clustering standard errors by banks does not qualitatively change our results.
[9] Denmark is noticeably missing from the list of European countries in our sample because data for survey responses to the ESS in 2016 and 2020 is missing for the country.

[TABLE 1 HERE]

There are 750 observations of climate-related disclosures in annual reports, representing 80.9% of the sample. The average value of the number of sentences related to climate in bank disclosures (*NSENT_AR*) across the entire sample is 1.64. In the subset of the 750 observations with disclosures, the average *NSENT_AR* is 2.02 (untabulated), corresponding to approximately 6.5 % of the total report length. The most extensive discussion of climate issues accounts for 55% of the annual report, whereas the shortest comprises only 1%.

More than half of the sample (56.2%), corresponding to 521 observations, includes discussions of climate-related issues in ESG disclosures. The mean *NSENT_ESG* value is 1.70 for the entire sample and 3.03 for the subset of 521 observations (untabulated), translating to an average of 20% of the ESG report length. The longest discussion about climate-related issues in ESG reports is 92% of total ESG report, while the shortest includes 1%. In total, 791 observations (85.4%) include climate disclosures in either annual or ESG reports, and 479 observations (51.7%) include them in both annual and ESG reports.

The sentiment of these disclosures is generally negative, as indicated by the positive minimum and average values of *NEGATIVE* and *UNCERTAINTY*. Furthermore, the readability of climate disclosures across ESG and annual reports is generally low, indicating higher complexity, as evidenced by the negative mean and median values of –18.70 and -18.56, respectively.

The variables *WORRY, RESP* and *HUMAN* are each used to measure the general attitudes of the public toward climate change. In our analysis, these variables are standardized to have a mean of zero and a standard deviation of one to facilitate interpretation of the estimated coefficients, particularly when analyzing their interactions with cultural values. The median value of the variable *WORRY* is 0.085, which is close to its mean value. The variable *RESP* has a median of 0.284, while the variable *HUMAN* holds a median value of 0.153.

With respect to firm-level control variables, *SIZE* has mean of 24.73 and a median of 24.54, suggesting a balanced sample in terms of bank size. Profitability (ROA) is modest, with a mean of 0.8% and a median of 0.7%. On average, banks are riskier than the market, as indicated by an average beta of 1.19. The loan-to-asset ratio (*LOAN_ASSET*) has a mean of 0.63, indicating that on average, 63% of banks' total assets are represented by loans. The ratio of non-performing loans to total loans (*NONPERF_LOAN*) has a mean of 0.07. The average value of deposits to total assets is 69.1%, while 34.5% of total income stems from non-interest income. The positive mean value of the *FINANCE* variable suggests that banks in our sample

have generally increased their debt and equity issuance over the past three years. The distributions of *MB* and *REV_GR* suggest that on average, banks in our sample are experiencing growth.

Panel B of Table 2 presents the sample composition and descriptive statistics by country. The highest number of observations are recorded for Italy (126), the United Kingdom (99), and Poland (99). France, Iceland, Norway, and the Netherlands have the largest quantity of climate-related disclosures in annual reports. Belgium and Portugal have only one bank in our sample and disclose climate related information in all years, resulting in a high average of *DISC_OVR*. Overall, Belgium, Estonia, France, Germany, Iceland, Netherlands, Norway, Portugal and Slovenia rank highest in terms of climate disclosures in annual and ESG reports combined. Belgium, France, Germany, Spain, and Sweden are among the countries with the most extensive climate disclosures. Norway is the country with the most specific disclosures (based on the density of numbers in disclosures) and its disclosures has the highest readability.

In terms of public attitudes toward climate change, Portugal scores highest on responses to "*How worried are you about climate change?*," with a score of 1.92, followed by Spain and Germany, each with a score of 1.55. Russia and the Slovak Republic have the lowest scores for this question, with scores of –2.55 and -1.47, respectively. France leads with the highest score for "*To what extent do you feel a personal responsibility to try to reduce climate change?* " at 1.33, followed by Switzerland at 1.23. Meanwhile, Russia and the Czech Republic have the lowest scores, at -2.82 and -2.49, respectively. The highest agreement for "*Do you think climate change is caused by human activity?* " is observed in Sweden, with a score of 1.25, whereas the lowest agreement is found in Russia and Lithuania. Regarding Hofstede's cultural values, Austria has the lowest rating on the Power Distance Index, while the Slovak Republic has the highest. Portugal and Slovenia score the lowest on the Individualism Index, whereas the highest values are found in the United Kingdom and Iceland. Sweden is the most highly characterized by feminine values, while Slovakia by masculine ones. Uncertainty Avoidance is high in Cyprus and Greece and low in Ireland, Sweden, and the United Kingdom. Germany is the most long-term oriented country, and Ireland is the least. Finally, Sweden is the most indulgent, whereas Bulgaria and Lithuania are the least.

Estonia ranks highest in environmental performance, followed by Germany and Finland, while Russia and Macedonia have the lowest scores. Investors are most protected in Ireland and least in Switzerland. Meanwhile, Switzerland boasts the highest level of financial development, whereas Estonia has the lowest. Ireland's GDP is heavily reliant on the industrial sector, while Cyprus relies more on agriculture and services.

Table 2 presents correlation coefficients for all dependent and independent variables. Across the majority of right-hand-side variables, correlations remain small in magnitude. The exceptions are *GOV_QUALITY* which is highly correlated with the cultural values.

[TABLE 2 HERE]

4. Empirical results

4.1. Public attitudes regarding climate change and bank climate-specific disclosures

Table 3 presents the estimation results of regression Equation (1). Columns 1-3 report the results of the regression of *WORRY* on three dependent variables: an indicator measuring the presence of climate-related disclosures in annual reports (*DISC_AR*), in ESG reports (*DISC_ESG*), and in both annual and ESG reports (*DISC_BOTH*).

[TABLE 3 HERE]

Coefficients in columns 1-3 indicate that *WORRY* is significantly and positively associated with the incidence of climate-related disclosure in ESG reports and in both annual and ESG reports combined. This suggests that banks in countries where people are more concerned about climate change are more likely to disclose information related to their stake in climate change mitigation and climate risk. A one–standard-deviation increase in *WORRY* is associated with a 0.390 increase in the log-odds of the *DISC_ESG* and 0.382 increase in the log-odds of *DISC_BOTH*, which corresponds to an average marginal effect of about 6 percentage-point increase in the probability of climate-related disclosures in ESG reports and both annual and ESG reports.[10]

While coefficients of *RESP* are not significant in any of the columns, the coefficients of *HUMAN* are once again positive and significant (0.544 and 0.424) in both Columns 8 and 9, indicating that a one standard deviation increase in considering human activity to be the cause

[10] This is calculated by subtracting probability of *DISC_ESG* when *WORRY* is 1 and 0, respectively, while setting the value of all control variables at means. Other marginal effects in this paper are calculated similarly.

of climate change is associated with a 8 percentage point increase in the likelihood of climate-related disclosures in bank ESG reports and 6 percentage point for both reports. The effect of each measure of climate awareness on climate related disclosures within annual reports is not statistically significant (p-value > 0.1).

We next consider the coefficients of country-level control variables. *GOV_QUALITY* is positively associated with more climate disclosure in annual reports and both reports. While pairwise correlation indicates that *EPI* is positively correlated with climate-related disclosures, when included alongside highly correlated control variables, its coefficient becomes negative. This does not necessarily indicate a negative relationship; rather, it reflects a suppression effect arising from correlation between control variables. As predicted, a higher degree of human development significantly and consistently increases the likelihood of climate-related disclosures in all reports. Meanwhile, countries with better investor protection are more likely to see climate-related disclosures in bank annual reports. Moreover, exclusion from the European Economic Area is significantly negatively associated with the incidence of climate-related disclosures. Countries that experienced the acute effects of climate change were thought to have more frequent disclosures pertaining to it. Consistently, abnormal temperatures are found to be weakly associated with a higher incidence of reporting. Unsurprisingly, a high GDP increases reporting, but growth in GDP and a high GDP contribution from the industrial sector reduces it, consistent with previous evidence that economic growth can impede sustainability efforts (Hunjra et al., 2024; Dai, 2025).

Turning to control variables at the bank level, bank size is the most significant determinant of disclosure, with the coefficient of *SIZE* being positive and significant across all columns. Similarly, income structure is consistently positively associated with climate-related disclosures, indicating that banks with a higher proportion of non-interest income provide more extensive disclosures about climate change in their reports. Profitability also correlates positively with increased disclosures in ESG reports, as evidenced by significant coefficients in six regressions. Banks with greater growth prospects, measured by the market-to-book, are more likely to disclose climate-related information in ESG reports. The AUC values across all models range from 0.86 to 0.93, indicating sufficient discriminatory power.

Next, we run the OLS regressions replacing the binary indicators of climate-related disclosure with disclosure length, measured as the number of sentences related to climate, for each of the three report types. Specifically, our dependent variables are now the length of disclosures in annual reports *(SENT_AR*), in ESG reports *(SENT_ESG*), and in annual and ESG reports combined *(SENT_BOTH*). The results are reported in Table 4.

[TABLE 4 HERE]

Results are consistent with those reported in Table 3. *WORRY* and *HUMAN* significantly predict disclosure length in ESG reports, with a standard deviation increase in each associated with 0.141 and 0.139 increase in dependent variable.[11] These findings provide further evidence supporting a positive link between public attitudes toward climate change and bank climate-related disclosures. On the other hand, studying the length of disclosures reveals that *RESP* does have a strongly significant positive effect on the number of sentences related to climate in annual reports. This effect corresponds to an 0.214 increase in the dependent variable for one standard deviation increase in *RESP*. However, similar to the results obtained for the previous regression, it is not related positively to climate-related disclosures in ESG reports.

The coefficient estimates for the control variables (untabulated) are more or less consistent with those obtained in the first regression.

4.2. The moderating effects of cultural values

Table 5 presents the results of estimating Equation (2), where the regression models include country-level cultural values and their interaction with public attitudes toward climate change. For this analysis, we report the results with the overall attitude variable *AWARE*. Due to high correlation among Hofstede's six cultural dimensions, we address collinearity by presenting the regression results for each cultural dimension individually with its corresponding interaction in Columns. 2-7, as well as results for a model that includes all six dimensions in Column 1. Only results for regressions where the dependent variable is the logarithm of climate-related disclosure length in combined annual and ESG reports (*NSENT_BOTH*) are presented for this analysis.

[TABLE 5 HERE]

Across all specifications, the coefficients of *AWARE* are positive and generally statistically significant. Coefficients range from 0.128 to 0.310, with significance at the 10%, 5%, or 1%

[11] Since dependent variable *NSENT_ESG* = ln(length of climate disclosure/length of the whole report*100 + 1), the coefficients of 0.141 and 0.139 would translate to roughly 15.1% and 14.9% increase in the relative length of climate disclosures.

level depending on the model. This indicates that higher public concern about climate change is associated with longer climate disclosures, even before considering cultural moderation.

Societies with greater power distances tend to have shorter disclosures, but power distance does not meaningfully alter how public awareness translates into disclosure length. Individualism is associated with somewhat shorter disclosures, but public climate awareness has a much stronger positive effect in more individualistic societies. In feminine cultures—where cooperation and care are emphasized, banks respond more strongly to public climate concern, producing longer disclosures. High-uncertainty-avoidance countries produce longer climate disclosures, regardless of public awareness. In the full model, rising public awareness further amplifies disclosure length in such cultures. In long-term oriented cultures, the effect of public climate awareness on disclosure length is stronger, even though long-term orientation alone does not predict disclosure length. Finally, indulgence does not meaningfully influence climate disclosure length or the effect of public awareness.

4.3. The sentiment and readability of climate disclosure

Table 6 reports results of the regression of disclosure quality on attitude variables, controls, and year fixed effects. Results in Panel A show that AWARE is positively associated with the composite measure of disclosure quality in ESG reports and combined reports, suggesting that in countries where the public concern about climate change is greater, bank climate disclosures tend to be of higher quality. Panel B presents the regression results for components of disclosure quality measure, and we present this only for the combined reports. The independent variables in columns 1-5 are: the density of numbers in the disclosure (*NUM_DENSITY*), the number of topics in the disclosure (*NUM_TOPIC*), the similarity of the climate disclosure to disclosures by the same bank in previous years (*STICKINESS*), the similarity of the climate disclosure to disclosures by other banks in the same year (*BOILERPLATE*), and disclosure readability measured by the Gunning Fog index multiplied by –1 (*READABILITY*). Results in Panel B indicates that countries with greater concern about climate change discuss a broader set of climate-related issues (*NUM_TOPIC*), easier to read (*READABILITY*), but also more similar to other banks (*BOILERPLATE*).

[TABLE 6 HERE]

We study two additional disclosure attributes and the results are in Panel C: firstly the negative tone of climate disclosure, measured as the relative ratio between negative words in the disclosure to the total number of words in the disclosure (*NEGATIVE*), and secondly, the percentage of words relaying uncertainty in the disclosure (*UNCERTAINTY*). Both measures use the Loughran-McDonald dictionary in defining negative, positive, and uncertainty. Results suggest that higher level of *AWARE* is associated with more negative tone but has no effect on the uncertainty.

4.4. Difference-in-difference estimations

The results presented thus far support the presence of a positive link between public attitudes to climate change, and the incidence and length of bank climate disclosures. However, they do not establish causality. It is plausible that public attitudes shift in response to changes in the disclosure practices of structurally significant institutions, or that both are simultaneously driven by a third element. To address these concerns and demonstrate that public attitudes contribute to climate disclosures unidirectionally, we perform a difference-in-difference analysis utilizing 2019 Fridays for Future (FFF) protests as an exogenous shock that increased public climate awareness and, in turn, caused banks to expand their climate-related disclosures. First, the analysis is restricted to countries that initially exhibited low public awareness in 2016, defined as those in the lowest two terciles of the awareness metrics in 2016. Then, within this group, countries with protest intensity above the median in 2019 are classified as treated. *POST* is a binary variable that takes the value of 1 for years after 2019. The interaction *TREAT*POST* captures the effect of the FFF shock after 2019. The results of the difference-in-difference estimation are presented in Table 7.

[TABLE 7 HERE]

Table 7 provides strong causal evidence that the Fridays for Future protests increased climate-related disclosures by banks in low-awareness countries. Both the likelihood and length of disclosures increase significantly after 2019—especially in annual reports, which seems to be banks' preferred channel for responding to shifts in public sentiment. These results are consistent with the paper's broader conclusion that public climate attitudes influence bank disclosure behavior.

4.5. Additional tests

Additional analyses are conducted to ensure that the obtained findings are not due to the choice of variables, methods, or the omission of bank governance characteristics as controls. Table 8 reports the results of these tests. Firstly, while the ESS is the most comprehensive survey on climate change awareness and concern within Europe that is available to us, it is still possible that its responses are biased or misrepresentative of public attitudes. Therefore, in Panel A, we replace our awareness measures from the ESS with responses to the Eurobarometer Survey capturing public concern about climate change. Secondly, in Panel B, observations for the independent variable *AWARE* are interpolated using nearest response values rather than linear interpolation. This is to avoid forming a trend in public awareness where none may exist. In Panel C, the bank's Governance Pillar score and board size are included as control variables, because board characteristics have been found to influence the disclosure of sustainability information (Ben-Amar & McIlkenny, 2015; Jizi, 2017; Pucheta-Martínez & Gallego-Álvarez, 2019). The inclusion of these controls reduces the sample to 670 bank-year observations. In Panel D, we control for the country's English proficiency and linguistic distance between the local language and English, as our sample relies on English-language reports and the results could be affected by sample selection bias. Including these variables in the model address this concern and does not alter our main results.

[TABLE 8 HERE]

Results suggest that in all alternative specifications, public attitudes continue to positively predict the incidence of climate-related disclosures in bank reports. Moreover, the change in interpolation method and the addition controls does not materially weaken the link between public attitudes and climate-related disclosure length in ESG reports.

Further robustness tests are not tabulated but are methodically described here. First, we include region fixed effects, which understandably capture some effects of the stickiness or region-dependent similarities in the measures of public awareness. In regressions estimated using the same bank- and country-specific controls as those specified in Equation (1) and year and region fixed effects, *AWARE* still significantly and positively predicts the length of climate-related disclosures in ESG reports. A standard deviation increase in *AWARE* relates to an 19.1% increase in relative length of climate-related disclosure in ESG reports.

Second, to address the non-normality of disclosure lengths as dependent variables, we perform Tobit regressions using the same set of controls and fixed effects as those specified in Equation (1). The results of these regressions are consistent with those obtained in the main analysis. A standard deviation increase in *AWARE* is associated with a 43.7% increase in relative length of climate disclosure in ESG reports, and a 41.7% increase in the relative length of disclosures in both reports.

Third, we control for financial literacy, which can intuitively explain the proposed link between public attitudes toward climate change and bank climate disclosures. Notably, the literature on financial literacy is mixed (see for e.g. Abreu et al., 2025; Zou and Deng, 2019; Van Rooij et al., 2011; Stolper and Walter, 2017; Fernandes et al., 2014; etc.), suggesting stronger evidence of the effects of financial literacy on stock market participation than on financial behaviors. Its inclusion as a control in the model specified by Equation (1) does not weaken the previously obtained estimates. In particular, *AWARE* to significantly and positively relate to the incidence and length of climate-related disclosures in ESG reports, and across ESG and annual reports. Disclosure incidence increases by 9.4% and 7.9% for one standard deviation increase in *AWARE*, and the same changes in awareness are associated with a 33.6% and 30.7% increase in the relative length of climate-related disclosures in ESG reports and both reports.

Fourth, we test the moderating effects of Hofstede's cultural dimensions on disclosure attributes. Our analysis shows distinct patterns in how Hofstede's cultural dimensions interact with climate awareness to shape different attributes of climate disclosure. Countries characterized by higher uncertainty avoidance tend to provide more specific disclosures, reflected in a higher density of climate-related sentences. In contrast, individualistic and indulgent cultures disclose climate information with lower specificity. Regarding disclosure breadth, firms from more feminine and long-term-oriented cultures offer more in-depth climate reporting, covering a wider range of climate-related topics. Feminine cultures are also associated with higher readability in climate disclosures. Additionally, in countries with high uncertainty avoidance, increased climate awareness further enhances the readability of disclosures. Patterns also emerge for tone. Power distance, individualism, femininity, and long-term orientation are generally linked to less negative climate disclosure. However, when climate awareness is high, firms in feminine cultures tend to include more negative climate-related information. Meanwhile, higher power distance corresponds to greater uncertainty tone, an effect that strengthens with higher climate awareness. Similarly, in long-term-oriented and indulgent cultures, rising awareness is associated with a more uncertainty-laden tone. Conversely, in cultures marked by individualism and femininity, higher awareness corresponds to lower uncertainty in disclosure narratives.

Additionally, our results suggest that in societies characterized by femininity, uncertainty avoidance, and long-term orientation, increase in public awareness about climate change measured by *AWARE* tends to further reduce the stickiness of climate-related disclosures. Simply put, these values encourage less recycling in the contents of climate disclosures across years in response to higher public concern.

Finally, we employ the Schwarz (2008) and House et al. (2004) models of national culture as alternatives to Hofstede (1980, 2001), in case the latter does not sufficiently represent or measure culture. Schwarz offers seven cultural dimensions, while House et al.'s GLOBE model has nine, covering values from several perspectives. For the purposes of this study, we limit our analysis to the social measure of GLOBE's cultural model, rather than the organizational or leadership measures. Our results corroborate that the measurement of culture across these models is inherently different (Brewer & Venaik, 2010; 2011), but also confirm that differences in national culture still play a mediating role in the relationship between public attitudes toward climate change and bank climate-related disclosures. Specifically, societies that lean toward harmony as opposed to mastery have significantly longer bank climate disclosures, but public awareness has a significantly lower effect on these disclosures. From analyses using the GLOBE dimensions, we learn that similar to the Hofstede cultural values, GLOBE's uncertainty avoidance is positively associated with the length of climate-related disclosures, but plays a negative role in moderating the attitudes-disclosure relationship. Also similar to our earlier findings on culture, GLOBE's power distance appears to negatively moderate the relationship between public attitudes and the length of bank climate disclosures.

5. Summary and conclusions

Finance promises to be a potent channel for encouraging climate action and directing efforts towards environmentally friendly goals. As stewards of this charge, banks face pressures from legal and regulatory stakeholders, competitors, and customers to allocate capital responsibly, manage climate risks, and effectively communicate their commitment to sustainability. Climate-related disclosures provide transparency and reduce information asymmetry, allowing investors to evaluate bank commitments to sustainability and more accurately price climate risks. Previous literature exploring the determinants of these disclosures identifies various country-specific factors that influence their intensity and quality (Caby et al., 2020; Giannarakis et al., 2016, 2018). The purpose of this research is to add to the existing evidence and knowledge of climate-related disclosures by determining whether the external sources of

influence on it can be extended to include public attitudes towards climate change. In addition, culture has been shown to predict outcomes related to institutional leadership and reputation, and is investigated as a moderator of the effects of public environmental concern on bank climate disclosures.

Overall, public attitudes toward climate change positively correlate with the incidence and length of climate-related disclosures in ESG and combined reports. This indicates that in countries where concern about climate change is heightened, banks tend to provide more comprehensive disclosures. Among cultural dimensions, countries with higher uncertainty avoidance are associated with lengthier climate disclosures across bank annual and ESG reports, and with significantly greater increases in disclosure length in response to increases in public awareness. When controlling for multiple cultural dimensions, femininity and long-term orientation also appear to positively moderate the relationship between climate change concern and disclosure length. Substituting Hofstede's cultural dimensions with the Schwarz (2008) and GLOBE (House et al., 2004) models does not provide comparable findings, but does confirm that the effects of public awareness on institutional behaviour and decision-making may be contingent on several cultural values. These values partly explain differences in how attitudes on climate change can influence bank climate disclosures, and future research should investigate socioeconomic and population-level data for sources of additional context.

Our analysis also reveals that country-level quality of investor protection mechanisms, total GDP, human development index, bank size, profitability, growth and income structure are strongly and positively associated with more climate disclosures. In contrast, countries with higher growth of GDP and countries depending on the industrial sectors have less climate disclosures.

Altogether, besides providing several interesting perspectives on banks' decisions to make climate-related disclosures and the extent and attributes of these disclosures in both ESG and annual reports, our results also underscore the importance of the broader social environment and cultural values for institutional behaviour and decision-making. If finance is to achieve its full potential in tackling climate change, education and policymaking should work towards increasing and homogenizing public awareness of the threat it poses to our future, and our abilities to address it. To this end, further exploration of the factors influencing public environmental concerns could help inform climate actions, reduce transition costs, and improve communication and transparency

References

Abreu, M., Mendes, V., & Coutinho dos Santos, M. (2025). Financial Literacy, Financial Resilience and Participation in Securities Markets: Evidence from Portugal. *Journal of Risk and Financial Management*, 18(12), 677.

Afzali, M., Colak, G., & Vähämaa, S. (2025). Climate change denial and corporate environmental responsibility. *Journal of Business Ethics*, 196(1), 31-59.

Agyei-Mensah, B.K. and Buertey, S. (2019). Do culture and governance structure influence extent of corporate risk disclosure? *International Journal of Managerial Finance*, 15(3), 315-334.

Athanasouli, D., & Goujard, A. (2015). Corruption and management practices: Firm level evidence. *Journal of Comparative Economics*, 43(4), 1014-1034.

Barton, J., & Waymire, G. (2004). Investor protection under unregulated financial reporting. *Journal of Accounting and Economics*, 38, 65-116.

Battiston, S., Mandel, A., Monasterolo, I., Schütze, F., & Visentin, G. (2017). A climate stress-test of the financial system. *Nature Climate Change*, 7(4), 283-288.

Ben-Amar, W., & McIlkenny, P. (2015). Board effectiveness and the voluntary disclosure of climate change information. *Business Strategy and the Environment*, *24*(8), 704-719.

Berger, A. N., Li, X., Morris, C. S., & Roman, R. A. (2021). The effects of cultural values on bank failures around the world. *Journal of Financial and Quantitative Analysis*, 56(3), 945-993.

Bifulco, G. M., Caserio, C., di Donato, F., & Trucco, S. (2025). Does Sustainable Performance Matter for Nonfinancial Disclosure Readability? A Fog Index Analysis on Italian-Listed Companies. *Business Strategy and the Environment*, 34(5), 5601-5623.

Bingler, J. A., Kraus, M., Leippold, M., & Webersinke, N. (2024). How cheap talk in climate disclosures relates to climate initiatives, corporate emissions, and reputation risk. *Journal of Banking & Finance*, *164*, 107191.

Block, S., Emerson, J. W., Esty, D. C., de Sherbinin, A., Wendling, Z. A., Kurczynski, K., ... & Lin, F. (2024). Environmental Performance Index. *New Haven, CT: Yale Center for Environmental Law & Policy. Retrieved from epi. yale. edu.*

Boiral, O. (2013). Sustainability reports as simulacra? A counter-account of A and A+ GRI reports. *Accounting, Auditing & Accountability Journal*, 26(7), 1036-1071.

Bolton, P., & Kacperczyk, M. (2023). Global pricing of carbon-transition risk. *The Journal of Finance*, 78(6), 3677-3754.

Brewer, P., & Venaik, S. (2011). Individualism–collectivism in Hofstede and GLOBE.

Brewer, P., & Venaik, S. (2010). Avoiding uncertainty in Hofstede and GLOBE. Journal of international business studies, 41(8), 1294-1315.

Bushee, B. J., Gow, I. D., & Taylor, D. J. (2018). Linguistic complexity in firm disclosures: Obfuscation or information? *Journal of Accounting Research*, 56(1), 85-121.

Caby, J., Ziane, Y., & Lamarque, E. (2020). The determinants of voluntary climate change disclosure commitment and quality in the banking industry. *Technological Forecasting and Social Change*, 161, 120282.

Calvet, L., Gianfrate, G., & Uppal, R. (2022). The finance of climate change. *Journal of Corporate Finance*, 73, 102162.

Cahan, S. F., De Villiers, C., Jeter, D. C., Naiker, V., & Van Staden, C. J. (2016). Are CSR disclosures value relevant? Cross-country evidence. *European Accounting Review*, 25(3), 579-611.

Capstick, S., Whitmarsh, L., Poortinga, W., Pidgeon, N. and Upham, P. (2015), International trends in public perceptions of climate change over the past quarter century. *WIREs Climate Change*, 6: 35-61.

Choi, D., Gam, Y. K., & Shin, H. (2023). Environmental reputation and bank liquidity: Evidence from climate transition. *Journal of Business Finance & Accounting*, 50(7-8), 1274-1304.

Cintamür, I. G., & Yüksel, C. A. (2018). Measuring customer based corporate reputation in banking industry: Developing and validating an alternative scale. *International Journal of Bank Marketing*, 36(7), 1414-1436.

Ciummo, S., Walch, F., & Breitenstein, M. (2022). Disclosure of climate change risk in credit ratings. ECB Occasional Paper, (2022/303).

Cohen, A., Hazan, M., Tallarita, R., & Weiss, D. (2019). The politics of CEOs. *Journal of Legal Analysis*, 11, 1-45.

Corner, A., Venables, D., Spence, A., Poortinga, W., Demski, C., & Pidgeon, N. (2011). Nuclear power, climate change and energy security: Exploring British public attitudes. *Energy Policy*, 39(9), 4823-4833.

Dai, T. (2025). Delving into the green growth dilemma and ESG investing in Southeast Asia. *Humanities and Social Sciences Communications,* 12(1), 1-8.

DasGupta, R. (2022). Financial performance shortfall, ESG controversies, and ESG performance: Evidence from firms around the world. *Finance Research Letters*, 46, 102487.

Dechezleprêtre, A., Fabre, A., Kruse, T., Planterose, B., Sanchez Chico, A., & Stantcheva, S. (2025). Fighting climate change: International attitudes toward climate policies. *American Economic Review*, 115(4), 1258-1300.

Deegan, C., Rankin, M., & Tobin, J. (2002). An examination of the corporate social and environmental disclosures of BHP from 1983-1997: A test of legitimacy theory. *Accounting, Auditing & Accountability Journal*, 15(3), 312-343.

Dietz, S., & Stern, N. (2008). Why economic analysis supports strong action on climate change: a response to the Stern Review's critics. *Review of Environmental Economics and Policy*, 2(1), 94-113.

DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review*, 48(2), 147-160.

Dimic, N., Fatmy, V., & Vähämaa, S. (2024). Religiosity and corporate social responsibility: A study of firm-level adherence to Christian values in the United States. *Corporate Social Responsibility and Environmental Management*, 31(1), 396-413.

Dowling, J., & Pfeffer, J. (1975). Organizational legitimacy: Social values and organizational behaviour. *Pacific Sociological Review*, 18(1), 122-136.

Dyck, A., Lins, K. V., Roth, L., & Wagner, H. F. (2019). Do institutional investors drive corporate social responsibility? International evidence. *Journal of Financial Economics*, 131(3), 693-714.

Eccles, R. G., & Klimenko, S. (2019). Shareholders are getting serious about sustainability. *Harvard Business Review*, 97(3), 106-116.

Fernandes, D., Lynch Jr, J. G., & Netemeyer, R. G. (2014). Financial literacy, financial education, and downstream financial behaviours. *Management Science*, *60*(8), 1861-1883.

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

Francis, J. R., Khurana, I. K., & Pereira, R. (2005). Disclosure incentives and effects on cost of capital around the world. *The Accounting Review*, *80*(4), 1125-1162.

Franzen, A., & Vogl, D. (2013). Two decades of measuring environmental attitudes: A comparative analysis of 33 countries. *Global Environmental Change*, 23(5), 1001-1008.

Galletta, S., Goodell, J. W., Mazzù, S., & Paltrinieri, A. (2023). Bank reputation and operational risk: The impact of ESG. *Finance Research Letters*, 51, 103494.

García-Sánchez, I. M., Aibar-Guzmán, B., Aibar-Guzmán, C., & Azevedo, T. C. (2020). CEO ability and sustainability disclosures: The mediating effect of corporate social responsibility performance. *Corporate Social Responsibility and Environmental Management*, 27(4), 1565-1577.

Ge, W., Qi, Z., Wu, Z., & Yu, L. (2024). Abnormal temperatures, climate risk disclosures and bank loan pricing: international evidence. *British Journal of Management*, 36(2), 726-744.

Gharbi, I., Hamed-Sidhom, M., Hussainey, K., and Ganouati, J. (2021). Religiosity and financial distress in US firms. *International Journal of Finance & Economics*, 26(3), 3902-3915.

Giannarakis, G., Zafeiriou, E., Arabatzis, G., & Partalidou, X. (2018). Determinants of corporate climate change disclosure for European firms. *Corporate Social Responsibility and Environmental Management*, 25(3), 281-294.

Giannarakis, G., Zafeiriou, E., Sariannidis, N., & Efthalitsidou, K. (2016). Determinants of dissemination of environmental information: An empirical survey. *Journal of Business Economics and Management*, 17(5), 749-764.

Giese, G., Nagy, Z., & Rauis, B. (2021). Foundations of climate investing: How equity markets have priced climate-transition risks. *Journal of Portfolio Management*, 47(9), 35-53.

Groenland, E. A. (2002). Qualitative research to validate the RQ-dimensions. *Corporate Reputation Review*, 4(4), 308-315.

Goncalo, J. A., & Staw, B. M. (2006). Individualism–collectivism and group creativity. *Organizational Behavior and Human Decision Processes*, 100(1), 96-109.

Gul, F. A., & Leung, S. (2004). Board leadership, outside directors' expertise and voluntary corporate disclosures. *Journal of Accounting and public Policy*, *23*(5), 351-379.

Hambrick, D. C., & Mason, P. A. (1984). Upper echelons: The organization as a reflection of its top managers. *Academy of Management Review*, 9(2), 193–206.

Han, L., Liu, T., Lu, H., & Zhang, W. (2025). Climate risk disclosure, green innovation and enterprise value. *Finance Research Letters*, 72, 106553.

Hartlieb, S., & Eierle, B. (2024). Do auditors respond to clients' climate change-related external risks? Evidence from audit fees. *European Accounting Review*, 33(3), 1075-1103.

Herbohn, K., Gao, R., & Clarkson, P. (2019). Evidence on whether banks consider carbon risk in their lending decisions. *Journal of Business Ethics*, 158, 155-175.

Hilary, G., & Hui, K. W. (2009). Does religion matter in corporate decision making in America?. *Journal of Financial Economics*, 93(3), 455-473.

Hofstede, G. (1980). *Culture's consequences: International differences in work-related values*. Beverly Hills, CA: Sage Publications.

Hofstede, G. (1991). *Cultures and organizations: Software of the mind*. London, UK: McGraw-Hill.

Hofstede, G. (2001). *Culture's consequences: Comparing values, behaviors, institutions and organizations across nations (2nd ed.)*. Thousand Oaks, CA: Sage Publications.

Hofstede, G. (2006). What did GLOBE really measure? Researchers' minds versus respondents' minds. *Journal of International Business Studies*, 37(6), 882-896.

House, R. J., Hanges, P. J., Javidan, M., Dorfman, P. W., & Gupta, V. (Eds.). (2004). *Culture, leadership, and organizations: The GLOBE study of 62 societies*. Sage publications.

Howe, P. D., Markowitz, E. M., Lee, T. M., Ko, C. Y., & Leiserowitz, A. (2013). Global perceptions of local temperature change. *Nature Climate Change*, 3(4), 352-356.

Hummel, K., & Schlick, C. (2016). The relationship between sustainability performance and sustainability disclosure–Reconciling voluntary disclosure theory and legitimacy theory. *Journal of Accounting and Public Policy*, 35(5), 455-476.

Hooi, G. (2007). The effects of culture on international banking disclosures. *Asia-pacific Journal of Accounting & Economics*, 14(1), 7-25.

Hunjra, A. I., Bouri, E., Azam, M., Azam, R. I., & Dai, J. (2024). Economic growth and environmental sustainability in developing economies. *Research in International Business and Finance*, 70, 102341.

Ilhan, E., Krueger, P., Sautner, Z., & Starks, L. T. (2023). Climate risk disclosure and institutional investors. *The Review of Financial Studies*, 36(7), 2617-2650.

Jizi, M. (2017). The influence of board composition on sustainable development disclosure. *Business Strategy and the Environment*, 26(5), 640-655.

Kanagaretnam, K., Lim, C. Y., & Lobo, G. J. (2011). Effects of national culture on earnings quality of banks. *Journal of International Business Studies*, 42, 853-874.

Kılıç, M., Uyar, A., Kuzey, C. and Karaman, A.S. (2021), Does institutional theory explain integrated reporting adoption of Fortune 500 companies? *Journal of Applied Accounting Research*, 22(1), 114-137.

Kim, D. H., & Orphanides, A. (2012). Term structure estimation with survey data on interest rate forecasts. *Journal of Financial and Quantitative Analysis,* 47(1), 241-272.

King, G., Lam, P., & Roberts, M. E. (2017). Computer-assisted keyword and document set discovery from unstructured text. *American Journal of Political Science*, 61(4), 971-988.

Krueger, P., Sautner, Z., & Starks, L. T. (2020). The importance of climate risks for institutional investors. *The Review of Financial Studies*, 33(3), 1067-1111.

Kurowski, Ł., Rutecka-Góra, J., & Smaga, P. (2022). Is knowledge on climate change a driver of consumer purchase decisions in Poland? The case of grocery goods and green banking. *Journal of Cleaner Production*, 369, 133444.

Lang, M., & Lundholm, R. (1993). Cross-sectional determinants of analyst ratings of corporate disclosures. *Journal of Accounting Research*, *31*(2), 246-271.

Lim, S., Matolcsy, Z., & Chow, D. (2007). The association between board composition and different types of voluntary disclosure. *European Accounting Review*, *16*(3), 555-583.

Loughran, T., & McDonald, B. (2016). Textual analysis in accounting and finance: A survey. *Journal of Accounting Research*, 54(4), 1187-1230.

Matsumura, E. M., Prakash, R., & Vera-Muñoz, S. C. (2024). Climate-risk materiality and firm risk. *Review of Accounting Studies*, 29(1), 33-74.

Meyer, J. W., & Rowan, B. (1977). Institutionalized organizations: Formal structure as myth and ceremony. *American Journal of Sociology*, 83(2), 340-363.

Miihkinen, A. (2012). What drives quality of firm risk disclosure?: the impact of a national disclosure standard and reporting incentives under IFRS. *The International Journal of Accounting*, *47*(4), 437-468.

Mobus, J.L. (2005). Mandatory environmental disclosures in a legitimacy theory context. *Accounting, Auditing & Accountability Journal*, 18(4), 492-517.

Mourouzidou-Damtsa, S., Milidonis, A., & Stathopoulos, K. (2019). National culture and bank risk-taking. *Journal of Financial Stability*, 40, 132-143.

Nawrotzki, R. J. (2012). The politics of environmental concern: A cross-national analysis. *Organization & Environment*, 25(3), 286-307.

Nguyen, Q., Diaz-Rainey, I., Kuruppuarachchi, D., McCarten, M., & Tan, E. K. (2023). Climate transition risk in US loan portfolios: Are all banks the same? *International Review of Financial Analysis*, 85, 102401.

Nicolò, G., Zanellato, G., Esposito, B., & Tiron-Tudor, A. (2024). Cultural dimensions and sustainability disclosure in the banking sector: Insights from a qualitative comparative analysis approach. *Business Strategy and the Environment*, 33(8), 8086-8101.

Nobanee, H., Dilshad, M. N., Abu Lamdi, O., Ballool, B., Al Dhaheri, S., AlMheiri, N., ... & Alhemeiri, S. S. (2022). Insurance for climate change and environmental risk: a bibliometric review. *International Journal of Climate Change Strategies and Management*, 14(5), 440-461.

OECD (2017). Investing in Climate, Investing in Growth. OECD Publishing, 10.1787/9789264273528-en

Ozkan, A., Temiz, H., & Yildiz, Y. (2023). Climate risk, corporate social responsibility, and firm performance. *British Journal of Management,* 34(4), 1791-1810.

Perkins, J., Jeffrey, C. and Freedman, M. (2022). Cultural influences on the quality of corporate social responsibility disclosures: an examination of carbon disclosure. *Sustainability Accounting, Management and Policy Journal*, 13(5), 1169-1200.

Pucheta-Martínez, M. C., & Gallego-Álvarez, I. (2019). An international approach of the relationship between board attributes and the disclosure of corporate social responsibility issues. *Corporate Social Responsibility and Environmental Management*, *26*(3), 612-627.

Ratter, B. M., Philipp, K. H., & von Storch, H. (2012). Between hype and decline: recent trends in public perception of climate change. *Environmental Science & Policy*, 18, 3-8.

Reboredo, J. C., & Ugolini, A. (2022). Climate transition risk, profitability and stock prices. *International Review of Financial Analysis*, 83, 102271.

Reinhardt, F. L., Stavins, R. N., & Vietor, R. H. (2008). Corporate social responsibility through an economic lens. *Review of Environmental Economics and Policy,* 2(2), 219-239.

Richardson, R. M., & Smith, S. W. (2007). The influence of high/low-context culture and power distance on choice of communication media: Students' media choice to communicate with professors in Japan and America. *International Journal of Intercultural Relations*, *31*(4), 479-501.

Ruiz, B., & García, J. A. (2019). Modelling customer-based bank reputation: the moderating role of uncertainty avoidance. *International Journal of Bank Marketing*, 37(1), 340-361.

Sautner, Z., Van Lent, L., Vilkov, G., & Zhang, R. (2023). Firm-level climate change exposure. *The Journal of Finance*, 78(3), 1449-1498.

Shin, J., Moon, J. J., & Kang, J. (2023). Where does ESG pay? The role of national culture in moderating the relationship between ESG performance and financial performance. *International Business Review*, 32(3), 102071.

Shwom, R., Bidwell, D., Dan, A., & Dietz, T. (2010). Understanding US public support for domestic climate change policies. *Global Environmental Change*, 20(3), 472-482.

Stanford University, 2010. Global Warming Poll, selected results. (http://woods.stanford.edu/docs/surveys/Global-Warming-Survey-Selected-Results-June2010.pdf

Stern, P. C., & Dietz, T. (Eds.). (2008). Public participation in environmental assessment and decision making. National Academies Press.

Stolper, O. A., & Walter, A. (2017). Financial literacy, financial advice, and financial behavior. *Journal of Business Economics*, *87*(5), 581-643.

Suchman, M. C. (1995). Managing legitimacy: Strategic and institutional approaches. *Academy of Management Review*, 20(3), 571-610.

Task Force on Climate-related Financial Disclosures. (2017). *Final report: Recommendations of the Task Force on Climate-related Financial Disclosures*. Financial Stability Board. https://www.fsb-tcfd.org/publications/final-recommendations-report/

United Nations Framework Convention on Climate Change. (2015). *Paris Agreement*. https://unfccc.int/sites/default/files/english_paris_agreement.pdf

United Nations Environment Programme Finance Initiative. (2021). *Annual overview 2021*. https://www.unepfi.org/publications/general-publications/unep-fi-annual-overview-2021/

Network for Greening the Financial System. (2019). *A call for action: Climate change as a source of financial risk*. https://www.ngfs.net/en/call-for-action

Organisation for Economic Co-operation and Development. (2020). *Climate finance provided and mobilised by developed countries in 2013–18: Insights from the OECD-CPI climate finance data*. OECD Publishing.

Van Rooij, M., Lusardi, A., & Alessie, R. (2011). Financial literacy and stock market participation. *Journal of Financial Economics*, *101*(2), 449-472.

von Borgstede, C., Andersson, M., & Johnsson, F. (2013). Public attitudes to climate change and carbon mitigation—Implications for energy-associated behaviours. *Energy Policy*, 57, 182-193.

Wang, H., Guo, T., & Tang, Q. (2021). The effect of national culture on corporate green proactivity. *Journal of Business Research*, 131, 140-150.

Webersinke, N., Kraus, M., Bingler, J. A., & Leippold, M. (2021). Climatebert: A pretrained language model for climate-related text. *arXiv preprint arXiv:2110.12010*.

Whitmarsh, L. (2011). Scepticism and uncertainty about climate change: Dimensions, determinants and change over time. *Global Environmental Change*, 21(2), 690-700.

Yu, E. P. Y., Tanda, A., Luu, B. V., & Chai, D. H. (2021). Environmental transparency and investors' risk perception: Cross-country evidence on multinational corporations' sustainability practices and cost of equity. *Business Strategy and the Environment*, 30(8), 3975-4000.

Zeng, S. X., Xu, X. D., Yin, H. T., & Tam, C. M. (2012). Factors that drive Chinese listed companies in voluntary disclosure of environmental information. *Journal of Business Ethics*, 109, 309-321.

Zhang, Y., Guo, Y., Zhang, M., Xu, S., Liu, X., & Newman, A. (2022). Antecedents and outcomes of authentic leadership across culture: A meta-analytic review. *Asia Pacific Journal of Management*, 39(4), 1399-1435.

Zheng, X., Ghoul, S. E., Guedhami, O., & Kwok, C. C. (2013). Collectivism and corruption in bank lending. *Journal of International Business Studies*, 44, 363-390.

Zou, J., & Deng, X. (2019). Financial literacy, housing value and household financial market participation: Evidence from urban China. *China Economic Review*, *55*, 52-66.

Table 1. Descriptive statistics

Panel A: *Descriptive statistics for the full sample*

	N	Mean	SD	25th pct	Median	75th pct
Main dependent variables						
DISC_AR	927	0.809	0.393	1.000	1.000	1.000
DISC_ESG	927	0.562	0.496	0.000	1.000	1.000
DISC_OVR	927	0.854	0.353	1.000	1.000	1.000
DISC_BOTH	927	0.517	0.500	0.000	1.000	1.000
NSENT_AR	927	2.022	1.400	0.790	2.087	3.242
NSENT_ESG	927	1.701	1.659	0.000	1.696	3.264
NSENT_OVR	927	2.213	1.315	1.270	2.363	3.295
NSENT_BOTH	927	1.461	1.554	0.000	1.131	2.957
Climate attitudes and cultural dimensions						
WORRY	927	0.000	1.000	-0.561	0.085	0.541
RESP	927	0.000	1.000	-0.620	0.284	0.681
HUMAN	927	0.000	1.000	-0.754	0.153	0.802
AWARE	927	0.074	0.773	-0.292	0.201	0.598
HOFPDI	927	0.000	1.000	-0.780	0.019	0.918
HOFIDV	927	0.000	1.000	-0.610	0.210	0.714
HOFFEM	927	0.000	1.000	-0.678	-0.420	0.613
HOFUAI	927	0.000	1.000	-0.818	0.222	0.699
HOFLTO	927	0.000	1.000	-0.675	-0.148	0.510
HOFIVR	927	0.000	1.000	-0.950	0.056	1.061
Control variables						
GOV_QUALITY	927	18.753	8.367	11.833	18.167	25.667
EPI	927	0.000	3.612	-2.821	0.627	2.094
HDI	927	-0.000	0.017	-0.007	0.004	0.011
IV_PROTECT	927	17.534	3.661	16.000	17.000	19.000
NONEEA	927	0.157	0.364	0.000	0.000	0.000
ABTEMP	927	0.735	0.974	0.160	0.600	1.480
FINDEV	927	0.463	0.499	0.000	0.000	1.000
LN_GDP	927	27.228	1.307	26.630	27.266	28.334
GDP_GR	927	3.382	8.878	-1.809	3.122	9.397
IND_GDP	927	35.897	10.616	26.859	35.609	43.245
CONCENTRATION	927	67.636	16.032	58.785	64.788	78.923
SIZE	927	24.731	1.958	23.310	24.546	26.273
ROA	927	0.008	0.009	0.004	0.007	0.012
BETA	927	1.189	0.505	0.902	1.232	1.501
LOAN_ASSET	927	0.625	0.151	0.533	0.642	0.734
NONPFLOAN	927	0.065	0.099	0.017	0.033	0.064
DEPOSIT_ASSET	927	0.691	0.156	0.579	0.738	0.820
INCOME_STR	927	0.345	0.165	0.248	0.328	0.425
MB	927	11.123	41.384	0.452	0.812	4.107
REV_GR	927	0.058	0.189	-0.038	0.036	0.121
FINANCE	927	0.019	0.059	-0.013	0.019	0.058
Disclosure attributes						
NUM_DENSITY	792	0.041	0.018	0.030	0.038	0.048
NUM_TOPIC	792	2.453	0.974	2.000	2.000	3.000
STICKINESS	792	0.602	0.312	0.448	0.717	0.851
READABILITY	792	-18.706	2.312	-17.288	-18.562	-19.944
NEGATIVE	792	0.128	0.321	-0.068	0.113	0.333
UNCERTAINTY	792	13.708	8.769	6.931	12.488	18.840
Variables used in the additional analysis (Different						

sample sizes)						
BANKGOV	670	65.982	20.442	52.685	70.093	82.677
BOARD_SIZE	670	12.225	4.044	9	12	15
EB_AWARE	779	3.137	0.229	2.992	3.125	3.255
FINLIT	919	51.436	12.634	42	52	66
ENG_PRO	921	592.903	56.625	540	600	615
LING_DIST	921	0.611	0.114	0.535	0.633	0.688

Panel B: *Descriptive statistics by country*

Country	*Obs.*	*Number of unique banks*	*WORRY*	*RESP*	*HUMAN*	*PDI*	*IDV*	*FEM*	*UAI*	*LTO*	*IVR*
Austria	41	5	1	0.25	0.89	-1.93	-0.61	-1.07	0.01	0.31	0.89
Belgium	10	1	0.23	0.1	0.39	0.77	0.65	0.01	1.05	1.76	0.56
Bulgaria	16	3	-0.63	-1.6	-1.3	1.02	-2.19	0.61	0.66	0.91	-1.73
Croatia	16	2	0.93	-1.08	-0.08	1.17	-2	0.61	0.44	0.18	-0.78
Cyprus	18	2	0.04	0.14	0.94	1.52	0.9	-1.11	1.83	0.97	1.28
Czech Republic	19	2	-0.82	-2.49	-0.92	0.37	-0.42	-0.12	0.18	0.97	-1.01
Estonia	6	2	-0.97	-0.62	-1.06	-0.48	-0.29	1.04	-0.43	1.76	-1.73
Finland	31	5	-0.13	0.76	0.5	-0.83	-0.11	1.22	-0.47	-1.14	0.56
France	29	3	0.32	1.33	0.33	0.92	0.4	0.48	0.7	0.51	0.06
Germany	33	4	1.55	0.52	0.47	-0.73	0.15	-0.51	-0.21	1.83	-0.39
Greece	39	5	-0.02	-0.76	1.08	0.52	-1.87	-0.12	1.83	-0.68	0.17
Hungary	17	2	0.19	-1.18	-0.18	-0.18	0.97	-1.45	0.53	0.18	-0.89
Iceland	8	2	-1.03	0.14	0.83	-0.98	1.16	1.39	-0.86	-0.15	1.12
Ireland	26	3	-0.62	0.45	-0.87	-1.08	0.34	-0.59	-1.51	-2.06	1.01
Italy	126	15	0.29	-0.55	0.62	0.02	0.71	-0.68	0.22	0.38	-0.95
Lithuania	9	1	-1.08	-0.78	-1.78	-0.38	-0.29	1.52	-0.21	1.76	-1.73
Macedonia	12	2	0.94	-1.82	-1.25	2.02	-1.56	0.4	0.74	-1.33	-0.67
Netherlands	16	2	-0.05	0.29	0.18	-0.58	0.97	1.73	-0.73	0.77	1.17
Norway	46	6	-0.52	0.59	-0.93	-0.93	0.27	1.99	-0.86	-1.33	0.45
Poland	99	11	-0.93	0.07	-1.33	0.92	-0.29	-0.42	1	-1.14	-1.01
Portugal	10	1	1.92	0.47	0.31	0.67	-2.38	1	1.48	-1.79	-0.78
Russia	27	4	-2.55	-2.82	-2.3	2.17	-1.62	0.78	1.09	1.7	-1.51
Slovak Republic	17	2	-1.47	-1.57	-0.42	2.72	-0.8	-2.4	-0.82	1.43	-1.06
Slovenia	6	1	1.25	0.25	-0.54	1.07	-2.38	1.52	0.79	-0.41	0.06
Spain	55	6	1.55	0.57	1.17	0.37	-0.86	0.53	0.7	-0.48	-0.17
Sweden	41	5	-0.85	0.65	1.25	-0.93	0.4	2.12	-1.77	-0.15	1.73
Switzerland	55	9	0.42	1.23	0.24	-0.78	0.21	-0.68	-0.52	1.23	1.06
UK	99	13	0.1	0.69	-0.1	-0.73	1.53	-0.51	-1.51	-0.28	1.23
Sample avg	927	119	0	0	0	0	0	0	0	0	0

(*continued next page*)

Country	*DISC_OVR*	*NSENT_OVR*	*NUM_ DENSITY*	*NUM_ TOPIC*	*STICKI NESS*	*READA BILITY*	*NEGATIVE*	*UNCER TAINTY*
Austria	0.90	2.32	0.04	2.70	0.58	17.45	0.22	12.35
Belgium	1.00	3.19	0.05	2.20	0.70	17.33	0.02	13.46
Bulgaria	0.25	0.49	0.07	2.50	0.05	19.60	0.32	10.23
Croatia	0.69	1.31	0.04	3.00	0.23	18.43	0.26	13.78
Cyprus	0.89	1.89	0.04	2.94	0.55	19.89	0.02	19.79
Czech Republic	0.79	1.90	0.04	2.40	0.48	17.94	0.06	11.27
Estonia	1.00	3.05	0.04	2.67	0.68	18.26	0.21	12.21
Finland	0.97	3.20	0.04	2.73	0.67	16.85	0.32	8.57
France	1.00	3.35	0.05	1.83	0.79	19.63	0.07	13.04
Germany	1.00	2.51	0.04	2.85	0.71	17.83	0.12	13.94
Greece	0.97	2.15	0.04	2.68	0.56	19.69	0.34	9.29
Hungary	0.65	1.12	0.04	2.36	0.31	17.59	0.47	7.92
Iceland	1.00	3.23	0.04	4.12	0.71	17.08	0.25	11.28
Ireland	0.85	2.58	0.03	2.23	0.64	18.96	0.06	20.89
Italy	0.85	1.70	0.04	2.57	0.48	21.52	0.01	13.67
Lithuania	0.33	0.58	0.04	2.33	0.11	19.48	-0.58	37.93
Macedonia	0.17	0.23	0.03	1.50	0.00	21.27	0.44	8.27
Netherlands	1.00	3.46	0.03	2.62	0.73	17.82	-0.02	18.76
Norway	1.00	3.21	0.05	1.80	0.65	15.97	0.11	12.55
Poland	0.77	1.61	0.04	2.71	0.36	18.98	0.02	13.93
Portugal	1.00	2.00	0.05	2.50	0.55	22.10	0.27	9.22
Russia	0.59	0.99	0.04	2.38	0.21	19.09	0.31	7.85
Slovak Republic	0.35	0.74	0.02	2.83	0.10	18.46	0.28	7.82
Slovenia	1.00	2.10	0.04	2.67	0.55	18.61	0.00	21.55
Spain	0.96	2.66	0.05	2.60	0.62	19.24	0.18	12.90
Sweden	0.98	3.21	0.05	2.15	0.72	16.93	0.12	10.11
Switzerland	0.93	2.30	0.04	2.84	0.57	17.32	0.33	11.32
United Kingdom	0.91	2.75	0.03	1.77	0.66	18.50	0.03	20.44
Sample avg	0.85	2.21	0.04	2.45	0.53	18.71	0.13	13.71

(*continued next page*)

	GOV_ QUALITY	*EPI*	*HDI*	*IV_ PROTECT*	*NONEEA*	*ABTEMP*	*FINDEV*	*LN_ GDP*	*GDP_ GR*	*IND_ GDP*	*TOP3*
Austria	24.97	1.52	-0.02	16.00	0	1.17	0.00	26.85	2.79	40.25	63.72
Belgium	20.67	-1.76	0.02	21.00	0	0.38	0.00	27.03	2.40	29.93	64.79
Bulgaria	6.42	0.88	-0.03	19.00	0	0.96	0.00	25.03	8.67	22.66	59.08
Croatia	10.60	1.84	-0.01	14.00	0	1.19	0.00	24.93	5.88	30.61	65.97
Cyprus	14.11	-9.62	0.01	18.00	0	0.63	0.00	24.04	5.97	15.70	78.68
Czech Republic	18.89	0.82	-0.01	16.00	0	0.36	0.00	26.30	6.18	50.73	62.86
Estonia	22.92	11.18	-0.03	17.00	0	1.34	0.00	24.39	8.55	32.68	91.37
Finland	31.18	3.41	-0.02	17.00	0	0.63	0.00	26.34	1.43	36.39	91.21
France	18.55	1.90	-0.00	16.00	0	0.93	1.00	28.65	1.43	25.60	65.41
Germany	24.88	4.31	0.01	15.00	0	0.34	0.18	29.03	2.55	43.40	76.21
Greece	8.02	5.50	0.02	16.00	0	0.78	0.00	26.08	1.22	22.08	95.39
Hungary	11.03	1.11	-0.03	13.00	0	1.03	0.00	25.80	5.74	42.46	65.73
Iceland	26.79	-7.55	0.02	19.00	1	1.03	0.00	24.11	11.63	27.54	100.00
Ireland	25.76	-3.59	0.00	26.00	0	0.36	0.00	26.84	8.38	65.39	69.09
Italy	11.69	-2.93	0.02	17.00	0	1.08	1.00	28.36	1.84	34.89	62.90
Lithuania	17.89	1.58	-0.03	17.00	0	0.05	0.00	24.75	6.11	42.33	94.44
Macedonia	4.50	-1.70	-0.06	19.00	1	0.61	0.00	23.28	5.87	36.58	76.10
Netherlands	28.18	-1.91	-0.02	14.00	0	0.36	1.00	27.62	3.96	26.70	87.05
Norway	31.30	-2.67	0.00	19.00	0	0.36	0.00	26.82	1.30	39.69	94.39
Poland	12.91	1.61	0.00	18.00	0	0.42	0.00	27.16	5.70	44.78	47.68
Portugal	19.70	-0.50	-0.04	18.00	0	1.21	0.20	26.22	3.28	30.11	67.14
Russia	1.66	-6.38	-0.03	14.00	1	0.54	0.00	28.09	2.41	43.06	55.79
Slovak Republic	13.18	5.00	-0.02	14.00	0	1.07	0.00	25.39	3.30	45.76	72.53
Slovenia	17.72	-3.61	0.01	22.00	0	0.92	0.00	24.84	5.38	45.32	65.44
Spain	14.96	-0.18	0.01	18.00	0	1.22	1.00	27.97	2.89	30.20	65.70
Sweden	29.39	-0.81	-0.00	19.00	0	0.59	1.00	27.06	0.99	34.23	90.00
Switzerland	31.30	-4.77	0.00	9.00	0	0.99	1.00	27.38	2.96	40.61	67.61
United Kingdom	22.66	4.12	0.01	24.00	1	0.43	1.00	28.73	2.71	25.38	46.83
Sample avg	18.75	0.00	-0.00	17.53	0.16	0.74	0.46	27.23	3.38	35.90	67.64

Table 2. Correlations

Variables	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*
(1) AWARE	1.00										
(2) HOFPDI	-0.49*	1.00									
(3) HOFIDV	0.24*	-0.48*	1.00								
(4) HOFFEM	-0.03	-0.13*	-0.19*	1.00							
(5) HOFUAI	-0.16*	0.66*	-0.61*	-0.17*	1.00						
(6) HOFLTO	-0.03	0.11*	0.06	-0.24*	0.04	1.00					
(7) HOFIVR	0.49*	-0.64*	0.44*	0.18*	-0.61*	-0.15*	1.00				
(8) GOV_QUALITY	0.40*	-0.77*	0.42*	0.31*	-0.71*	-0.08*	0.74*	1.00			
(9) EPI	0.09*	-0.08*	-0.08*	-0.11*	-0.09*	-0.15*	-0.02	0.00	1.00		
(10) HDI	0.41*	-0.20*	0.39*	-0.21*	-0.01	-0.07*	0.17*	0.00	0.00	1.00	
(11) IV_PROTECT	-0.01	-0.17*	0.33*	0.10*	-0.38*	-0.55*	0.26*	0.05	0.25*	0.18*	1.00
(12) NONEEA	-0.20*	0.01	0.29*	-0.04	-0.35*	0.00	0.24*	-0.06	0.13*	-0.09*	0.46*
(13) ABTEMP	0.13*	0.02	-0.09*	-0.08*	0.09*	0.08*	-0.07*	-0.10*	-0.05	0.03	-0.15*
(14) FINDEV	0.47*	-0.25*	0.53*	-0.04	-0.38*	0.20*	0.30*	0.16*	-0.13*	0.39*	0.04
(15) LN_GDP	0.27*	-0.27*	0.49*	-0.16*	-0.27*	0.12*	0.09*	0.10*	0.09*	0.49*	0.14*
(16) GDP_GR	-0.02	0.05	-0.04	-0.04	0.03	-0.03	-0.06	-0.08*	0.00	-0.01	0.04
(17) IND_GDP	-0.31*	-0.06	-0.10*	-0.12*	-0.10*	-0.12*	-0.22*	0.13*	-0.16*	-0.20*	-0.10*
(18) TOP3	0.13*	-0.21*	-0.19*	0.54*	-0.07*	-0.01	0.23*	0.34*	-0.10*	-0.08*	-0.23*
(19) SIZE	0.27*	-0.10*	0.19*	0.02	-0.06	0.09*	0.18*	0.10*	0.05	0.22*	0.08*
(20) ROA	-0.22*	0.00	0.05	0.14*	-0.16*	0.05	-0.05	0.05	-0.11*	-0.16*	0.04
(21) BETA	0.17*	0.09*	-0.02	-0.06	0.25*	-0.07*	-0.07*	-0.25*	0.13*	0.30*	0.18*
(22) LOAN_ASSET	-0.11*	-0.17*	-0.02	0.16*	-0.21*	-0.10*	0.02	0.19*	-0.07*	-0.08*	-0.03
(23) NONPFLOAN	-0.10*	0.26*	-0.23*	-0.12*	0.36*	-0.06	-0.15*	-0.39*	0.03	0.10*	0.02
(24) DEPOSIT_ASSET	-0.17*	0.29*	-0.37*	-0.26*	0.34*	0.00	-0.23*	-0.31*	0.01	-0.13*	-0.09*
(25) INCOME_STR	0.19*	-0.08*	0.16*	-0.12*	-0.03	0.17*	0.01	0.11*	-0.17*	0.08*	-0.29*
(26) MB	-0.21*	0.04	0.07*	-0.06	0.06	0.05	-0.13*	-0.15*	-0.10*	-0.27*	-0.16*
(27) REV_GR	0.00	0.00	-0.01	0.00	0.00	-0.01	-0.05	-0.04	0.00	0.00	0.03
(28) FINANCE	-0.01	0.08*	-0.01	-0.02	-0.01	0.05	-0.10*	-0.07*	-0.01	-0.07*	0.01

(*Continued next page*)

Variables	*(12)*	*(13)*	*(14)*	*(15)*	*(16)*	*(17)*	*(18)*	*(19)*	*(20)*	*(21)*	*(22)*
(12) NONEEA	1.00										
(13) ABTEMP	-0.11*	1.00									
(14) FINDEV	0.19*	0.09*	1.00								
(15) LN_GDP	0.23*	0.01	0.64*	1.00							
(16) GDP_GR	0.00	0.23*	-0.12*	-0.08*	1.00						
(17) IND_GDP	-0.25*	-0.14*	-0.34*	-0.06	0.02	1.00					
(18) CONCENTRATION	-0.37*	0.03	-0.21*	-0.43*	-0.07*	-0.08*	1.00				
(19) SIZE	0.03	0.01	0.34*	0.48*	-0.07*	-0.12*	-0.10*	1.00			
(20) ROA	0.15*	0.09*	-0.04	-0.05	0.16*	0.06	-0.06	-0.24*	1.00		
(21) BETA	-0.05	-0.05	0.09*	0.13*	0.03	-0.25*	-0.07*	0.36*	-0.19*	1.00	
(22) LOAN_ASSET	-0.06	-0.06	-0.09*	-0.05	-0.04	0.25*	0.12*	-0.34*	0.15*	-0.25*	1.00
(23) NONPFLOAN	-0.04	-0.06	-0.14*	-0.23*	-0.07*	-0.18*	0.04	-0.21*	-0.30*	0.28*	-0.03
(24) DEPOSIT_ASSET	-0.09*	0.02	-0.30*	-0.36*	0.14*	0.09*	-0.16*	-0.44*	0.01	0.03	0.11*
(25) INCOME_STR	-0.11*	0.05	0.33*	0.14*	-0.09*	-0.03	-0.06	0.21*	-0.06	-0.07*	-0.40*
(26) MB	0.12*	0.03	-0.20*	-0.25*	0.07*	0.10*	0.05	-0.11*	0.16*	-0.10*	0.03
(27) REV_GR	0.00	0.09*	-0.01	-0.01	0.36*	0.02	-0.02	-0.12*	0.28*	-0.02	0.02
(28) FINANCE	0.04	-0.02	-0.02	-0.06	0.35*	0.02	-0.12*	-0.24*	0.24*	-0.12*	0.12*

Variables	*(23)*	*(24)*	*(25)*	*(26)*	*(27)*	*(28)*
(23) NONPFLOAN	1.00					
(24) DEPOSIT_ASSET	0.22*	1.00				
(25) INCOME_STR	-0.16*	-0.16*	1.00			
(26) MB	-0.04	0.00	-0.05	1.00		
(27) REV_GR	-0.07*	0.12*	-0.02	0.01	1.00	
(28) FINANCE	-0.10*	0.25*	-0.05	0.05	0.38*	1.00

Note: * *shows significance at p<0.05*

Table 3. Climate Attitudes and Banks' Climate Disclosure Decisions (Logit Regression)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
WORRY	0.108	0.390***	0.382***						
	(0.61)	(3.15)	(2.95)						
RESP				0.241	-0.146	-0.163			
				(1.16)	(-0.86)	(-0.87)			
HUMAN							-0.070	0.544***	0.424***
							(-0.36)	(4.03)	(2.84)
GOV_QUALITY	0.123***	-0.015	0.011	0.101***	0.015	0.044*	0.128***	-0.011	0.017
	(6.61)	(-1.05)	(0.62)	(3.43)	(0.67)	(1.65)	(6.92)	(-0.74)	(1.00)
EPI	-0.015	-0.055**	-0.037	-0.014	-0.047*	-0.029	-0.012	-0.066***	-0.044
	(-0.45)	(-2.16)	(-1.38)	(-0.42)	(-1.96)	(-1.10)	(-0.35)	(-2.66)	(-1.64)
HDI	38.072***	20.789***	23.758***	35.692***	25.364***	29.249***	39.550***	17.607**	21.052**
	(3.86)	(2.74)	(3.03)	(3.49)	(3.07)	(3.42)	(3.80)	(2.18)	(2.50)
IV_PROTECT	0.088**	0.012	0.060*	0.082**	0.015	0.062**	0.089**	0.007	0.055*
	(2.16)	(0.39)	(1.95)	(1.99)	(0.51)	(2.05)	(2.14)	(0.23)	(1.80)
NONEEA	0.031	-1.377***	-1.578***	0.075	-2.066***	-2.288***	-0.135	-1.395***	-1.718***
	(0.06)	(-2.80)	(-3.31)	(0.15)	(-4.38)	(-4.87)	(-0.26)	(-2.95)	(-3.67)
ABTEMP	0.236	-0.014	0.052	0.250*	0.058	0.121	0.257*	-0.007	0.066
	(1.60)	(-0.14)	(0.42)	(1.68)	(0.57)	(0.94)	(1.71)	(-0.08)	(0.54)
FINDEV	-0.935*	-1.381***	-0.977***	-0.821*	-1.327***	-0.942***	-0.773	-1.882***	-1.349***
	(-1.86)	(-4.01)	(-2.95)	(-1.83)	(-3.80)	(-2.79)	(-1.51)	(-4.82)	(-3.58)
LN_GDP	-0.111	0.555***	0.248*	-0.130	0.605***	0.307**	-0.129	0.683***	0.366***
	(-0.54)	(4.28)	(1.79)	(-0.66)	(4.88)	(2.36)	(-0.64)	(5.20)	(2.71)
GDP_GR	-0.059*	-0.024	-0.020	-0.058*	-0.030*	-0.026	-0.061*	-0.021	-0.018
	(-1.85)	(-1.43)	(-1.16)	(-1.81)	(-1.85)	(-1.58)	(-1.87)	(-1.25)	(-1.10)
IND_GDP	-0.038**	0.021	0.015	-0.034*	-0.001	-0.007	-0.044**	0.021	0.012
	(-2.06)	(1.55)	(1.13)	(-1.90)	(-0.10)	(-0.56)	(-2.43)	(1.58)	(0.91)
TOP3	0.007	0.034***	0.024***	0.012	0.024***	0.014	0.008	0.024***	0.016*
	(0.78)	(4.62)	(3.02)	(1.12)	(2.90)	(1.59)	(0.77)	(3.11)	(1.88)
SIZE	0.620***	0.757***	0.747***	0.621***	0.759***	0.753***	0.627***	0.746***	0.740***
	(6.84)	(8.42)	(8.70)	(6.87)	(8.44)	(8.73)	(6.95)	(8.39)	(8.59)
ROA	31.657**	24.204**	31.622***	32.194**	18.496	25.463**	29.051**	23.404**	29.789***
	(2.15)	(2.00)	(2.79)	(2.20)	(1.50)	(2.33)	(1.98)	(1.99)	(2.74)
BETA	-0.118	0.300	0.515**	-0.108	0.346	0.556**	-0.116	0.318	0.526**
	(-0.37)	(1.24)	(2.08)	(-0.34)	(1.44)	(2.26)	(-0.36)	(1.31)	(2.14)

(*continued next page*)

LOAN_ASSET	0.923	0.403	1.640**	1.045	0.270	1.479**	0.891	0.145	1.391*
	(0.95)	(0.48)	(2.21)	(1.07)	(0.32)	(2.00)	(0.92)	(0.18)	(1.96)
NONPFLOAN	0.600	1.033	0.127	0.493	0.760	-0.120	0.496	0.213	-0.490
	(0.39)	(0.78)	(0.10)	(0.33)	(0.59)	(-0.09)	(0.33)	(0.17)	(-0.39)
DEPOSIT_ASSET	0.635	0.681	0.720	0.660	1.012	1.054	0.649	0.812	0.893
	(0.74)	(0.86)	(0.91)	(0.77)	(1.29)	(1.30)	(0.76)	(1.04)	(1.14)
INCOME_STR	3.213***	2.841***	4.145***	3.238***	2.730***	4.002***	3.188***	2.757***	4.033***
	(3.64)	(3.72)	(5.45)	(3.67)	(3.59)	(5.19)	(3.62)	(3.61)	(5.25)
MB	0.002	0.011***	0.006**	0.002	0.013***	0.007***	0.003	0.010***	0.005**
	(0.81)	(3.41)	(2.20)	(1.00)	(4.05)	(2.83)	(1.05)	(3.61)	(2.28)
REV_GR	-0.870	-0.170	-0.537	-0.931	-0.082	-0.442	-0.866	-0.059	-0.430
	(-1.19)	(-0.28)	(-0.86)	(-1.29)	(-0.14)	(-0.72)	(-1.19)	(-0.10)	(-0.69)
FINANCE	2.175	2.552	1.822	2.176	2.019	1.361	1.771	2.467	1.720
	(0.76)	(1.06)	(0.71)	(0.80)	(0.87)	(0.55)	(0.64)	(1.04)	(0.68)
Intercept, Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	927	927	927	927	927	927	927	927	927
AUC	0.91	0.87	0.87	0.91	0.86	0.87	0.91	0.87	0.87

The dependent variables in columns 1, 4, 7 are *DISC_AR*, indicating climate related disclosures in the annual reports.
The dependent variables in columns 2, 5, 8 are *DISC_ESG*, indicating climate related disclosures in ESG related documents.
The dependent variables in columns 3, 6, 9 are *DISC_BOTH*, indicating climate related disclosures in both annual reports and ESG related documents.
For brevity, we do not report the results for *DISC_OVR*, as they are highly similar to those obtained using *DISC_AR*.
The z-statistics in parentheses are based on robust standard errors clustered by firm. *, **, and *** denote statistical significance levels of 10%, 5%, and 1%, respectively (two-tailed)

Table 4. Climate Attitudes and Climate Disclosure Length

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
WORRY	-0.045	0.141***	0.139***						
	(-1.00)	(2.65)	(2.71)						
RESP				0.214***	0.011	0.087			
				(3.32)	(0.12)	(1.06)			
HUMAN							-0.031	0.202***	0.130*
							(-0.51)	(2.81)	(1.79)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	927	927	927	927	927	927	927	927	927
R-squared	0.61	0.38	0.39	0.62	0.38	0.38	0.61	0.38	0.39

The dependent variables in columns 1, 4, 7 are *NSENT_AR*, a measure of climate related disclosures length in the annual reports.
The dependent variables in columns 2, 5, 8 are *NSENT_ESG*, a measure of climate related disclosures length in ESG related documents.
The dependent variables in columns 3, 6, 9 are *NSENT_BOTH*, a measure of climate related disclosures length in both annual reports and ESG related documents.
The *t*-statistics in parentheses are based on robust standard errors clustered by country and year. *, **, and *** denote statistical significance levels of 10%, 5%, and 1%, respectively (two-tailed)

Table 5. Moderating Effects of Culture on Climate Disclosures Length

Dependent variable = NSENT_BOTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)
AWARE	0.128	0.310***	0.195*	0.270***	0.153	0.249***	0.234**
	(1.16)	(3.38)	(1.94)	(3.02)	(1.57)	(2.62)	(2.16)
HOFPDI	-0.312**	0.157**					
	(-2.28)	(2.21)					
HOFIDV	-0.052		-0.117*				
	(-0.47)		(-1.70)				
HOFFEM	0.224*			0.053			
	(1.92)			(0.96)			
HOFUAI	0.472***				0.275***		
	(3.26)				(3.05)		
HOFLTO	0.055					-0.031	
	(0.70)					(-0.65)	
HOFIVR	0.141						0.118
	(1.20)						(1.27)
HOFPDI AWARE*	-0.089	-0.035					
	(-0.74)	(-0.46)					
HOFIDV AWARE*	0.381***		-0.023				
	(2.62)		(-0.33)				
HOFFEM AWARE*	0.411***			0.177**			
	(3.16)			(2.59)			
HOFUAI AWARE*	0.666***				0.056		
	(3.52)				(0.70)		
HOFLTO AWARE*	0.162**					0.003	
	(2.32)					(0.05)	
HOFIVR AWARE*	0.204						0.010
	(1.34)						(0.12)
Intercept, Controls, Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	927	927	927	927	927	927	927
R-squared	0.46	0.45	0.45	0.45	0.45	0.45	0.45

The *t*-statistics in parentheses are based on robust standard errors clustered by country and year. *, **, and *** denote statistical significance levels of 10%, 5%, and 1%, respectively (two-tailed)

Table 6. Effects of Climate Attitudes on Climate Disclosure Quality

Panel A: *Climate attitude and composite measure of quality*

Dependent variable =	(1) *QUALITY_AR*	(2) *QUALITY_ESG*	(3) *QUALITY_OVR*
AWARE	-0.001	0.016**	0.015**
	(-0.13)	(2.30)	(2.56)
Intercept, Controls, Year FE	Yes	Yes	Yes
N	750	521	792
R-squared	0.30	0.23	0.29

Panel B: *Climate attitude and components of quality measure*

Dependent variable =	(1) *NUM_DENSITY*	(2) *NUM_TOPIC*	(3) *STICKINESS*	(4) *BOILERPLATE*	(5) *READABILITY*
AWARE	-0.001	0.081**	0.012	0.018***	0.448***
	(-0.61)	(2.19)	(0.67)	(3.11)	(2.95)
Intercept, Controls, Year FE	Yes	Yes	Yes		Yes
N	792	792	792	792	792
R-squared	0.03		0.56	0.10	0.46

Panel C: *Climate attitude and other disclosure attributes*

Dependent variable =	(1) *NEGATIVE*	(2) *UNCERTAINTY*
AWARE	0.107***	-0.869
	(4.51)	(-1.40)
Intercept, Controls, Year FE	Yes	Yes
N	792	792
R-squared	0.17	0.34

The *t*-statistics in parentheses are based on robust standard errors clustered by country and year. *, **, and *** denote statistical significance levels of 10%, 5%, and 1%, respectively (two-tailed)

Table 7. Difference-in-Differences Estimates Using the Fridays for Future Campaign as a Quasi-Experiment for the Causal Effect of Climate Attitudes

Dependent variable =	(1) *DISC_ AR*	(2) *DISC_ ESG*	(3) *DISC_ BOTH*	(4) *NSENT_ AR*	(5) *NSENT_ ESG*	(6) *NSENT_ BOTH*
TREAT*POST	**1.569*** **	**0.783** **	**0.497**	**0.520*** **	**0.271**	**0.376** **
	(2.91)	**(2.07)**	**(1.14)**	**(3.19)**	**(1.30)**	**(2.08)**
TREAT	-2.962***	0.098	-0.194	-0.914***	0.030	-0.325
	(-4.67)	(0.21)	(-0.34)	(-5.80)	(0.12)	(-1.38)
POST	2.460**	2.308**	3.471***	1.876***	1.626***	2.360***
	(2.09)	(2.50)	(3.88)	(6.15)	(3.90)	(6.67)
Intercept, Controls, Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	645	645	645	645	645	645
R-squared				0.70	0.36	0.46

Table 8. Additional Analysis:

Panel A: Using the Eurobarometer Survey Instead of the European Social Survey

Dependent variable =	(1) *DISC_ AR*	(2) *DISC_ ESG*	(3) *DISC_ BOTH*	(4) *NSENT_ AR*	(5) *NSENT_ ESG*	(6) *NSENT_ BOTH*
EB_AWARE	2.377**	1.972**	2.403***	0.549**	-0.056	0.674*
	(2.16)	(2.32)	(2.74)	(2.40)	(-0.14)	(1.81)
Intercept, Controls, Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	779	779	779	779	779	779
R-squared				0.65	0.41	0.47

Panel B: Employing Adjacent Climate Attitude Values Instead of Linear Interpolation

Dependent variable =	(1) *DISC_ AR*	(2) *DISC_ ESG*	(3) *DISC_ BOTH*	(4) *NSENT_ AR*	(5) *NSENT_ ESG*	(6) *NSENT_ BOTH*
AWARE	0.199	0.747***	0.703***	0.068	0.204*	0.214**
	(0.64)	(3.26)	(3.01)	(0.73)	(1.83)	(2.08)
Intercept, Controls, Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	772	772	772	772	772	772
R-squared				0.61	0.38	0.44

Panel C: Controlling Bank's Corporate Governance

Dependent variable =	(1) *DISC_ AR*	(2) *DISC_ ESG*	(3) *DISC_ BOTH*	(4) *NSENT_ AR*	(5) *NSENT_ ESG*	(6) *NSENT_ BOTH*
AWARE	0.904	0.996***	0.763***	0.117	0.255*	0.242**
	(1.58)	(3.75)	(2.79)	(1.27)	(1.89)	(2.04)
BANK_GOV	0.014*	0.009	0.009	0.001	0.002	0.003
	(1.75)	(1.50)	(1.54)	(0.67)	(0.78)	(0.96)
BOARD_SIZE	0.037	0.036	0.043	-0.017	0.001	-0.012
	(0.62)	(0.83)	(1.02)	(-1.49)	(0.07)	(-0.72)
Intercept, Controls, Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	670	670	670	670	670	670
R-squared				0.63	0.30	0.41

Panel D: Controlling Country's English Proficiency and Linguistic Distance

Dependent variable =	(1) *DISC_ AR*	(2) *DISC_ ESG*	(3) *DISC_ BOTH*	(4) *NSENT_ AR*	(5) *NSENT_ ESG*	(6) *NSENT_ BOTH*
AWARE	0.320	0.904***	0.817***	0.058	0.330***	0.313***
	(1.21)	(4.47)	(3.93)	(0.76)	(3.60)	(3.69)
ENG_PRO	0.013*	-0.000	0.003	0.004*	0.002	0.005
	(1.85)	(-0.01)	(0.37)	(1.71)	(0.83)	(1.59)
LING_DIST	10.724***	6.330**	7.255**	3.057***	3.048**	3.182**
	(2.85)	(2.22)	(2.25)	(3.16)	(2.35)	(2.39)
Intercept, Controls, Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	921	921	921	921	921	921
R-squared				0.63	0.39	0.46

The t-statistics in parentheses are based on robust standard errors clustered by country and year. *, **, and *** denote statistical significance levels of 10%, 5%, and 1%, respectively (two-tailed).

Appendix 1: Variable definitions

Variables	Definition	Data sources
Main dependent variables		
DISC_AR	Binary variable. Equals 1 if there are climate-related disclosures within the annual reports and 0 otherwise	Annual reports (PDF retrieved from LSEG database)
DISC_ESG	Binary variable. Equals 1 if there are climate-related disclosures within the ESG reports. This includes ESG web-based reporting, corporate governance report, articles of association, sustainability report, code of conduct, environmental policy, audit committee, stakeholder engagement, and others.	PDF retrieved from LSEG database
DISC_OVR	Binary variable. Equal 1 if either *DISC_AR* or *DISC_ESG* equals 1.	PDF retrieved from LSEG database
DISC_BOTH	Binary variable. Equal 1 if both *DISC_AR* or *DISC_ESG* equals 1.	
NSENT_AR	A continuous measure calculated as ln(1 + number of climate-related sentences/total number of sentences in the annual report)	Annual reports (PDF retrieved from LSEG database)
NSENT_ESG	A continuous measure calculated as ln(1 + number of climate-related sentences/total number of sentences in the ESG related reports). This includes ESG web-based reporting, corporate governance report, articles of association, sustainability report, code of conduct, environmental policy, audit committee, stakeholder engagement, and others.	PDF retrieved from LSEG database
NSENT_OVR	A continuous measure calculated as ln(1 + number of climate-related sentences/total number of sentences in the annual reports and ESG related reports)	PDF retrieved from LSEG database
NSENT_BOTH	A continuous measure calculated as ln(1 + number of climate-related sentences/total number of sentences in the annual reports and ESG related reports) when banks disclose climate related issues in both reports.	
Climate attitudes and cultural dimensions		
WORRY	Continuous measure, answer to the question *How worried about climate change?* The lowest score of the answer is 1 (Not at all worried) and the highest is 5 (Extremely worried). This variable is standardized.	European Social Survey in 2016, 2020, 2023
RESP	Continuous measure, answer to the question *To what extent feel personal responsibility to reduce climate change*? The lowest score is 0 (Not at all) and highest is 10 (A great deal). This variable is standardized.	European Social Survey in 2016, 2020, 2023
HUMAN	Continuous measure, answer the question *Climate change caused by natural processes, human activity, or both*? Lowest score is 1 (Entirely by natural processes) and highest is 5 (Entirely by human activity). This variable is standardized.	European Social Survey in 2016, 2020, 2023
HOFPDI	Power Distance Index, higher score indicates more power distance	
HOFIDV	Individualism versus Collectivism, a higher score indicates a stronger inclination toward individualism	
HOFFEM	Femininity versus Masculinity, a higher score indicates a greater orientation toward femininity	

HOFUAI	Uncertainty Avoidance Index, a higher score indicates low tolerance for uncertainty	
HOFLTO	Long-Term vs. Short-Term Orientation, a higher score indicates more long-term orientation	
HOFIVR	Indulgence vs. Restraint, a higher score reflects a stronger tendency toward indulgence.	
Control variables		
GOV_QUALITY	Continuous measure. Average of ranks from six governance indicators: voice and accountability, government effectiveness, control of corruption, political stability, rule of law, and regulatory quality	World Bank database
EPI	Continuous measure (orthogonalized to avoid multicollinearity with *GOV_QUALITY* and *HDI*). Yale Environment performance index. Higher values indicate better performance.	https://epi.yale.edu/
HDI	Continuous measure (orthogonalized to avoid multicollinearity with *GOV_QUALITY* and *EPI*). The country's human development index	
IV_PROTECT	Continuous measure (orthogonalized).. The country's investor protection index from World Bank database	World Bank database
NONEEA	Binary variable. 1 if the country does not belong to European Economic Area	
ABTEMP	Continuous measure. Abnormal temperature at the country level following Ge et al. (2024)	
FINDEV	Binary variable. A country's financial development index higher than median value of the sample get value of 1.	International Monetary Fund (IMF)
LN_GDP	Continuous measure. Natural logarithm of GDP	World Bank database
GDP_GR	Continuous measure. GDP Growth	World Bank database
IND_GDP	Continuous measure. Contribution of the industrial sector to the total GDP as percentage	World Bank database
TOP3	Continuous measure. The assets of three largest commercial banks as a share of total commercial banking assets	World Bank database
SIZE	Continuous measure. Natural logarithm of total assets.	Calculated using data from LSEG database
ROA	Continuous measure. Net income after taxes divided by total assets	Calculated using data from LSEG database
BETA	Continuous measure. Stock beta.	Retrieved from LSEG database
LOAN_ASSET	Continuous measure. The ratio of loans to total assets	Calculated using data from LSEG database
NONPFLOAN	Continuous measure. The ratio of non-performing loans to total loans	Calculated using data from LSEG database
DEPOSIT_ASSET	Continuous measure. The ratio of deposits to total assets	Calculated using data from LSEG database
INCOME_STR	Continuous measure. The ratio of non-interest income to total revenue	Calculated using data from LSEG database
MB	Continuous measure. Calculated by dividing market capitalization by book value of equity.	Calculated using data from LSEG database
REV_GR	Continuous measure. Calculated by dividing changes in revenues by previous year revenues	Calculated using data from LSEG database
FINANCE	Continuous measure. Calculated by taking new debt and stock issuance in 3 consecutive years, multiplied by 100 and divided by assets.	Calculated using data from LSEG database
Disclosure		

attributes		
NUM_DENSITY	Continuous measure. Number density is calculated as the ratio of numbers in the disclosure divided by the total words in the disclosure	PDF retrieved from LSEG database
NUM_TOPIC	Continuous measure. Number of topics in the disclosures, calculated using LDA method.	PDF retrieved from LSEG database
BOILERPLATE	Continuous measure. The similarity of climate related disclosures compared to other banks' disclosures in the same year	PDF retrieved from LSEG database
STICKINESS	Continuous measure. The similarity of climate-related disclosures compared to the bank's own disclosure in previous year	PDF retrieved from LSEG database
READABILITY	Continuous measure. The Gunning fog index multiplied by -1	PDF retrieved from LSEG database
NEGATIVE	Continuous measure. First, the percentage of negative (*NEG*) and positive (*POS*) words according to Loughran-McDonald dictionary to total words in the disclosures is calculated. Then this measure is calculated as (*NEG – POS)/(NEG + POS*)	PDF retrieved from LSEG database
UNCERTAINTY	Continuous measure. The percentage of uncertainty words according to Loughran-McDonald dictionary to total words in the disclosures	PDF retrieved from LSEG database
Variables used in the additional analysis (Different sample sizes)		
TREAT	Binary variable. Equals 1 if a country's "Fridays for Future" (FFF) protest count per capita is above the median of the "low awareness" subsample. "Low awareness" subsample includes countries in the two lowest terciles of the awareness metrics according to the survey in 2016. Analysis is done for each climate awareness separately (*WORRY, RESP, HUMAN*). This variable thus identifies countries with low climate awareness in 2016 that responded strongly to the FFF campaign	
POST	Binary variable. Equals 1 if observations in years after 2019 and 0 otherwise	
BANKGOV	Continuous measure. Governance pillar score by Refinitiv	LSEG database
BOARD_SIZE	Continuous measure. The number of board members.	LSEG database
EB_AWARE	Continuous measure. Climate change awareness according to the Eurobarometer survey	Eurobarometer survey

Appendix 2: Textual Analysis Approach for Identifying Climate Risk Disclosures and Measuring Related Metrics

This appendix describes how we identify climate risk disclosures using a keyword discovery method adapted from Sautner et al. (2024) and originally developed by King et al. (2017), and how we subsequently calculate related measures. At the end of the appendix, we present two alternative approaches as robustness check of our findings, one is based on the keyword lists and another one uses ClimateBERT model.

The procedures adapted from Sautner et al. (2024) are as follows:

- We begin with two lists of word pairs (bigrams): Basic bigrams (C_0) - A small set of reliable climate-related terms, e.g., "carbon emissions," "greenhouse gases" - and rough bigrams (C_r) - a broader set of potentially climate-related terms, selected as the most frequent bigrams from Intergovernmental Panel on Climate Change (IPCC) documents. These may include both relevant and irrelevant terms. The goal is to expand the small, reliable set (C_0) by identifying additional relevant terms from the broader set (C_r).
- We search annual reports using both lists: The reference set comes from sentences containing basic bigrams (C_0), and the search set comes from sentences containing rough bigrams (C_r). As the search set is very large, we take a random sample of 100,000 sentences for the next step.
- We split both the reference set and the search set into a training portion (to build the model) and a test portion (to evaluate accuracy). We test three classification methods: Support Vector Classifier (SVC), Multinominal model, and Random Forest Classifier to find the best boundary between climate and non-climate sentences. The best-performing model predicts the probability that a sentence is climate-related. If the probability is greater than 80%, we classify the sentence as target (climate-related). Otherwise, it is classified as non-target (irrelevant).
- As the final steps, we create a list of bigrams that best separate the target set and non-target set. From the target set and non-target set, we create a list of bigrams that appear only in the target set and not in the non-target set (C_s). Additionally, we add to C_s bigrams that appear in both sets but are more frequent in the target set than in the non-target set.
- The final climate change bigrams library is the combined list of initial basic bigrams set (C_0) and new bigrams C_s. The final library is used to capture climate related sentences from bank reports.

After the climate related sentences are captured, they are used to construct dependent variables in regression analysis as follows:

- DISC_AR, DISC_ESG, and DISC_OVR: these binary variables equal one if the bank discloses climate related information in their reports.
- NSENT_AR, NSENT_ESG, NSENT_OVR: These continuous variables are calculated as the logarithm of the ratio of climate-related sentences to the total number of sentences in each report.
- NUM_DENSITY: This variable is a measure of specificity. It measures the relative frequency of numerical expressions—such as integers, decimal numbers, and percentages—by dividing their count by the total number of words in a document.
- NUM_TOPIC: The number of topics per disclosure is derived using Latent Dirichlet Allocation (LDA). First, the optimal number of latent topics is selected by maximizing the average coherence score across multiple random initializations. Given the selected model, the number of topics is then defined as the count of topics that are meaningfully represented in the text. This measure reflects the extent to which a disclosure spans multiple distinct thematic areas.
- BOILERPLATE and STICKINESS: STICKINESS is defined as the similarity between a firm's disclosure in a given year and its disclosure in the immediately preceding year, measuring within-firm textual persistence over time. BOILERPLATE is defined as the average similarity between a firm's disclosure and the disclosures of other firms in the same year, capturing cross-firm convergence toward standardized language. In both cases, similarity is computed using cosine similarity applied to term-weighted text representations (TF–IDF weighting with standard stop-word removal).
- READABILITY is measured using the Gunning Fog Index, calculated based on sentence length and word complexity. To avoid distortions arising from numerical expressions, the metric is computed on text from which numbers have been removed. Sentences and words are then tokenized, syllables are counted at the word level, and complex words are defined as words containing three or more syllables. Gunning Fog Index is computed based on average sentence length and the proportion of complex words: 0.4 * ((total words/total sentences) + 100 * (complex word count /total words)). Higher Gunning Fog Index indicates greater textual complexity and lower readability. We multiply this index with minus 1 to get the variable READABILITY.[12]
- NEGATIVE sentiment is constructed using the Loughran–McDonald lexicon. First, words in each disclosure are classified as positive or negative according to the lexicon. The negative sentiment measure is then calculated as the difference between the

[12] An example of sentence with low readability: "*The last financial year was marked, in particular, by an intensification of activities to develop and implement organisational, procedural and methodological solutions aimed at ensuring full alignment with the content of the Expectations of the Guide on Climate and Environmental Risks (issued by the ECB in November 2020) and, more generally, to implement the sound practice indications received from the Supervisory Authorities in the context of their ongoing and ordinary supervision of the bank's operations.*" This sentence is extremely long and with many complex words.

proportion of negative and positive words, divided by their sum. Negative word list includes words such as accuse, accident, argument, boycott, etc, while positive word list includes words such as achieve, attain, honored, etc.[13]

- UNCERTAINTY is measured using the Loughran–McDonald uncertainty word list and is defined as the frequency of uncertainty-related terms relative to total word count, capturing the extent to which disclosures convey ambiguity or lack of precision about future outcomes. Uncertainty word list includes words such as approximate, assumption, cautious, conditional, etc.[14]

As a robustness check for our textual analysis approach, we first repeat our analysis an alternative set of climate-related keywords drawn from prior literature. Specifically, we employ keyword lists from Li et al. (2024) and Sautner et al. (2023).[15] Li et al. (2024) construct a final dictionary consisting of 37 unigrams and 1,649 bigrams, which is not fully disclosed in their paper. However, they report the top 30 keywords, and the last five keywords capture very few instances, suggesting that even in a large dictionary, only a limited number of keywords meaningfully identify relevant sentences. In addition, Sautner et al. (2023) do not fully disclose their keyword list but report 50 initial and unambiguous bigrams that clearly capture climate-related content. We combine the disclosed keywords from Li et al. (2024) and Sautner et al. (2023) to construct the alternative keyword set used in our robustness test.

In the second robustness test, we utilize the ClimateBERT, a Large Language Model (LLM) specifically designed for capturing corporate climate disclosures (Bingler et al., 2024).[16]

The results obtained using this alternative keyword set (Table A1) and the ClimateBERT model (Table A2) are not qualitatively different from our main findings, indicating that our inferences are robust to the choice of textual analysis approach.

Table A3 presents the top 30 keywords along with their respective frequencies. The first two columns show the initial, unambiguous bigrams from Sautner et al. (2023), which are general and focused purely on climate change. The second list contains the top bigrams derived from

[13] Example of sentence with negative tone: "*The most significant risks relating to accident and health insurance contracts result from lifestyle changes and from climate and environmental changes.*"

[14] Example of sentence with uncertainty tone: "*ESG risks include all risks arising from* ***potential*** *negative impacts, direct or indirect, on the environment, people, communities and all stakeholders in general, along with those arising from corporate governance. ESG risk* ***could*** *affect profitability, reputation and credit quality and* ***could*** *lead to adverse legal consequences. Although in the assessment of climate and other environmental risks an immediate threat to the Bank was not identified, the urgency and* ***uncertainty*** *of this issue require continued monitoring*."

[15] Another influential paper in climate related textual analysis is Engle et al. (2020). However, we do not use this paper as it analyses articles in the Wall Street Journal rather than corporate disclosures.

[16] ClimateBERT model can be found here: https://www.chatclimate.ai/climatebert

the procedures described above. These keywords are more Europe-specific, reflecting concepts such as the EU taxonomy and the Green Asset Ratio (GAR), showing that our procedure performs effectively. The final list shows the keywords used in our robustness check.

Table A1: Main analysis with logit and OLS regression using different set of climate related keywords to detect climate related disclosures.

Dependent variable =	(1) *DISC_ AR*	(2) *DISC_ ESG*	(3) *DISC_ BOTH*	(4) *NSENT_ AR*	(5) *NSENT_ ESG*	(6) *NSENT_ BOTH*
AWARE	0.165	0.699***	0.597***	-0.028	0.275***	0.198**
	(0.58)	(3.36)	(2.68)	(-0.42)	(2.86)	(2.56)
Intercept, Controls, Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	927	927	927	927	927	927
AUC/R-squared	0.91	0.87	0.87	0.65	0.38	0.45

Table A2: Main analysis with logit and OLS regression using ClimateBERT model to detect climate related disclosures.

Dependent variable =	(1) *DISC_ AR*	(2) *DISC_ ESG*	(3) *DISC_ BOTH*	(4) *NSENT_ AR*	(5) *NSENT_ ESG*	(6) *NSENT_ BOTH*
AWARE	0.141	0.619***	0.573**	0.039	0.195**	0.183**
	(0.49)	(2.92)	(2.54)	(0.52)	(2.32)	(2.05)
Intercept, Controls, Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	927	927	927	927	927	927
AUC/R-squared	0.91	0.87	0.88	0.60	0.38	0.38

Table A3: Top 30 keywords with their frequencies

Top 30 initial and unambiguous bigrams from Sautner et al. (2023) and frequencies		Top 30 final bigrams from keyword discovery method by King et al (2017) and frequencies		Top 30 keywords from Li et al. (2024) and Sautner et al. (2023) and frequencies (Robustness check)	
climate change	39250	climate change	39250	climate change	28618
greenhouse gas	5803	covered assets	12572	greenhouse gas	4512
renewable energy	4546	and proportion	8286	renewable energy	3304
extreme weather	1144	the denominator	7308	energy efficiency	3134
carbon dioxide	830	greenhouse gas	5803	weather	1547
carbon neutral	581	change adaptation	4725	flood	1133
sea level	496	renewable energy	4546	energy efficient	981
ghg emission	486	eligible proportion	4224	flooding	871
environmental sustainability	447	the numerator	3261	extreme weather	817

clean energy	342	sustainable taxonomy	2919	carbon dioxide	575
electric vehicle	224	not taxonomy	2632	temperatures	407
carbon emission	217	assets taxonomy	2285	carbon neutral	405
air pollution	202	gar calculation	1961	sea level	399
sustainable energy	200	for gar	1843	ghg emission	351
gas emission	198	commercial immovable	1524	environmental sustainability	341
carbon price	189	building renovation	1431	drought	317
carbon energy	167	immovable property	1350	energy management	316
energy climate	162	motor vehicle	1332	storms	309
solar energy	155	total gar	1253	clean energy	254
wind power	140	gar assets	1218	droughts	233
water resources	132	taking possession	1141	green energy	226
clean water	126	residential immovable	1139	precipitation	180
carbon tax	112	the gar	984	carbon emission	168
air quality	109	carbon dioxide	830	wildfires	161
new energy	96	which motor	786	gas emission	145
clean air	73	relevant taxonomy	653	sustainable energy	145
wind energy	69	the greenhouse	647	carbon price	145
solar thermal	26	taxonomy taxonomy	578	the renewable	144
kyoto protocol	25	sea level	496	wind power	140
global decarbonization	24	ghg emission	486	wind farm	136