Climate Change Concerns and Corporate Carbon Emissions*

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Abstract

Using county-level data on local perceptions of global warming, we find that firms headquartered in counties with more climate-conscious residents exhibit lower carbon emissions. This outcome is achieved not by substituting emissions across different scopes within the firm, but through carbon abatement initiatives, including green innovation, climate target setting, and renewable energy use. The negative relationship is more pronounced in counties with greater social capital, collectivist values, democratic leanings, proximity to the coast, and educated populations. Local climate change concerns also matter more for firms exposed to greater attention. Besides, firms headquartered in climate-conscious counties concern more about the risks, uncertainties, or adverse impacts of global warming, and spend more on pro-climate lobbying. Evidence from local temperature anomalies and social contagion of concerns supports causal inferences.

JEL Classification: G30, G34, M14, Q54

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1 Introduction

Why are firms willing to mitigate negative environmental externalities? A common explanation based on a shareholder perspective ("doing well by doing good") is that carbon reduction, as a voluntary initiative, has a positive impact on competitiveness, profitability, and firm value (e.g., Krueger et al., 2020; Matsumura et al., 2014). Another explanation ("doing good by doing well") is that firms can afford the substantial investment needed for environmental issues (e.g., Hong et al., 2012; Xu & Kim, 2022). While both explanations may be true, they hardly explain the heterogeneity in carbon emissions across firms: If carbon abatement adds value or is costly on average, why are some firms committed to it to a greater extent than other firms?

Traditionally, corporate carbon emissions are externalized rather than internalized by shareholders, suggesting that they are not only related to the firm's own choices but also to the firm's explicit and implicit contractual environment, that is, legal regulations and social preferences (Azar et al., 2021; Jacobsen et al., 2023; Liang & Renneboog, 2017; Magill et al., 2015; Shapiro & Walker, 2018).[1] The nature of this externality also indicates that corporate carbon emissions represent a trade-off between a shareholder focus and a stakeholder focus, largely depending on the external context. While previous research has revealed the role of factors such as shareholder preferences and institutional forces in corporate carbon footprint management (e.g., Azar et al., 2021; Shapiro & Walker, 2018), there is limited evidence on

[1] For example, a stream of literature examines the influence of environmental regulations, finding that some are ineffective in controlling emissions and could result in unintended consequences, such as reallocating emissions to less regulated areas or diminishing local productivity (e.g., Bartram et al., 2022; Becker & Henderson, 2000; Ben-David et al., 2021; Gibson, 2019; Greenstone, 2002).

how climate change concerns among local stakeholders – a social preference or informal institution – come into play. We therefore use granular data on regional public perspectives toward global warming to examine its influence on corporate carbon emissions. In light of the role of enterprises in global warming and the rise in climate awareness among the population, this research question is particularly relevant.[2]

Our basic hypothesis, grounded on stakeholder theory and legitimacy theory (Eesley & Lenox, 2006; Freeman, 1984; Suchman, 1995), is that firms headquartered in regions with residents highly concerned about climate change are motivated to have lower carbon emissions. Specifically, the attitudes expressed by a large portion of a community is perhaps more salient to businesses today than ever before (e.g., Balakrishnan et al., 2023; Sumner, 2022). Growing concerns about climate change among the public place considerable pressure on firms to take proactive steps against global warming (e.g., Buntaine et al., 2024; DellaVigna et al., 2012; Kilpatrick, 1985; Lotila, 2010). Ignoring this stakeholder demand could lead to adverse social feedback and potential costs, while acting in a climate-responsible manner could help maintain legitimacy and dominance (e.g., Brønn & Vidaver-Cohen, 2009; Buntaine et al., 2024; Eesley

[2] Human activities since the Industrial Revolution, especially the economic behaviors of enterprises, have increased the concentration of greenhouse gases in the atmosphere. For instance, the Carbon Majors Report shows that just 100 companies have accounted for more than 70% of global greenhouse gas emissions since 1988. In addition to the energy industry, the top 15 U.S. food and beverage companies generate nearly 630 million metric tons of greenhouse gases annually. On the other hand, a recent survey shows that climate change is a particular concern for citizens, standing out among the many threats the world faces, such as disinformation, cyberattacks, global economy conditions and infectious diseases. 75% of people in 19 countries consider global climate change to be a major threat. People express their concerns through their own practices, peaceful marches, climate rallies and even disruptive protests. For example, one billion people participated in Earth Day 2023, with the theme of investing in our planet and a focus on expanding the green economy. See https://www.pewresearch.org, https://www.epa.gov/ghgemissions, https://www.bbc.com, https://www.theguardian.com, https://www.epa.gov/climatechange-science, https://www.nrdc.org.

& Lenox, 2006; Idowu et al., 2013; Suchman, 1995).[3] As the more appropriate option, firms subject to carbon abatement demands are motivated to reduce emissions to meet stakeholder expectations and thereby alleviate public scrutiny. Our null hypothesis is that local concern about climate change has no explanatory power in predicting corporate carbon emissions, perhaps because stakeholder perceptions are not important enough to elicit firm attention and subsequent actions in the trade-off.

To test our hypothesis, we collect data on climate change concerns from Yale Climate Opinion Map and define *Worried* as the ratio of population who are somewhat or very worried about global warming (Bernstein et al., 2019; Howe et al., 2015). We obtain data on corporate carbon emissions from S&P Global Trucost and measure *Scope 1* as the natural logarithm of one plus the ratio of Scope 1 carbon emissions to total revenue. We find that firms headquartered in counties where residents are more climate-conscious have lower carbon emissions. The results are not only statistically significant but also economically meaningful. An increase in *Worried* by one standard deviation implies an approximate decrease in carbon intensity by 12.51% of a standard deviation. Our findings hold up under a set of robustness checks.

Then, we use instrumental variable estimation to mitigate endogeneity and establish causality. The first instrument is the local temperature anomalies, *Anomaly*, measured by the

[3] For example, consumers may switch to products or services from firms that take a climate-responsible approach. Employees may move to climate-responsible firms. Firms that fail to act may face boycotts or protests from consumer groups or non-governmental organizations. They may also face environmental-related investigations, litigation, and regulatory challenges due to climate publicity. In contrast, proactively responding to climate change concerns help firms develop differentiated advantages while gaining legitimacy in the eyes of the public.

deviation of the annual average temperature from the historical annual average temperature. This instrument is largely exogenous with respect to firm outcomes but is positively correlated with local concern about global warming (e.g., Addoum et al., 2020; Choi et al., 2020; Zaval et al., 2014). To further strengthen our identification, we propose the social contagion of climate change concerns (*Contagion*) as our second instrument. Leveraging the Facebook social connectedness index between U.S. counties, we measure *Contagion* as a weighted sum of the annual temperature anomalies of socially connected counties. The two-stage least-squares (2SLS) regression results support the causal inference.

We next explore the underlying mechanisms through which concerns about climate change lead to fewer corporate carbon emissions. Intuitively, to achieve this, firms may (i) reallocate emissions across different scopes of the same firm or (ii) implement carbon abatement practices. Our evidence is most consistent with the last channel. Specifically, we regress corporate Scope 2, Scope 3 upstream, and Scope 3 downstream carbon emissions on climate change concerns, and find no evidence that firms headquartered in climate-conscious counties appear to substitute or outsource their emissions. We then examine whether firms make more green investments and take emission abatement measures to achieve this outcome. The results show that firms located in climate-conscious counties are more likely to engage in green innovation, set climate targets, and use renewable energy. These efforts may contribute to the observed lower carbon emissions.

We argue that local concerns about climate change create considerable pressure on firms. By lowering carbon footprints, firms can mitigate adverse social feedback and potential costs that arise from increased climate publicity. If this is the case, we would expect the baseline relationship to be more pronounced among firms facing more pro-climate demands from local stakeholders. To this end, we conduct three sets of cross-sectional analyses.

First, social capital, defined as the norms and networks that facilitate collective action, favor the behavior consistent with social norms and limit deviations from these norms (Hasan et al., 2017; Jha & Cox, 2015; Woolcock, 2001). Collectivism, on the other hand, emphasizes cohesion and mutual obligations (e.g., Bazzi et al., 2020). In counties where social capital or collectivistic values are prevalent, we hypothesize that local concerns about global warming exert stronger demands on firms from stakeholders regarding carbon footprints. Supporting our conjecture, the subsample regression results show that the negative relationship between climate change concerns and corporate carbon emissions is more pronounced when firms are in counties with a higher level of social capital or collectivism.

Second, we examine how local political orientation, coastal proximity, and education level could be at play. As anecdotal evidence and research suggested, counties with more democratic leanings, proximity to the coast, and educated populations should exhibit greater pressure on global warming because of local stakeholder's beliefs and preferences (e.g., Cheung, 2016; Di Giuli & Kostovetsky, 2014; IPCC, 2012). We find consistent evidence showing that climate change concerns matter more for firms headquartered in these counties.

Third, we test whether concerns over climate change negatively correlate more strongly with carbon emissions in firms subjected to higher public attention. Specifically, B2C firms encounter increased stakeholder scrutiny due to direct engagement with consumers (Bénabou

& Tirole, 2010; Darendeli et al., 2022). Firms with extensive analyst coverage as well as larger firms generally attract more public eyes (e.g., Baker et al., 2002; Etzion, 2007; Kuhnen & Niessen, 2012; Lim & Monroe, 2022). The cross-sectional regression results show that the negative relationship between climate change concerns and corporate carbon emissions is more pronounced for firms in B2C industries or with greater analyst coverage, and for larger firms.

Furthermore, we explore how firms view global warming when residents are concerned about climate change. We examine corporate sentiment on climate issues during earnings conference calls. We find that local concern about global warming leads firms to adopt a negative tone toward climate change, indicating corporate concern about the risks, uncertainties, or adverse impacts associated with climate change. Then, we explore whether local climate change concerns influence corporate climate change-related practices that firms undertake in addition to, but closely related to, carbon emissions. We focus on corporate climate lobbying activities and find that firms headquartered in counties with more climate-conscious residents spend more on pro-climate lobbying and less on anti-climate lobbying. Last, we analyse the persistent effect of climate change concern on corporate carbon emissions over time. We find that our baseline results hold when using *Worried* lagged by two, three, four, and five years.

This paper makes several contributions. First, our paper adds to the literature examining the implication of local climate change opinion. Previous studies have primarily focused on how climate change beliefs are at play in equity markets, fixed income markets, savings markets, as well as housing and mortgage markets (e.g., Alekseev et al., 2022; Anderson &

Robinson, 2024; Baldauf et al., 2020; Bernstein et al., 2019; Duan & Li, 2024; Dursun-de Neef & Ongena, 2024; Pursiainen et al., 2024). We extend this line of research through the lens of corporate decision-making, a relatively underexplored area. To the best of our knowledge, our paper is among the first to investigate whether and how climate change concerns shape corporate carbon footprints. In this regard, our paper echoes Zingales (2000)'s call to examine the neglected but not secondary role of stakeholder opinion on corporate governance.

Second, our paper relates to the emerging literature on whether stakeholder pressure drives corporate behavior towards social goals. For instance, Bogan et al. (2024) find a substantial increase in the appointment of minority directors following the murder of George Floyd and the subsequent Black Lives Matter protests. Similarly, Balakrishnan et al. (2023) find that firms respond to public demands for equity, diversity, and inclusion by appointing more Black directors to boards. In addition, the boycott campaign spurred by the Russo-Ukrainian War forces firms to cease operations in Russia (Pajuste & Toniolo, 2022). In this vein, our research in the context of global decarbonization advances our understanding of whether and how stakeholder opinion on climate change compels firms to emit less greenhouse gas.

Third, our study enriches literature on the determinants of corporate carbon emissions. Prior research has primarily explored how institutional forces (such as regulations and market pressures), shareholder and managerial preferences, corporate networks, and firm characteristics influence corporate carbon footprints (Akey & Appel, 2021; Asgharian et al., 2023; Azar et al., 2021; Bolton & Kacperczyk, 2023; Cohen et al., 2023; Forster & Shive, 2020;

Jing et al., 2023; Jouvenot & Krueger, 2021; Martinsson et al., 2024; Ramadorai & Zeni, 2024; Reid & Toffel, 2009; Shapiro & Walker, 2018; Tomar, 2023). In this paper, we introduce new insights through a social preference or informal institution, that is, local opinion about global warming. More generally, our paper is related to Buntaine et al. (2024), who emphasize the importance of bottom-up participation on environmental governance.

Climate change is expected to brings huge economic and social costs (Bilal & Känzig, 2024). The challenges associated with global warming require a collaborative approach involving governments, corporations, and citizens. Specifically, the transition to a low-carbon economy hinges on the design and implementation of effective policies. However, recent anecdotal evidence and studies highlight the uncertainty surrounding climate policy (e.g., Gavriilidis, 2021; Ilhan et al., 2021). Moreover, firms may even impede ambitious climate policies through lobbying activities or undermine the effectiveness of climate policies through regulatory arbitrage (Bartram et al., 2022; Leippold et al., 2024). It is thus crucial to understand public perceptions of global warming and explore how these beliefs drive progress towards decarbonization. We find that stakeholder concern about climate change matters as it is negatively related to corporate carbon emissions. Stakeholder demands likely compels firms to internalize costs traditionally externalized to the environment and third parties. In this regard, our research has important implications for policymakers and activists: While regulations and initiatives are essential, raising public awareness and concern about climate change stands as an effective tool for tackling global warming.

The remainder of this paper proceeds as follows: Section 2 describes the data and methodology. Section 3 presents the main results. Section 4 concludes the paper.

2 Data and methodology

2.1 Sample construction

We start our sample with U.S. listed firms in the CRSP/Compustat Merged database from 2014 to 2021.[4] We collect data on corporate carbon emissions from S&P Global Trucost, data on climate change concerns from Yale Climate Opinion Maps, data on monthly temperature from National Centers for Environmental Information (NCEI), data on Facebook social connectedness index from Meta, data on corporate patent activity from Kogan et al. (2017), data on ESG from Refinitiv, data on social capital index from Lin and Pursiainen (2022) and Rupasingha et al. (2006), data on collectivism and coast proximity from Bazzi et al. (2020), data on presidential election voting from MIT Election Lab, data on demographics from U.S. Census Bureau, data on analyst coverage from I/B/E/S, data on corporate climate change sentiment from Sautner et al. (2023), and data on corporate climate lobbying from Leippold et al. (2024). We also collect data on the historical county of headquarters from the header section of 10-K/Qs filed on the EDGAR system provided by Bill McDonald.[5] Firm age data are from the CRSP database, and financial data are from CRSP/Compustat Merged database.

[4] The sample period begins in 2014 because Yale Climate Opinion Maps provides survey results for each U.S. County from that year onwards. Since we lag all right-hand-side variables by one year, the sample period for left-hand-side variables, e.g., corporate carbon emission, is from 2015 to 2022.

[5] Headquarter data in Compustat and CRSP are constantly updated and therefore reflect only the most recent status, which may lead to measurement errors in determining local climate change concerns around firm headquarters, especially for firms that relocated their headquarters. Bill McDonald parses corporate 10-K/Q filings on the EDGAR system annually and captures the firms' historical location, facilitating accurate identification. See https://sraf.nd.edu/data.

Following previous literature (e.g., Jing et al., 2023), we exclude regulated utilities (SIC codes 4900-4999) and financial institutions (SIC codes 6000-6999). We further remove firm-year observations with missing data on control variables. The final sample includes 14,480 firm-year observations for 2,971 distinct companies.

2.2 Corporate carbon emissions

We measure corporate carbon emissions using data provided by S&P Global Trucost, a database prevalent in recent studies (e.g., Azar et al., 2021; Bolton & Kacperczyk, 2023; Cohen et al., 2023). Trucost compiles emission data from publicly available sources, such as financial reports, CSR reports, CDP filings, and EPA filings. It categorizes carbon emissions related to corporate activities into different scopes.[6] For each scope, Trucost quantifies carbon emissions in absolute tonnes of CO_2 equivalent, as well as calculates emission intensity as the ratio of absolute tonnes to a firm's revenue in millions of U.S. dollars. Among them, emission intensity, i.e., carbon efficiency, reflects corporate operational scale and indicates its dependency on carbon emissions in generating revenue.

In this paper, we focus on Scope 1 carbon emissions – emissions that come from direct emitting sources a firm owns or controls – because they are more directly controlled by firms, and they are more accurately quantified. We logarithmically transform the Scope 1 carbon intensity. Specifically, we define *Scope 1* as a proxy for corporate carbon emissions, measured

[6] There are Scope 1, Scope 2, Scope 3 upstream, and Scope 3 downstream carbon emissions. We provide the detailed definition and discussion of other scopes in Section 3.3.1.

by the natural logarithm of one plus the ratio of Scope 1 carbon emissions to revenue in millions of dollars. Higher values indicate greater levels of carbon emissions.

2.3 Climate change concerns

We leverage data from Yale Climate Opinion Maps to capture the within-county variation in local opinion about global warming. Based on national surveys conducted since 2008, the Maps offers granular estimates of climate change perceptions across U.S. adults at both state and county levels. The high-resolution estimates are derived from a statistical model that uses multilevel regression with post-stratification (MRP) on survey responses, along with demographic and geographic characteristics (Howe et al., 2015). These estimates are validated by multiple methods, thus largely reflecting the actual perceptions of the population in each region.[7]

To study the relationship between climate change concerns and corporate carbon emissions, we follow Bernstein et al. (2019) and use data from responses to the question "How worried are you about global warming?" Respondents indicating they are "very worried" or "somewhat worried" are categorized as "worried", while those responding "not very worried" or "not at all worried" are classified as "not worried". Respondents who choose "don't know" or do not respond are not categorized. We then take the proportion of the population in each county that is "worried" about climate change as our primary measure for climate change concerns. Specifically, we define *Worried* as a proxy for local concerns about climate change

[7] The Yale Climate Opinion Maps provides estimates for each state since 2008 and for each county since 2014. See https://climatecommunication.yale.edu/visualizations-data/ycom-us.

where the firm is headquartered, measured by the ratio of population who are somewhat or very worried about global warming.

Figure 1 shows the spatial distribution of climate change concerns across conterminous U.S., with Panel A reporting the percentage of the population worried about climate change in 2014 and Panel B in 2021. We find that perceptions of Americans vary greatly depending on where they live, and that attitudes change over time. On average, climate change concerns among the U.S. population are growing.

2.4 Instrumental variables

2.4.1 Local temperature anomalies

To capture exogenous variation in local perceptions about global warming, we use local temperature anomalies as our first instrument for climate change concerns. Specifically, anecdotal evidence and prior research suggest that concerns about climate change are elevated when local temperatures are abnormally high (e.g., Choi et al., 2020; Ma & Yildirim, 2023; Zaval et al., 2014). Meanwhile, local temperature anomalies resulting from global atmospheric changes appears to be exogenous to corporate outcomes (e.g., Addoum et al., 2020). We expect that local temperature anomalies can only influence corporate carbon emissions through climate change concerns.[8]

[8] Someone may argue that the instrument of local temperature anomalies may be related to corporate carbon emissions through other channels rather than climate change concerns. For instance, abnormal changes in temperature may cause firms to use more energy in production and operations, thus affecting carbon emissions. However, as long as such additional channels are present, they would tend to bias our results toward the null hypothesis. Nonetheless, we strengthen our identification by developing our second instrument.

We obtain county-level monthly temperature data from NCEI, a subsidiary of the National Oceanic and Atmospheric Administration. NCEI provides a comprehensive picture of weather and climate conditions, including time-series data for monthly maximum, minimum and average temperatures. The input data used to construct these monthly observations come from records of weather stations across the U.S., dating back to 1895.

Following existing literature on climate change (e.g., Addoum et al., 2020; Cuculiza et al., 2024; Ma & Yildirim, 2023), we calculate local temperature anomalies (*Anomaly*) for county *c* in year *t* using the following model specification:

$$Anomaly_{c,t} = Temp_{c,t} - \overline{Temp}_{c,1895:t-1} \tag{1}$$

where *Temp* is the annual average temperature, measured by averaging monthly mean temperatures. $\overline{Temp}$ is the historical average temperature from 1895 to the previous year, serving as the benchmark. A higher value of *Anomaly* indicates abnormally high local temperature relative to the past. We expect *Anomaly* to be positively associated with *Worried*.

2.4.2 Social contagion of concerns

To further strengthen our identification, we use the social contagion of climate change concerns as our second instrument. The rationale behind this instrument is that social networks shape beliefs since individuals' opinions and behaviors are positively influenced by friends connected through social ties (e.g., Bailey et al., 2018; Bailey et al., 2024; Bailey et al., 2022). For instance, Hu (2022) find that households increase their purchase of flood insurance when distant friends experience floods or campaign for such insurance. During the COVID-19 pandemic, people with friends in severely affected areas experience reduced mobility compared to people with friends in less affected areas (Bailey et al., 2024). Charoenwong et al. (2020) find that social connections with areas severely affected by the pandemic increase compliance with mobility restrictions by approximately 50%. A recent study by Mayer (2023) show that people whose friends experience temperature shocks are more concerned about global warming. Intuitively, therefore, individuals are likely to be influenced by friends' opinions about climate change and thus form similar beliefs.

We collect data on Facebook social connectedness index (*SCI*) from Meta.[9] This index measures the strength of connectedness between two geographic areas, represented by the frequency and density of Facebook friendship ties between each county pair in the U.S. (Bailey et al., 2018).[10] We then measure the perceptions of friends in each county on global warming by respective local temperature anomalies. Finally, we use the following model specification to construct our instrument for the climate change concerns of county *c* being contagious from a set of socially connected counties denoted by *P*:

$$Contagion_{c,t} = \frac{\sum_{p\in P}(Anomaly_{p,t} \times SCI_{c,p})}{\sum_{p\in P} SCI_{c,p}} \tag{2}$$

where *Anomaly* is the yearly temperature anomaly for connected county *p* in year *t*. *SCI* is the degree of social connectedness between county *c* and its connected county *p*. Therefore, the

[9] More than 68% of U.S. adults use Facebook and this ratio is relatively stable across races, education levels, and income groups. Establishing a connection requires mutual consent and the maximum number of connections is limited. Therefore, friendships observed on Facebook are similar to real-world social ties in that connections primarily occur between acquaintances. Given the scale of Facebook's user base, the social connectedness index provides a comprehensive measure of the social network at a granular level. See https://www.pewresearch.org, https://about.meta.com.

[10] Meta assigns people to geographic areas based on their information and activity on Facebook, such as cities specified in their Facebook profile. Then, Meta counts the total number of friendship links between users across geographic regions. See https://dataforgood.facebook.com.

numerator is the weighted sum of *Anomaly* in each county within group *P*, where the weights are the Facebook social connectedness index between county *c* and each county *p*. The denominator is the sum of the social connectedness between county *c* and all counties within group *P*, allowing for the standardization of the influence of each county. The resulting value, *Contagion*, represents an estimate of the extent to which social ties to other counties contribute to the level of climate change concerns within county *c* at year *t*.

This instrument has two main advantages. First, it captures plausible exogenous variations in climate change concerns caused by non-local temperature anomalies and is therefore rigorously independent of local corporate activity. Second, it allows us to measure the diffusion of opinions across space by taking into account the strength of social ties.[11]

2.5 Control variables

We control for a set of firm characteristics that may influence corporate carbon emissions: *Ln (Age)*, measured by the natural logarithm of the years since a firm first appeared in the CRSP monthly stock return files; *Ln (Total Assets)*, measured by the natural logarithm of total assets, adjusted for the annual average consumer price index in 2014; *CapEx*, measured by the ratio of capital expenditures to total assets; *Book Leverage*, measured by the ratio of book value of debt to total assets; *RoA*, measured by the ratio of net income to total assets; *R&D Intensity*, measured by the ratio of R&D expenditures to total sales, where missing R&D is set to zero;

[11] We note that this approach assumes a simplified social contagion mechanism in which ideas are directly transmitted among friends on social media and opinions can be linearly aggregated.

and *Cash Flow*, measured by the ratio of net cash flow to total assets. We winsorize all continuous variables at the 1st and 99th percentiles to mitigate the effects of outliers.

2.6 Description of the data

Table 1 presents the summary statistics for the main variables used in our analyses. The average value of *Scope 1* (after logarithm) is 2.983. The average value of *Worried* is 0.646, suggesting that, on average, 64.6% of the U.S. population is somewhat or very worried about global warming. The statistics for all control variables are within reasonable ranges and comparable with previous studies. For instance, our sample firms are characterized by an average *Ln (Total Assets)* of 7.308, an average *Book Leverage* of 0.291, an average *R&D Intensity* of 0.774.

3 Main results

3.1 Baseline regression

To examine the relationship between climate change concerns and corporate carbon emissions, we estimate the following model specification:

$$Scope\ 1_{i,c,t} = \alpha + \beta Worried_{c,t-1} + \gamma X_{i,c,t-1} + \epsilon_{i,c,t-1} \tag{3}$$

where *i*, *c*, and *t* denote firm, county, and year, respectively. *Scope 1* is measured by the natural logarithm of one plus the ratio of Scope 1 carbon emissions to revenue. The main variable of interest is *Worried*, measured as the share of population who are somewhat or very worried about global warming. *X* is a vector of control variables as discussed in Section 2.5. Depending on the model, we include industry fixed effects (based on 2-digit SIC codes) and year fixed effects or industry-year joint fixed effects.[12] Since *Worried* is measured at the county level, we cluster standard errors by county in all regressions to account for serial correlation of the error term (Petersen, 2009).[13] To mitigate potential concern about reverse causality, we lag all right-hand-side variables by one year.

Table 2 presents the regression results of the relationship between climate change concerns and corporate carbon emissions. Panel A of Table 2 reports the baseline results. We find that all coefficients on *Worried* are negative and statistically significant across model specifications. The results suggest that local concern about global warming negatively relates to corporate carbon emissions. The results are also economically meaningful. In column (4), for example, an increase in climate change concerns by one standard deviation implies a decrease in carbon intensity by 12.51% of a standard deviation.[14] Therefore, we find evidence supporting the hypothesis that firms headquartered in counties with climate-conscious populations have lower carbon emissions.

To explore the shape of the relationship between climate change concerns and corporate carbon emissions, we regress *Scope 1* on *Worried* quintile dummies, with the same set of control variables and fixed effects as in column (4) of Panel A. In Figure 2, we plot the estimated coefficients for *Scope 1* by *Worried* quintiles. The ranges indicate 95% confidence intervals, based on standard errors clustered by firm. The omitted group is the first quintile, so

[12] We follow the existing literature and use industry-year joint fixed effects in the rest of the analysis to account for decarbonization trends at the industry level.
[13] Our results are robust to the double clustering by county and year.
[14] It is calculated as $(e^{1.473\times 0.080}-1)\times 100$.

the coefficients are relative to the quintile with the lowest level of concern about climate change. We find that corporate carbon emissions decrease monotonically with climate change concerns.

For robustness checks, we first re-estimate the baseline model using alternative measures of corporate carbon emissions, including *Δ Scope 1*, measured by the one-year change in the natural logarithm of one plus the ratio of Scope 1 carbon emissions to revenue; *Scope 1 Absolute*, measured by the natural logarithm of one plus the Scope 1 carbon emissions; and *Scope 1/Assets (Equity)*, measured by the natural logarithm of one plus the ratio of Scope 1 carbon emissions to total assets (equity). Panel B of Table 2 reports the regression results. Consistent with our main findings, firms headquartered in counties with climate-conscious populations have reduced or lower carbon emissions.

Second, we define the following alternative proxies for climate change concerns: *Happening*, measured by ratio of population who think that global warming is happening; *Citizens*, measured by ratio of population who think citizens themselves should be doing more or much more to address global warming; and *Corporations*, measured by ratio of population who think corporations and industry should be doing more or much more to address global warming. Higher values of *Happening*, *Citizens*, and *Corporations* indicate greater concern about climate change. Panel C of Table 2 reports the regression results. We find that our results are robust to alternative measures of climate change concern above.[15]

Third, we consider some additional controls for local demographic characteristics that may bias our baseline results, such as the proportion of local female population (*Female*), aging

[15] In columns (2) and (3) of Panel C, the number of observations decrease substantially because data for these two survey questions are only available in recent years.

population (*Aging*) and Caucasian population (*Caucasian*). We also control for the potential influence of local regulations related to climate change, including the passage of U.S. State Climate Action Plans (*CAP*) and the geographical distance between a firm's headquarter to an Environmental Protection Agency regional office (*EPA*). Panel D of Table 2 reports the regression results. All coefficients on *Worried* are negative and statistically significant, reinforcing our baseline results.

Last, to alleviate potential concerns that idiosyncrasies in certain year may drive our results, we run the baseline specification by year. Figure 3 provides evidence that these concerns appear to be minimal.

3.2 2SLS estimation

While our measure of climate change concerns characterizes heterogeneity in local perceptions about global warming within counties, this survey-based measurement may be subject to measurement error. Some unobservable confounding factors may also bias our results. To facilitate causal inference, we use the 2SLS regression method to study the impact of climate change concerns on corporate carbon emissions. We estimate the following model specification:

$$Worried_{c,t} = \alpha + \beta Instrument_{c,t} + \gamma X_{i,c,t} + \theta + \epsilon_{i,c,t} \tag{4}$$

$$Scope\ 1_{i,c,t} = \alpha + \beta Worried_{c,t-1}^{Instrument} + \gamma X_{i,c,t-1} + \theta + \epsilon_{i,c,t-1} \tag{5}$$

where *i*, *c*, and *t* denote firm, county, and year, respectively. *Instrument* represents *Anomaly* and *Contagion*. *Anomaly* is measured by the deviation of the annual average temperature in a given year from the historical annual average temperature from 1895 to the previous year. *Contagion* is measured by the weighted sum of the annual temperature anomalies of socially connected counties. X is a vector of controls similar to those in Table 2. θ denotes industry-year joint fixed effects.

Table 3 presents the 2SLS regression results using local temperature anomalies and social contagion of climate change concerns as instruments separately. Columns (1) and (3) report the first stage results. Consistent with our conjecture, we find that both *Anomaly* and *Contagion* are positively associated with *Worried*. The F-statistics from first stage regressions suggest that we are unlikely to have a weak instrument problem. Columns (2) and (4) report the second stage results. We find that the coefficients on the fitted *Worried* estimated from respective first stage regressions are negative and statistically significant. These results confirm our main findings, i.e., climate change concerns are negatively related to corporate carbon emissions. Therefore, this relationship appears to be causal.

3.3 Potential channel

There are two potential channels through which local climate change concerns lower corporate carbon emissions. First, firms headquartered in climate-conscious counties may reallocate emissions across carbon emission scopes within the same firm. Second, these firms may take carbon abatement measures to lower their footprints. In this section, we examine each channel separately.

3.3.1 Substitution across emission scopes

To assess how growing climate change concerns translate into lower corporate carbon emissions, we investigate whether there are substitution effects across different scopes of carbon emissions. In addition to Scope 1, corporate carbon emissions are classified into three scopes based on firm activities: Scope 2 emissions arise from the consumption of purchased energy that is produced upstream from direct operations of a firm; and Scope 3 upstream (downstream) emissions encompass all other emissions related to upstream (downstream) operations that are not directly owned or controlled by a firm.[16] Intuitively, firms headquartered in counties with climate-conscious populations may lower Scope 1 carbon emissions and instead increase Scope 2 and 3 emissions in response to local stakeholder demands.

To this end, we re-estimate the baseline model using the following left-hand-side variables: *Scope 2*, measured by the natural logarithm of one plus the ratio of Scope 2 carbon emissions to revenue; *Scope 3 Upstream*, measured by the natural logarithm of one plus the ratio of Scope 3 upstream carbon emissions to revenue; and *Scope 3 Downstream*, measured by the natural logarithm of one plus the ratio of Scope 3 downstream carbon emissions to revenue. Table 4 presents the regression results of the relationship between climate change concerns and other carbon emission scopes. We find that all coefficients on *Worried* are negative and statistically significant. The results for Scope 2, Scope 3 upstream and Scope 3 downstream emissions are

[16] Take an airline as an example, Scope 1 emissions include emissions from aircraft engines during flights. Electricity consumed by the airline to power its office facilities is included in Scope 2 emissions, and emissions produced from the manufacturing of aircrafts purchased by the airline is included in Scope 3 upstream emissions. See https://www.spglobal.com/esg/trucost.

comparable to Scope 1 in magnitude. The negative relationships suggest that firms headquartered in climate-conscious counties do not appear to reallocate emissions across carbon emission scopes of the firm. Especially, these firms do not outsource part of their emissions to suppliers, a phenomenon discovered by Dai et al. (2024). These results indicate that there is no evidence of substitution effects across the scope of carbon emissions.

3.3.2 Carbon abatement initiatives

Since that firms headquartered in regions with residents highly concerned about climate change do not reallocate carbon emissions across scopes, we examine whether they actively implement carbon abatement measures to achieve lower carbon emissions.

We begin by examining the relationship between climate change concerns and corporate green investments. The green patent activity represents a substantial investment in environmental issues and is evidenced to tackle carbon emissions (e.g., Carrión-Flores & Innes, 2010; Sautner et al., 2023). We collect corporate patent data from Kogan et al. (2017) and identify green patents using the International Patent Classification (IPC) Green Inventory and the Cooperative Patent Classification (CPC) system. We then define two variables: *Green Patent*, a dummy variable that equals one if a firm applies for green patents; and *Green Patent #*, the natural logarithm of one plus the number of green patents applied by a firm, adjusted following Fang et al. (2014) to address truncation issues. We re-estimate our baseline specification using proxies for green investment as left-hand-side variables.

Table 5 presents the regression results of the relationship between climate change concerns and carbon abatement initiatives. In columns (1) and (2), the dependent variables are *Green Patent* and *Green Patent #* respectively.[17] We find that coefficients on *Worried* are positive and statistically significant, suggesting that firms increase their green innovation in response to local climate change concerns.

Next, we investigate two common corporate carbon abatement practices: climate target setting and renewable energy use. We obtain ESG data from Refinitiv and define four variables: *Reduction Target*, a dummy variable that equals one if a firm sets emission reduction target; *Reduction Target %*, the percentage of emission reduction target set by a firm; *Renewable Energy*, a dummy variable that equals one if a firm uses purchased or produced renewable energy; and *Renewable Energy %*, the percentage of purchased and produced renewable energy in gigajoules to total energy use in millions.

In columns (3) to (6) of Table 5, the dependent variables are *Reduction Target*, *Reduction Target %*, *Renewable Energy*, and *Renewable Energy %* respectively. We note that the relevant sample is smaller than our baseline sample due to limited coverage of specific ESG data. All coefficients on *Worried* are positive and statistically significant, suggesting that firms headquartered in climate-conscious counties are more likely to set emission reduction targets or use renewable energy. Besides, the goals set and the proportion used are also higher.

[17] Throughout the analysis, we estimate a linear probability model when the left-hand-side variable is binary.

In summary, our findings show that local concerns about global warming motivate firms to engage in green innovation, set climate targets, and use renewable energy. These efforts may contribute to the observed lower carbon emissions.

3.4 Cross-sectional analysis

To the extent that climate change concerns motivate firms to emit less carbon, we further examine cross-sectional variation in this relationship. Specifically, we argue that strong concerns about climate change create considerable stakeholder demands on firms. Lowering carbon footprints helps mitigate adverse social feedback and potential costs arising from climate publicity. If this is the case, we would expect the baseline relationship to be more pronounced among firms facing greater pro-climate demands from stakeholders.

3.4.1 Social capital and collectivism

First, we explore the role of social capital and collectivism in corporate responses to local climate change concerns. Social capital, defined as the norms and networks that facilitate collective action, favors behavior consistent with social norms and limits deviations from these norms (Hasan et al., 2017; Jha & Cox, 2015; Woolcock, 2001). Collectivism, on the other hand, emphasizes cohesion and mutual obligations (e.g., Bazzi et al., 2020). Intuitively, social capital and collectivism promote imposed or internalized climate change beliefs. Therefore, in counties where social capital or collectivistic values are prevalent, we hypothesize that local concerns about global warming exert stronger demands on firms from stakeholders regarding carbon footprints.

We use two variables to capture the level of social capital in each county: *Social Capital LP*, the social capital index of Lin and Pursiainen (2022); and *Social Capital RGF*, the social capital index of Rupasingha et al. (2006). A higher index indicates higher social capital in the region. To proxy for collectivism, we follow Bazzi et al. (2020) and measure collectivistic values using the time that the county is part of the frontier (*Frontier Experience*) and the historical share of infrequent names (*Infrequent Names*). A county with less *Infrequent Names* or *Frontier Experience* tends to be more collectivistic.

Table 6 presents the subsample regression results by social capital and collectivism. In columns (1) and (2), firms in counties with *Social Capital LP* above sample medians each year are classified as High, otherwise as Low. The use of *Social Capital RGF* in columns (3) and (4) is similar. We find that the coefficients on *Worried* are negative and statistically significant for the high social capital group (columns (1) and (3)), whereas they are statistically insignificant for the low social capital group (columns (2) and (4)). In columns (5) to (8), firms in counties with *Frontier Experience* or *Infrequent Names* above sample medians each year are classified as High, otherwise as Low. The estimated coefficients on *Worried* are negative and statistically significant for the collectivist group (columns (6) and (8)), whereas they are statistically insignificant for the individualist group (columns (5) and (7)). Consistent with our conjecture, the negative relationship between climate change concerns and corporate carbon emissions is stronger when firms are in counties with greater social capital or collectivist values.

3.4.2 Political orientation, coastal proximity, and education level

Second, we examine how political orientation, coastal proximity and education level could be at play. Specifically, the Democratic platform emphasizes issues related to corporate social and environmental responsibility more than the Republican platform (e.g., Cheung, 2016; Di Giuli & Kostovetsky, 2014). In general, populations closer to the coast are more concerned about global warming since they are more vulnerable to the direct adverse consequences of climate change, i.e., rising sea levels (IPCC, 2012; Milfont et al., 2014). Additionally, individuals with higher education backgrounds are often better able to grasp the complexities of climate science and associated risks.[18] Intuitively, counties with more Democratic voters, closer to the coast, and educated residents should exhibit greater stakeholder pressure on global warming issues. Therefore, we anticipate a stronger negative association between climate change concerns and corporate carbon emissions in these regions.

We obtain presidential election voting data from MIT Election Lab, coastal proximity data from Bazzi et al. (2020), and education level data from U.S. Census Bureau. Then, we define the following variables: *Democratic Voting*, the ratio of the percentage of a county's population voting for the Democratic Party to that voting for the Republican Party in the presidential election; *Distance to Coast*, the distance from a county to the coast; and *College Degree*, the percentage of the population (age 25 and above) who earn a college degree or higher.

[18] See, e.g., https://blogs.worldbank.org, https://www.pewresearch.org.

Table 7 presents the subsample regression results by political orientation, coastal proximity, and education level. In columns (1) to (6), firms in counties with *Democratic Voting*, *Distance to Coast*, or *College Degree* above sample medians each year are classified as High, otherwise as Low. We find that the estimated coefficients on *Worried* are negative and only statistically significant for counties that are more Democratic, proximate to the coast, and well educated (columns (1), (4), and (5)). Consistent with our conjecture, the negative relationship between local climate change concerns and corporate carbon emissions is stronger when firms headquartered in counties with greater democratic leanings, proximity to the coast, and educated populations.

3.4.3 Corporate exposure to public attention

Third, we test whether concerns over climate change negatively correlate more strongly with carbon emissions in firms subjected to higher public attention. Specifically, the visibility of a firm to the public depends on its business model, i.e., business-to-consumer (B2C) versus business-to-business (Bénabou & Tirole, 2010; Darendeli et al., 2022). B2C firms, engaging directly with consumers, are more sensitive to customer opinions and encounter increased public scrutiny. Additionally, analysts collect and disseminate information about firms and provide indirect but additional social pressure on firms (Yu, 2008). Firms with extensive analyst coverage tend to be more prominent (Kuhnen & Niessen, 2012; Lim & Monroe, 2022), making them more exposed to public eyes. Likewise, larger firms naturally attract more public attention by virtue of their size (Baker et al., 2002; Etzion, 2007). Consequently, we anticipate that climate change concerns matter more for firms in B2C industries, those with more analyst coverage, and larger firms.

To this end, we follow Lev et al. (2010) and identify B2C industries based on 4-digit SIC codes. We define *B2C Industry* as a dummy variable that equals one if a firm is in a business-to-customer sector. We measure *Analyst Coverage* by the natural logarithm of the number of analysts following a firm, and *Firm Size* by the natural logarithm of total assets.

Table 8 presents the subsample regression results by corporate exposure to public attention. In columns (1) and (2), firms in the *B2C Industry* are classified as Yes, otherwise as No. In columns (3) to (6), firms with *Analyst Coverage* or *Firm Size* above sample medians each year are classified as High, otherwise as Low. We find that the estimated coefficients on *Worried* are negative and statistically significant for the *B2C Industry* group as well as high *Analyst Coverage* and *Firm Size* group (columns (1), (3), and (5)). Consistent with our expectations, the negative relationship between climate change concerns and corporate carbon emissions is more pronounced when firms are more exposed to public attention.

3.5 Climate change sentiment

Our basic hypothesis suggests that firms care about local perceptions of global warming and, therefore, adjust their subsequent carbon footprints in response to stakeholder pressure associated with climate change concerns. To further explore how firms view climate change when residents are concerned about global warming, we examine corporate sentiment on climate change during earnings conference calls. We leverage data developed by Sautner et al.

(2023), who adapt a machine learning keyword discovery algorithm to capture tones of earnings call participants. The negative tone toward climate change indicates concern about the risks, uncertainties, or adverse impacts associated with global warming.

We define two variables, namely, *Negative Tone* and *Positive Tone*. Specifically, *Negative Tone* is measured by the relative frequency with which climate change-related bigrams are mentioned together with negative tone words in a sentence in the earnings call transcripts. *Positive Tone* is measured by the relative frequency with which climate change-related bigrams are mentioned together with positive tone words in a sentence in the earnings call transcripts.

Table 9 presents the regression results of the relationship between climate change concerns and climate change sentiment. In column (1), the dependent variable is *Negative Tone*. We find that firms in climate-conscious counties tend to have a negative tone on global warming during earnings calls, suggesting that increases in local climate change concerns are positively associated with corporate concerns about global warming. We find consistent results in column (2), where the dependent variables are *Positive Tone*. Therefore, the salience of local climate change concerns is transmitted to firms' attitude towards global warming.

3.6 Corporate climate lobbying

So far, we find that firms headquartered in counties with climate-conscious populations have lower carbon emissions. Recent literature shows that firms are likely to engage in climate lobbying activities (Leippold et al., 2024). Therefore, we further explore whether local climate change concerns influence corporate climate change-related practices that firms undertake in addition to, but closely related to, carbon emissions. To this end, we follow Leippold et al. (2024) to focus on corporate climate lobbying activities.

Based on climate keywords, bill titles and bill codes from OpenSecrets lobbying reports, Leippold et al. (2024) identify lobbying expenses associated with pro-climate and anti-climate spending. We define *Pro-climate (Anti-climate) Lobbying* by the ratio of pro-climate (anti-climate) lobbying expenses to total assets, and then regress the two measures on *Worried* separately.

Table 10 presents the regression results of the relationship between climate change concerns and corporate climate lobbying. In columns (1) and (2), the dependent variables are *Pro-climate Lobbying* and *Anti-climate Lobbying*, respectively. We find that firms headquartered in counties with more climate-conscious residents spend more on pro-climate lobbying and less on anti-climate lobbying. Combined with our main findings, the results deepen our understanding of the full picture of how local climate change concerns influence corporate climate practices.

3.7 Persistent effect

To further mitigate the potential endogeneity concern raised from reverse causality and simultaneity, we analyse the persistent effect of climate change concern on corporate carbon emissions over time. To this end, we re-estimate model (3) but lag *Worried* by two to five years. Table 11 presents the regression results of the relationship between lagged climate change concern and corporate carbon emissions. We find that our baseline results hold when using

Worried lagged by two, three, four, and five years. The results suggest that the effect of climate change concern on corporate carbon emissions persists over several years, helping to alleviate the endogeneity issue.

4 Conclusion

Does stakeholder opinion about global warming truly matter? Employing county-level data from the Yale Climate Opinion Maps, we find evidence that local concerns about climate change are negatively associated with corporate carbon emissions. Instead of substituting across different carbon emission scopes, firms headquartered in counties with climate-conscious populations pursue green innovation, set climate targets, and use renewable energy. Firms tend to emit lower levels of greenhouse gases when they are headquartered in counties with greater social capital, collectivist values, democratic leanings, proximity to the coast, and educated populations. This negative relationship is also stronger for firms exposed to greater public attention: Those in B2C industries and those with higher analyst coverage or larger size. Furthermore, firms headquartered in climate-conscious counties concern about the risks, uncertainties, or adverse impacts associated with global warming. They spend more on pro-climate lobbying and less on anti-climate lobbying. Our use of local temperature anomalies and social contagion of climate change concerns as instruments supports causal inferences. Overall, our study underscores the pivotal role of stakeholder opinion on climate change in driving the transition towards a carbon-neutral economy.

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Appendix A Variable definitions

Variable	Definition
Scope 1	The natural logarithm of one plus the ratio of Scope 1 carbon emissions to revenue (*Data source: Trucost*).
Δ Scope 1	The one-year change in the natural logarithm of one plus the ratio of Scope 1 carbon emissions to revenue (*Data source: Trucost*).
Scope 1 Absolute	The natural logarithm of one plus the Scope 1 carbon emissions (*Data source: Trucost*).
Scope 1/Assets	The natural logarithm of one plus the ratio of Scope 1 carbon emissions to total assets (*Data source: Trucost and CRSP/Compustat Merged*).
Scope 1/Equity	The natural logarithm of one plus the ratio of Scope 1 carbon emissions to equity (*Data source: Trucost and CRSP/Compustat Merged*).
Scope 2	The natural logarithm of one plus the ratio of Scope 2 carbon emissions to revenue (*Data source: Trucost*).
Scope3 Upstream	The natural logarithm of one plus the ratio of Scope 3 upstream carbon emissions to revenue (*Data source: Trucost*).
Scope3 Downstream	The natural logarithm of one plus the ratio of Scope 3 downstream carbon emissions to revenue (*Data source: Trucost*).
Worried	The ratio of population who are somewhat or very worried about global warming (*Data source: Yale Climate Opinion Maps*).
Happening	The ratio of population who think that global warming is happening (*Data source: Yale Climate Opinion Maps*).
Citizens	The ratio of population who think citizens themselves should be doing more or much more to address global warming (*Data source: Yale Climate Opinion Maps*).
Corporations	The ratio of population who think corporations and industry should be doing more or much more to address global warming (*Data source: Yale Climate Opinion Maps*).
Ln (Age)	The natural logarithm of the years since a firm first appeared in the CRSP monthly stock return files (*Data source: CRSP/Compustat Merged*).
Ln (Total Assets)	The natural logarithm of total assets, adjusted for the annual average consumer price index in 2014 (*Data source: CRSP/Compustat Merged*).
CapEx	The ratio of capital expenditures to total assets (*Data source: CRSP/Compustat Merged*).
Book Leverage	The ratio of book value of debt to total assets (*Data source: CRSP/Compustat Merged*).
RoA	The ratio of net income to total assets (*Data source: CRSP/Compustat Merged*).
R&D Intensity	The ratio of R&D expenditures to total sales, where missing R&D is set to zero (*Data source: CRSP/Compustat Merged*).
Cash Flow	The ratio of net cash flow to total assets (*Data source: CRSP/Compustat Merged*).
Anomaly	The deviation of the annual average temperature in a given year from the historical annual average temperature from 1895 to the previous year (*Data source: National Centers for Environmental Information*).
Contagion	The weighted sum of the annual temperature anomalies of socially connected counties (*Data source: National Centers for Environmental Information and Meta*).
Female	The ratio of female population to the total population (*Data source: U.S. Census Bureau*).
Aging	The ratio of elderly population to the total population (*Data source: U.S. Census Bureau*).
Caucasian	The ratio of Caucasian population to the total population (*Data source: U.S. Census Bureau*).

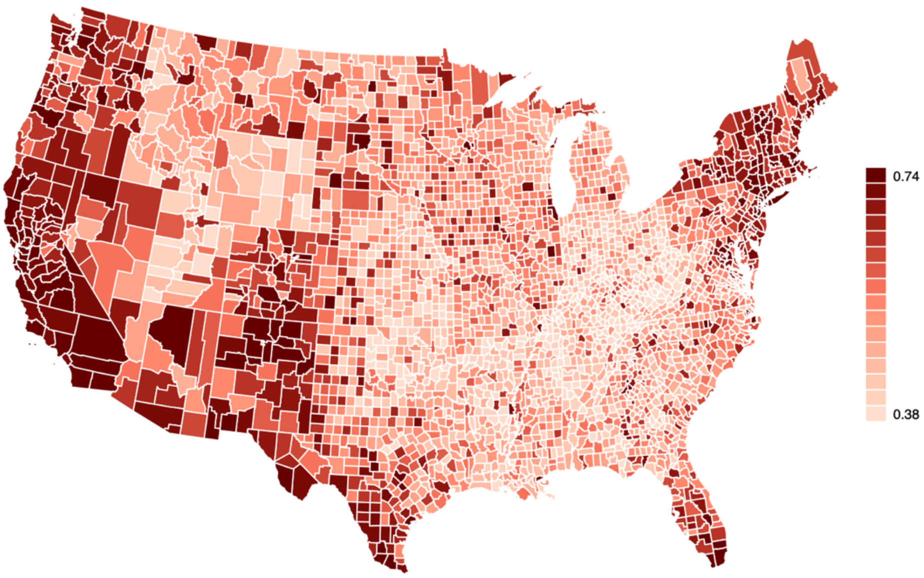
CAP	A dummy variable that equals one if the state where a firm is headquartered has passed Climate Action Plans (*Data source: U.S. CAP*).
EPA	The geographical distance between a firm's headquarter to an Environmental Protection Agency regional office (*Data source: U.S. EPA*).
Green Patent	A dummy variable that equals one if a firm applies for green patents (*Data source: Kogan et al. (2017)*).
Green Patent #	The natural logarithm of one plus the number of green patents applied by a firm (*Data source: Kogan et al. (2017)*).
Reduction Target	A dummy variable that equals one if a firm sets emission reduction target (*Data source: Refinitiv*).
Reduction Target %	The percentage of emission reduction target set by a firm (*Data source: Refinitiv*).
Renewable Energy	A dummy variable that equals one if a firm uses purchased or produced renewable energy (*Data source: Refinitiv*).
Renewable Energy %	The percentage of purchased and produced renewable energy in gigajoules to total energy use in millions (*Data source: Refinitiv*).
Social Capital LP	The social capital index of Lin and Pursiainen (2022) (*Data source: Lin and Pursiainen (2022)*).
Social Capital RGF	The social capital index of Rupasingha et al. (2006) (*Data source: Rupasingha et al. (2006)*).
Frontier Experience	The time that the county is part of the frontier of Bazzi et al. (2020) (*Data source: Bazzi et al. (2020)*).
Infrequent Names	The historical share of infrequent names of Bazzi et al. (2020) (*Data source: Bazzi et al. (2020)*).
Democratic Voting	The ratio of the percentage of a county's population voting for the Democratic Party to that voting for the Republican Party in the presidential election (*Data source: MIT Election Lab*).
Distance to Coast	The distance from a county to the coast (*Data source: Bazzi et al. (2020)*).
College Degree	The percentage of population (age 25 and above) who earn a college degree or higher (*Data source: U.S. Census Bureau*).
B2C Industry	A dummy variable that equals one if a firm is in a B2C sector as in Lev et al. (2010). SIC codes: 0000–0999, 2000–2399, 2500–2599, 2700–2799, 2830–2869, 3000–3219, 3420–3429, 3523, 3600–3669, 3700–3719, 3751, 3850–3879, 3880–3999, 4813, 4830–4899, 5000–5079, 5090–5099, 5130–5159, 5220–5999, 7000–7299, and 7400–9999 (*Data source: CRSP/Compustat Merged*).
Analyst Coverage	The natural logarithm of the number of analysts following a firm (*Data source: I/B/E/S*).
Firm Size	The natural logarithm of total assets, adjusted for the annual average consumer price index in 2014 (*Data source: CRSP/Compustat Merged*).
Negative Tone	The relative frequency with which climate change-related bigrams are mentioned together with negative tone words in a sentence in the earnings call transcripts (*Data source: Sautner et al. (2023)*).
Positive Tone	The relative frequency with which climate change-related bigrams are mentioned together with positive tone words in a sentence in the earnings call transcripts (*Data source: Sautner et al. (2023)*).
Pro-climate Lobbying	The ratio of pro-climate lobbying expenses to total assets (*Data source: Leippold et al. (2024)*).

Anti-climate Lobbying	The ratio of anti-climate lobbying expenses to total assets (*Data source: Leippold et al. (2024)*).

Figure 1 Yale climate opinion maps

This figure shows the spatial distribution of climate change concerns over years. Panel A reports the percentage of population who worried about climate change in 2014. Darker reds indicate higher levels of concern about climate change. Panel B reports the percentage of population who worried about climate change in 2021.

A. Percentage of population who worried about climate change in 2014



B. Percentage of population who worried about climate change in 2021

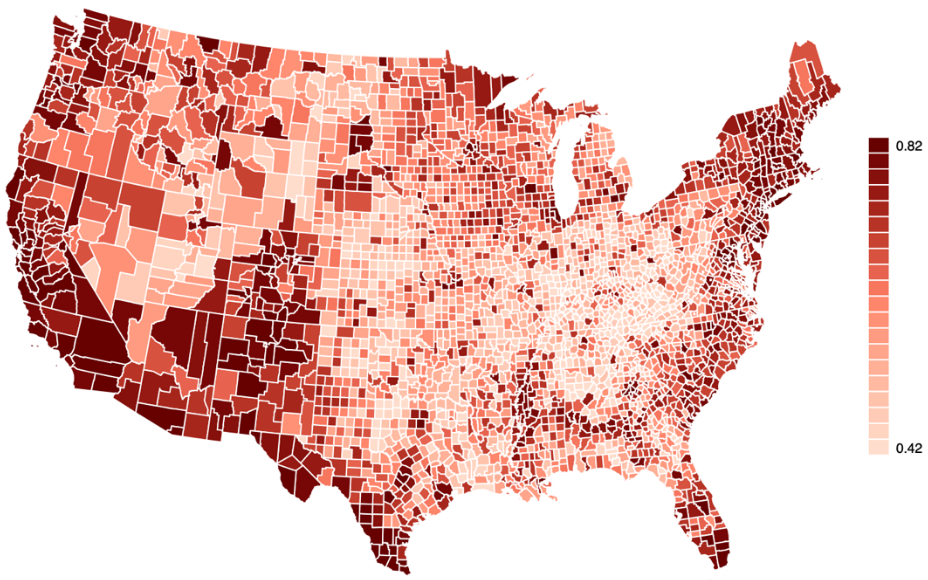


Figure 2 Relationship between climate change concerns and corporate carbon emissions

This figure shows the estimated coefficients of *Scope 1* on *Worried* quintile dummies from the below regression:

$$Scope\ 1_{i,c,t} = \alpha + \beta Worried\ Quintiles_{c,t-1} + \gamma X_{i,c,t-1} + \theta + \epsilon_{i,c,t-1}$$

where i, c, t and j denote firm, county, year, and industry, respectively. *Scope 1* is measured by the natural logarithm of one plus the ratio of Scope 1 carbon emissions to revenue. *Worried* is measured by the share of population who are somewhat or very worried about global warming. X is a vector of control variables as discussed in Section 2.5. θ denotes industry-year joint fixed effects. The ranges indicate 95% confidence intervals, based on standard errors clustered by county.

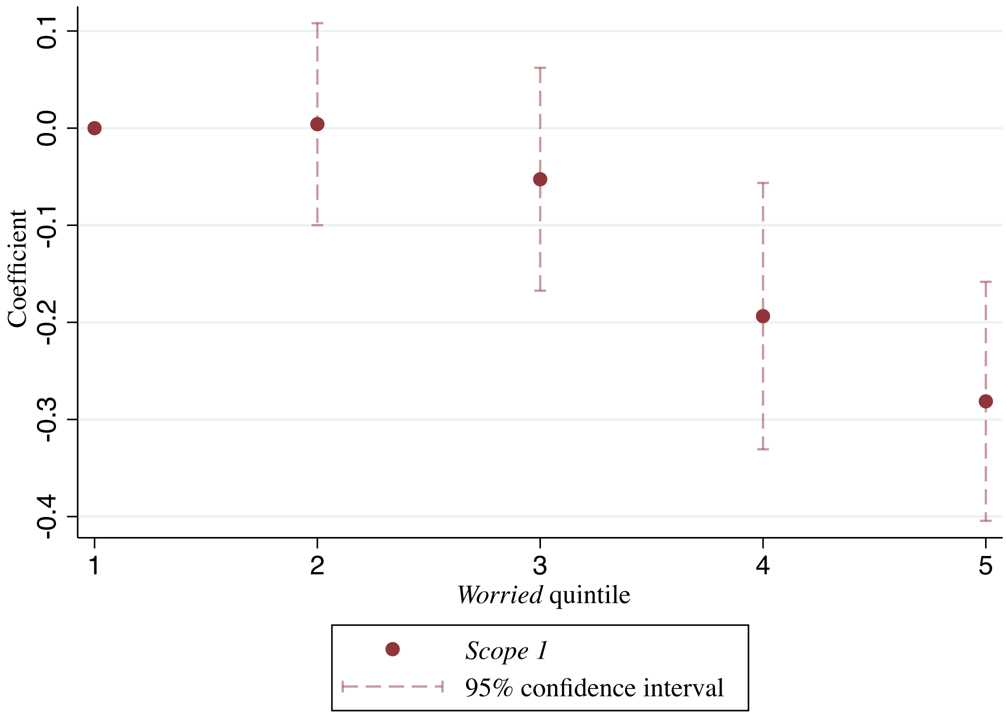


Figure 3 Baseline regression by year

This figure shows the estimated coefficients of *Scope 1* on *Worried* from the below regression by year:

$$Scope\ 1_{i,c,t} = \alpha + \beta Worried\ Quintiles_{c,t-1} + \gamma X_{i,c,t-1} + \theta + \epsilon_{i,c,t-1}$$

where i, c, t and j denote firm, county, year, and industry, respectively. *Scope 1* is measured by the natural logarithm of one plus the ratio of scope 1 carbon emissions to revenue. *Worried* is measured by the share of population who are somewhat or very worried about global warming. X is a vector of control variables as discussed in Section 2.5. θ denotes industry-year joint fixed effects. The ranges indicate 95% confidence intervals, based on standard errors clustered by county.

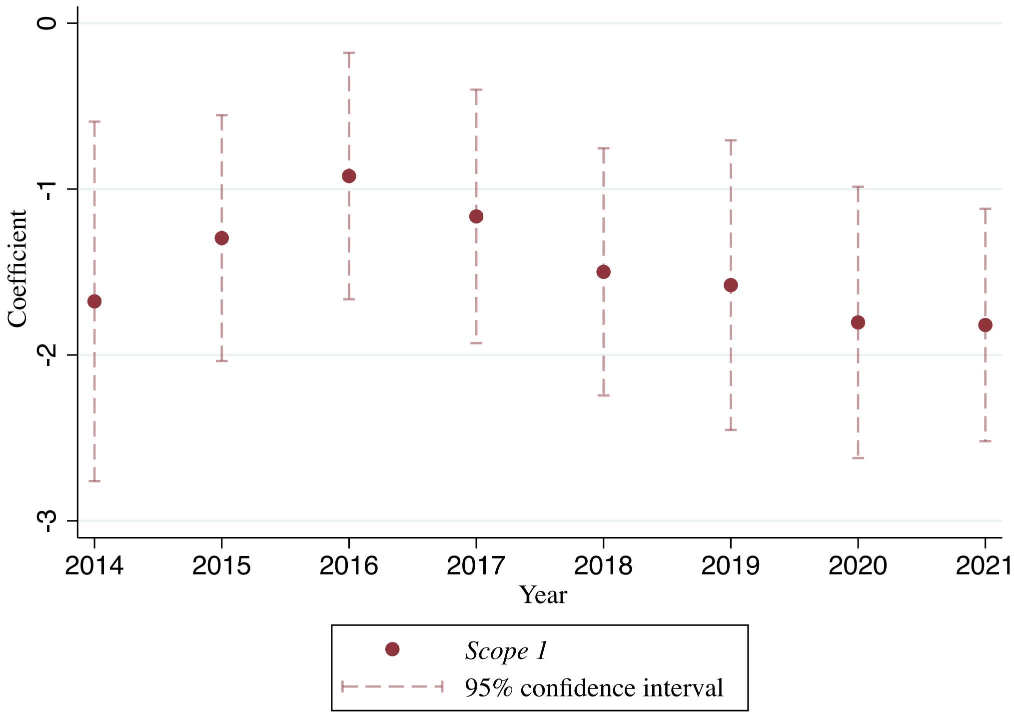


Table 1 Summary statistics

This table presents the descriptive statistics for the main variables used in our analyses. *Scope 1* is measured by the natural logarithm of one plus the ratio of Scope 1 carbon emissions to revenue. *Worried* is measured by the share of population who are somewhat or very worried about global warming. All variables are defined in Appendix A. All continuous variables are winsorized at the 1% level.

	Mean	Std	P25	P50	P75	N
Corporate Carbon Emissions						
Scope 1	2.983	1.467	2.142	2.768	3.415	14,480
Δ Scope 1	-0.050	0.314	-0.066	-0.022	0.008	12,665
Scope 1 Absolute	9.661	2.771	7.898	9.710	11.368	14,480
Scope 1/Assets	2.679	1.565	1.495	2.588	3.559	14,480
Scope 1/Equity	2.596	1.881	1.052	2.338	3.693	14,479
Scope 2	3.027	0.906	2.418	2.981	3.639	14,480
Scope3 Upstream	4.684	0.811	4.032	4.606	5.280	14,480
Scope3 Downstream	4.241	2.492	2.356	4.387	6.036	11,776
Climate Change Concerns						
Worried	0.646	0.080	0.592	0.648	0.704	14,480
Happening	0.735	0.066	0.690	0.740	0.786	14,480
Citizens	0.679	0.049	0.646	0.676	0.715	8,297
Corporations	0.730	0.049	0.694	0.727	0.769	8,297
Control Variables						
Ln (Age)	2.645	1.113	1.792	2.944	3.434	14,480
Ln (Total Assets)	7.308	1.831	6.008	7.283	8.531	14,480
CapEx	0.039	0.043	0.012	0.025	0.049	14,480
Book Leverage	0.291	0.236	0.098	0.267	0.423	14,480
RoA	-0.035	0.217	-0.057	0.028	0.073	14,480
R&D Intensity	0.774	3.636	0.000	0.009	0.124	14,480
Cash Flow	0.038	0.178	0.019	0.078	0.127	14,480
Instrumental Variables						
Anomaly	1.264	0.611	0.908	1.350	1.734	14,422
Contagion	1.046	0.444	0.831	1.162	1.360	14,480
Other Variables						
Green Patent	0.138	0.345	0.000	0.000	0.000	14,480
Green Patent #	0.294	0.876	0.000	0.000	0.000	14,480
Reduction Target	0.229	0.421	0.000	0.000	0.000	12,442
Reduction Target %	0.398	0.294	0.180	0.300	0.500	2,159
Renewable Energy	0.289	0.453	0.000	0.000	1.000	12,450
Renewable Energy %	0.200	0.240	0.026	0.099	0.283	1,504
Negative Tone	-0.170	0.352	-0.177	0.000	0.000	13,262
Positive Tone	0.454	0.904	0.000	0.140	0.443	13,262
Pro-climate Lobbying	2.280	11.055	0.000	0.000	0.000	3,235
Anti-climate Lobbying	1.385	6.093	0.000	0.000	0.000	3,235

Table 2 Climate change concerns and corporate carbon emissions

This table presents the regression results of the relationship between climate change concerns and corporate carbon emissions. Panel A reports the baseline results. *Scope 1* is measured by the natural logarithm of one plus the ratio of Scope 1 carbon emissions to revenue. *Worried* is measured by the share of population who are somewhat or very worried about global warming. Panel B reports the regression results using alternative measures of corporate carbon emissions. *Δ Scope 1* is measured by the one-year change in the natural logarithm of one plus the ratio of Scope 1 carbon emissions to revenue. *Scope 1 Absolute* is measured by the natural logarithm of one plus the Scope 1 carbon emissions. *Scope 1/Assets* is measured by the natural logarithm of one plus the ratio of Scope 1 carbon emissions to total assets. *Scope 1/Equity* is measured by the natural logarithm of one plus the ratio of Scope 1 carbon emissions to equity. Panel C reports the regression results using alternative measures of climate change concerns. *Happening* is measured by the ratio of population who think that global warming is happening. *Citizens* is measured by the ratio of population who think citizens themselves should be doing more or much more to address global warming. *Corporations* is measured by the ratio of population who think corporations and industry should be doing more or much more to address global warming. Panel D reports the baseline regression results with additional controls. All variables are defined in Appendix A. All continuous variables are winsorized at the 1% level. Standard errors shown in parentheses are clustered by county. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Baseline regression

	(1)	(2)	(3)	(4)
	Scope 1	*Scope 1*	*Scope 1*	*Scope 1*
Worried	-4.466***	-3.135***	-1.489***	-1.473***
	(0.541)	(0.508)	(0.336)	(0.337)
Ln (Age)		0.112***	0.004	0.002
		(0.027)	(0.014)	(0.014)
Ln (Total Assets)		0.009	-0.051**	-0.051**
		(0.035)	(0.023)	(0.023)
CapEx		11.569***	4.406***	4.818***
		(0.827)	(0.500)	(0.549)
Book Leverage		0.300**	0.210***	0.205***
		(0.120)	(0.074)	(0.077)
RoA		-0.203	-0.010	0.053
		(0.228)	(0.080)	(0.077)
R&D Intensity		-0.003	-0.020***	-0.019***
		(0.004)	(0.004)	(0.004)
Cash Flow		-0.372*	0.300***	0.232**
		(0.220)	(0.108)	(0.105)
Industry FE	No	No	Yes	No
Year FE	No	No	Yes	No
Industry×Year FE	No	No	No	Yes
N	14,480	14,480	14,480	14,480
R^2	0.060	0.179	0.620	0.628

Panel B: Alternative measures of corporate carbon emissions

	(1)	(2)	(3)	(4)
	Δ Scope 1	*Scope 1 Absolute*	*Scope 1/Assets*	*Scope 1/Equity*
Worried	-0.069**	-1.974***	-1.560***	-2.818***
	(0.034)	(0.427)	(0.352)	(0.514)
Controls	Yes	Yes	Yes	Yes
Industry×Year FE	Yes	Yes	Yes	Yes
N	12,665	14,480	14,480	14,479
R^2	0.081	0.801	0.608	0.594

Panel C: Alternative measures of climate change concerns

	(1)	(2)	(3)
	Scope 1	*Scope 1*	*Scope 1*
Happening	-1.542***		
	(0.416)		
Citizens		-2.216***	
		(0.532)	
Corporations			-2.084***
			(0.552)
Controls	Yes	Yes	Yes
Industry×Year FE	Yes	Yes	Yes
N	14,480	8,297	8,297
R^2	0.627	0.609	0.608

Panel D: Additional controls

	(1)	(2)	(3)
	Scope 1	*Scope 1*	*Scope 1*
Worried	-1.370***	-1.481***	-1.389***
	(0.469)	(0.339)	(0.338)
Female	8.093***		
	(2.734)		
Aging	-1.002		
	(0.899)		
Caucasian	0.243		
	(0.208)		
CAP		-0.010	
		(0.039)	
EPA			0.001
			(0.012)
Controls	Yes	Yes	Yes
Industry×Year FE	Yes	Yes	Yes
N	14,238	14,480	14,001
R^2	0.629	0.628	0.625

Table 3 2SLS estimation

This table presents the 2SLS regression results using local temperature anomalies and social contagion of climate change concerns as instruments separately. Columns (1) and (3) report the first stage results. *Worried* is measured by the share of population who are somewhat or very worried about global warming. Columns (2) and (4) report the second stage results. *Scope 1* is measured by the natural logarithm of one plus the ratio of Scope 1 carbon emissions to revenue. *Anomaly* is measured by the deviation of the annual average temperature in a given year from the historical annual average temperature from 1895 to the previous year. *Contagion* is measured by the weighted sum of the annual temperature anomalies of socially connected counties. $Worried^{Anomaly}$ and $Worried^{Contagion}$ are the fitted values estimated from their respective first stage regression. All variables are defined in Appendix A. All continuous variables are winsorized at the 1% level. Standard errors shown in parentheses are clustered by county. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1) *Worried*	(2) *Scope 1*	(3) *Worried*	(4) *Scope 1*
Anomaly	0.038***			
	(0.008)			
$Worried^{Anomaly}$		-3.386***		
		(0.860)		
Contagion			0.078***	
			(0.015)	
$Worried^{Contagion}$				-3.405***
				(0.825)
Controls	Yes	Yes	Yes	Yes
Industry×Year FE	Yes	Yes	Yes	Yes
N	14,422	14,422	14,480	14,480
R^2	0.451	0.046	0.442	0.045
F-statistic	22.12		26.39	
(p-value)	(0.000)		(0.000)	

Table 4 Substitution across emission scopes

This table presents the regression results of the relationship between climate change concerns and other carbon emission scopes. *Scope 2* is measured by the natural logarithm of one plus the ratio of Scope 2 carbon emissions to revenue. *Scope 3 Upstream* (*Downstream*) is measured by the natural logarithm of one plus the ratio of Scope 3 upstream (downstream) carbon emissions to revenue. *Worried* is measured by the share of population who are somewhat or very worried about global warming. All variables are defined in Appendix A. All continuous variables are winsorized at the 1% level. Standard errors shown in parentheses are clustered by county. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
	Scope 2	*Scope3 Upstream*	*Scope3 Downstream*
Worried	-1.270***	-0.901***	-1.392**
	(0.228)	(0.204)	(0.588)
Controls	Yes	Yes	Yes
Industry×Year FE	Yes	Yes	Yes
N	14,480	14,480	11,776
R^2	0.513	0.680	0.567

Table 5 Carbon abatement initiatives

This table presents the regression results of the relationship between climate change concerns and carbon abatement initiatives. *Green Patent* is a dummy variable that equals one if a firm applies for green patents. *Green Patent #* is measured by the natural logarithm of one plus the number of green patents applied by a firm. *Reduction Target* is a dummy variable that equals one if a firm sets emission reduction target. *Reduction Target %* is measured by percentage of emission reduction target set by a firm. *Renewable Energy* is a dummy variable that equals one if a firm uses purchased or produced renewable energy. *Renewable Energy %* is measured by the percentage of purchased and produced renewable energy in gigajoules to total energy use in millions. *Worried* is measured by the share of population who are somewhat or very worried about global warming. All variables are defined in Appendix A. All continuous variables are winsorized at the 1% level. Standard errors shown in parentheses are clustered by county. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1) *Green Patent*	(2) *Green Patent #*	(3) *Reduction Target*	(4) *Reduction Target %*	(5) *Renewable Energy*	(6) *Renewable Energy %*
Worried	0.338**	0.877**	0.256***	0.427***	0.216**	0.371**
	(0.155)	(0.437)	(0.083)	(0.132)	(0.096)	(0.146)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	14,480	14,480	12,442	2,159	12,450	1,504
R^2	0.265	0.282	0.408	0.276	0.395	0.352

Table 6 Social capital and collectivism

This table presents the subsample regression results by social capital and collectivism. *Scope 1* is measured by the natural logarithm of one plus the ratio of Scope 1 carbon emissions to revenue. *Worried* is measured by the share of population who are somewhat or very worried about global warming. *Social Capital LP* is measured by the social capital index of Lin and Pursiainen (2022). *Social Capital RGF* is measured by the social capital index of Rupasingha et al. (2006). *Frontier Experience* is measured by the time that the county is part of the frontier of Bazzi et al. (2020). *Infrequent Names* is measured by the historical share of infrequent names of Bazzi et al. (2020). Firms in counties with *Social Capital LP*, *Social Capital RGF*, *Frontier Experience*, or *Infrequent Names* above sample medians each year are classified as High, otherwise as Low. All variables are defined in Appendix A. All continuous variables are winsorized at the 1% level. Standard errors shown in parentheses are clustered by county. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	Social Capital LP		*Social Capital RGF*		*Frontier Experience*		*Infrequent Names*	
	High	Low	High	Low	High	Low	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Scope 1	*Scope 1*	*Scope 1*	*Scope 1*	*Scope 1*	*Scope 1*	*Scope 1*	*Scope 1*
Worried	-1.815***	-0.642	-2.134***	-0.541	-0.861	-1.547***	-1.029	-1.794***
	(0.333)	(0.584)	(0.373)	(0.497)	(0.578)	(0.362)	(0.626)	(0.443)
Coeff. Equality	-1.173***		-1.593***		0.686***		0.765***	
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	7,164	7,204	7,045	7,374	6,918	7,483	7,072	7,324
R^2	0.629	0.649	0.646	0.635	0.661	0.601	0.680	0.571

Table 7 Political orientation, coastal proximity, and education level

This table presents the subsample regression results by political orientation, coastal proximity, and education level. *Scope 1* is measured by the natural logarithm of one plus the ratio of Scope 1 carbon emissions to revenue. *Worried* is measured by the share of population who are somewhat or very worried about global warming. *Democratic Voting* is measured by the ratio of the percentage of a county's population voting for the Democratic Party to that voting for the Republican Party in the presidential election. *Distance to Coast* is measured by the distance from a county to the coast. *College Degree* is measured by the percentage of population (age 25 and above) who earn a college degree or higher. Firms in counties with *Democratic Voting*, *Distance to Coast*, or *College Degree* above sample medians each year are classified as High, otherwise as Low. All variables are defined in Appendix A. All continuous variables are winsorized at the 1% level. Standard errors shown in parentheses are clustered by county. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	Democratic Voting		*Distance to Coast*		*College Degree*	
	High	Low	High	Low	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)
	Scope 1	*Scope 1*	*Scope 1*	*Scope 1*	*Scope 1*	*Scope 1*
Worried	-1.307**	-0.649	0.100	-1.701***	-1.578***	-0.792
	(0.639)	(0.605)	(0.475)	(0.616)	(0.420)	(0.490)
Coeff. Equality	-0.658***		1.801***		-0.786***	
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	7,128	7,284	7,041	7,330	7,033	7,126
R^2	0.623	0.640	0.640	0.621	0.616	0.647

Table 8 Corporate exposure to public attention

This table presents the subsample regression results by corporate exposure to public attention. *Scope 1* is measured by the natural logarithm of one plus the ratio of Scope 1 carbon emissions to revenue. *Worried* is measured by the share of population who are somewhat or very worried about global warming. *B2C Industry* is a dummy variable that equals one if a firm is in a B2C sector as in Lev et al. (2010). Firms in the *B2C Industry* are classified as Yes, otherwise as No. *Analyst Coverage* is measured by the natural logarithm of the number of analysts following a firm. *Firm Size* is measured by the natural logarithm of total assets. Firms with *Analyst Coverage* or *Firm Size* above sample medians each year are classified as High, otherwise as Low. All variables are defined in Appendix A. All continuous variables are winsorized at the 1% level. Standard errors shown in parentheses are clustered by county. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	B2C Industry		*Analyst Coverage*		*Firm Size*	
	Yes	No	High	Low	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)
	Scope 1	*Scope 1*	*Scope 1*	*Scope 1*	*Scope 1*	*Scope 1*
Worried	-1.804***	-0.535	-2.903***	-0.229	-2.050***	-0.473
	(0.360)	(0.491)	(0.507)	(0.428)	(0.451)	(0.374)
Coeff. Equality	-1.269***		-2.674***		-1.577***	
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	6,808	7,671	5,740	6,297	7,215	7,193
R^2	0.368	0.735	0.695	0.575	0.692	0.598

Table 9 Climate change sentiment

This table presents the regression results of the relationship between climate change concerns and climate change sentiment. *Negative Tone* is measured by the relative frequency with which climate change-related bigrams are mentioned together with negative tone words in a sentence in the earnings call transcripts. *Positive Tone* is measured by the relative frequency with which climate change-related bigrams are mentioned together with positive tone words in a sentence in the earnings call transcripts. *Worried* is measured by the share of population who are somewhat or very worried about global warming. All variables are defined in Appendix A. All continuous variables are winsorized at the 1% level. Standard errors shown in parentheses are clustered by county. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1) *Negative Tone*	(2) *Positive Tone*
Worried	0.196***	-0.428**
	(0.076)	(0.216)
Controls	Yes	Yes
Industry×Year FE	Yes	Yes
N	13,262	13,262
R^2	0.167	0.215

Table 10 Corporate climate lobbying

This table presents the regression results of the relationship between climate change concerns and corporate climate lobbying. *Pro-climate Lobbying* is measured by the ratio of pro-climate lobbying expenses to total assets. *Anti-climate Lobbying* is measured by the ratio of anti-climate lobbying expenses to total assets. *Worried* is measured by the share of population who are somewhat or very worried about global warming. All variables are defined in Appendix A. All continuous variables are winsorized at the 1% level. Standard errors shown in parentheses are clustered by county. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
	Pro-climate Lobbying	*Anti-climate Lobbying*
Worried	9.366***	-7.659***
	(3.512)	(2.203)
Controls	Yes	Yes
Industry×Year FE	Yes	Yes
N	3,235	3,235
R^2	0.191	0.156

Table 11 Persistent effect

This table presents the regression results of the relationship between lagged climate change concerns and corporate carbon emissions. *Scope 1* is measured by the natural logarithm of one plus the ratio of Scope 1 carbon emissions to revenue. *Worried* is measured by the share of population who are somewhat or very worried about global warming. All variables are defined in Appendix A. All continuous variables are winsorized at the 1% level. Standard errors shown in parentheses are clustered by county. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
	Scope 1	*Scope 1*	*Scope 1*	*Scope 1*
$Worried_{t-2}$	-1.568***			
	(0.371)			
$Worried_{t-3}$		-1.632***		
		(0.404)		
$Worried_{t-4}$			-1.707***	
			(0.420)	
$Worried_{t-5}$				-1.837***
				(0.442)
Controls	Yes	Yes	Yes	Yes
Industry×Year FE	Yes	Yes	Yes	Yes
N	11,430	8,992	6,856	4,992
R^2	0.624	0.623	0.626	0.627