Climate Regulatory Risk and Capital Structure:

Evidence from State Climate Adaptation Plans

Tunde Kovacs, Saira Latif, Xiaojing Yuan, Chi Zhang[*]

This version: March 2021

Abstract

In the emerging literature on climate risk and business, climate regulatory risk has received far less attention than its importance to business practitioners. Taking the staggered implementation of state climate adaptation plans (SCAPs) as a quasi-natural experiment, we examine how state initiatives addressing climate challenges affect corporate capital structure decisions. Using difference-in-differences analyses, we find that firms headquartered in states that finalize SCAPs increase their net financial leverage significantly more in the post-adaptation period than firms in the neighboring states without SCAPs. The leverage increase is larger for firms that face greater climate risks, do not receive government subsidies, are financially constrained, and are exposed to high litigation risks. We attribute this change to a reduction in firms' climate regulatory risk allowing them to adopt riskier capital structure.

Keywords: climate adaptation, state climate action, local policy, subnational regulation, environmental regulation, climate risks, leverage

[*] University of Massachusetts, Lowell

Climate Regulatory Risk and Capital Structure:

Evidence from State Climate Adaptation Plans

"*Climate risk is investment risk*", Larry Fink, CEO, BlackRock Inc[1].

1. Introduction

In recent years, climate risk has been gathering more and more attention from investors. In an open letter, the CEO of the world's largest asset management firm, Blackrock, reminded corporate CEOs that investors demand corporations to disclose their response strategy to challenges presented by a warming planet, and major rating agencies such as Standard & Poor's have started including climate risk in their ratings criteria.[2] In their survey, Krueger, Sautner, and Starks (2020) find that institutional investors rate climate risk as important or fairly important to their portfolio decisions. Academic research on this topic, however, is still at a nascent stage (Hong, Karolyi, and Scheinkman, 2020).

Climate risk for corporations can manifest as a physical assets risk (for example damage due to extreme weather or rising sea levels), as a regulatory risk (for example, the impact of regulatory changes related to emissions or building standards) and as a technological risk (for example, green innovations related to alternative energy rendering old technology obsolete or inefficient). While the literature in each of these areas is growing, there are very few studies addressing the most imminent of the afore-mentioned risks: the regulatory risk (Krueger, Sautner, and Starks, 2020). This gap in the literature is primarily due to the difficulty in finding climate actions that would provide a suitable natural experimental setting. Existing studies on the effect

[1] https://www.blackrock.com/us/individual/larry-fink-ceo-letter
[2] https://www.spglobal.com/en/research-insights/articles/environmental-and-climate-risks-factor-into-ratings

of climate \risk on capital structure and financing (for instance, Ginglinger and Moreau, 2019; Delis, de Greiff, and Ongena, 2019; Seltzer, Starks, Zhu, 2020; Nguyen and Phan, 2020) use a single trans-national event, such as the Paris climate accord or the Kyoto protocol, arguably incomplete contracts with little enforcement possibility, as natural experiments in their empirical setup.

In this study, we examine the effect of climate-related regulatory risk on corporate leverage by using state-level climate adaptation plans (SCAPs). SCAPs represent a complex set of state level climate-related strategies with actionable goals. We argue that the adoption of SCAP in a state represents resolution of climate regulation uncertainty. We postulate that this reduction in regulatory risk relaxes overall risk constraint on the firm allowing it to adopt riskier financial leverage.[3]

Climate is a global phenomenon, and as such, individual states might not have a discernible impact on its trajectory. However, they play a pivotal role in preparing their residents to adapt and respond to the effects of climate change. A recent example of such subnational climate activism is when some states responded to the Trump administration's withdrawal from the Paris Climate Agreement in 2017[4] by forming an alliance to uphold the goals of the agreement at their state level.[5] Local climate action plans are not trivial in terms of either their scope or cost. For instance, New York City plans to spend $19.5 billion to make New York more resilient to climate change issues affecting its 8.2 million residents.

The U.S. setting for studying subnational climate action plans is particularly interesting because of its geographical dispersion and resulting heterogeneity of climate challenges faced by

[3] The mechanism for this effect is similar to, but in reverse direction of, the crowding out effect of financial leverage in response to the adoption of state-level labor protection laws documented by Serfling (2016).
[4] https://www.nytimes.com/2017/06/01/climate/trump-paris-climate-agreement.html?module=inline
[5] To this date, 24 state governors have joined the United States Climate Alliance. https://www.usclimatealliance.org/

different states. In any given year in the United States, some states face drought-related issues, while others grapple with the consequences of hurricanes and floods. This divergence of challenges requires a local plan of action alongside a national strategy. Partly for this reason and partly because of insufficient support at the federal level, different U.S. state governments have passed their own State Climate Adaptation Plans (SCAPs) that vary in scope, goals, and strategies. However, all of them share the common goal of protecting the environment and putting strategies in place to better handle climate-related adverse events. They contain a set of climate adaptation goals, implementation strategies, and a broad timeline to achieve these goals. We exploit both the staggered adoption and heterogeneity of these plans in formulating our tests.

To date, 17 states have finalized these SCAPs.[6] The enforcement of the state plans is through a mixture of legislative actions, executive orders by the governors, and soft appeal to all the stakeholders in the area. Ray and Grannis (2015) provide a detailed description and analysis of progress made towards the plan goals of each state. SCAP goals can be broadly divided into three categories: planning and capacity building, law and policy, and post-implementation monitoring (Ray and Grannis, 2015). The first category includes awareness campaigns and collaborative dialogues with local businesses, and it has the potential to influence voluntary corporate behavior toward climate issues. The second category includes binding guidance, code changes, new design standards, and zoning changes. The resulting new regulations and their post-implementation monitoring have a direct effect on the cost of doing business in these states. In essence, SCAPs can have a wide-ranging direct and indirect effect on corporate policy and action.

---

[6] In our study we use 15 out of these 17 plans. Rhode Island adopted its plan on July 2, 2018 and North Carolina on June 2, 2020, these dates fall outside of our sample period.

In this study, we use the staggered adoption of SCAPs as a quasi-natural experiment to examine the effect of climate regulatory risk on corporate financial leverage. Ex-ante, this relation is ambiguous. On the one hand, climate adaptation plans can induce firms to decrease their net financial leverage if they put a spotlight on previously ignored corporate climate risks thereby increasing the perceived overall business risk. They can also compel firms to conserve borrowing capacity to meet future enforcement costs (for example, fines and litigation costs). On the other hand, state climate adaptation plans may lead to increased net leverage due to multiple, not mutually exclusive factors. First, the final adaptation of the plans resolves uncertainty about future climate regulation, reducing a major component of a firm's climate risk that is of imminent concern to institutions (Kreuger, Sautner, and Starks, 2020.) This reduction in risk allows firms to increase leverage. The government's commitment to mitigate the effects of climate hazards *ex-post* can also convince market participants to view it as a 'public safety net' providing another channel for relaxing the constraint on financial leverage. Second, in the short run, additional resources are demanded to meet new compliance costs following the state climate adaptation plans. Local firms, especially those without much internal financial slack, might reach out to their lenders to raise money. Third, through encouraging environment-friendly and sustainable business model changes, the long run climate initiatives can increase the value of firms' assets in place and growth options (Porter and van der Linde, 1995a and 1995b; Konar and Cohen, 2001; Chen 2008), leading to higher debt capacity.

Using a sample of U.S. public firms for the period of 1998 to 2016 and a difference-in-differences (DID) framework, we find supportive evidence of the prediction that SCAPs lead to higher leverage. In particular, we show that firms headquartered in plan adoption states (treatment firms) increase their net market leverage by about 3.3% more on average after SCAPs are finalized, relative to firms in states without such plans (control firms).[7,8] We also see a significantly higher increase in net book leverage. A dynamic year-by-year version of our main DID framework shows that the significant increase in net market leverage of SCAP-state firms is immediate and permanent without any reversal in the years following the plan adoption.

We perform a host of robustness tests to check the validity of our results. It is possible that our results are driven by random chance without any true underlying relationship. To address this concern, we try alternative model specifications including a firm-level matched sample analysis, different pre and post time windows, alternative regression clustering techniques, and placebo tests on both SCAP implementation dates and the treatment and control sample composition. Our results are validated through all these robustness checks, providing additional empirical support for SCAPs' net leverage increasing effect on corporate capital structure.

To provide evidence that SCAPs increase leverage by reducing regulatory risk, we exploit the heterogeneity in plan specificity across states. Specifically, we use the number of stated plan goals as a proxy for the intensity of the plan. We hypothesize that the more specific the plan, the larger the reduction in climate regulation uncertainty and the larger its effect on firm leverage. Our results support this hypothesis both when using the overall plan specificity and also when using the three main subcategories of plan goals: planning and activism, law and regulation, and monitoring. The results are consistent with the argument that SCAPs increase firm leverage by reducing regulatory uncertainty and providing state commitment.

[7] To isolate any confounding effects, our control group includes firms located in neighboring states that face potentially similar climate challenges and economic conditions due to their geographical proximity.

[8] Many existing studies on capital structure decisions have used firms' headquarter states in their analyses because executives make major financing and investments through their headquarter operations. See, for example, Heider and Ljungqvist (2015), Klasa, Ortiz-Molina, Serfling, and Srinivasan (2018), Chava, Danis, and Hsu (2019), Guernsey, John, and Litov (2019), among many others. In Appendix A3.7, we also consider the diversity of a firm's divisional locations.

Next, we explore the interaction of climate regulatory risk and climate physical risk on corporate leverage. We find that SCAPs mitigate climate risk and enable additional financial leverage more for firms located in states facing greater physical climate challenges. After SCAP finalization, leverage is significantly higher for firms located in treatment states with poor air quality, in states with high industrial carbon emissions, and in states that suffer more economic damages from climate-related natural disasters.

Climate risk in one of many types of risks a firm faces and its strategy to manage it may depend on the severity of other risks it faces. We, therefore, also analyze the treatment effect of SCAPs in the context of a firm's financial flexibility: being financially constrained, being more prone to litigation risk, and receiving government subsidies. More financially constrained firms and firms with higher litigation risk exhibit greater leverage increase in the post SCAP period. The results support the argument that both types of firms experience a greater reduction in leverage constraints as a consequence of resolution of climate-related regulatory risk. The leverage increase is not present among firms that receive government subsidies indicating that government subsidies may work as a substitute for debt financing.

Further analysis reveals that firms located in states with finalized SCAPs increase their net leverage by decreasing cash holdings and net equity issuance and by increasing net debt issuance compared to their counterparts located in adjacent states. Moreover, we observe an increase in long-term market leverage and an increase in debt maturity, indicating that the effect goes above and beyond the need for financing short-run compliance costs.

Our paper provides several contributions. First, we contribute to the literature exploring the relationship between climate-related regulatory risk and corporate financial policies. Much of this literature concentrates on a single trans-national regulatory event. Seltzer, Starks, and Zhu

(2020) provide evidence that following the Paris Climate Agreement, creditors charge higher bond spreads and incorporate climate risk in their assessment of credit ratings, while Delis, de Greiff, and Ongena (2019) find that banks price carbon emission-related risk. Ginglinger and Quentin (2019) provide evidence that French firms facing higher climate risks reduce leverage in the period after the Paris Climate Agreement. Nguyen and Phan (2018) have similar findings on carbon emissions by Australian firms following the Kyoto Protocol. In contrast to these studies, we exploit state-level climate adaptation plans as regulatory shocks. SCAPs have the advantage of staggered adoption dates that improves the ability of our empirical setup to attribute effects to the regulatory change, are arguably more enforceable than trans-national voluntary agreements, and display a heterogeneity in their goal specificity that allows for cross-sectional analysis. We find that long-term financial leverage is positively related to state-level climate-change combating policies, implying that while trans-national agreements draw attention to climate-related risks and increase forward looking regulatory risk due to lack of implementation guidance, adopting detailed local climate regulation and preparedness plans mitigates climate-related regulatory risk for firms.

Second, we contribute to recent finance research examining the impact of various aspects of climate and environmental risks on corporate financial policies. Using KLD data on corporate social responsibility, Chava (2014) documents that equity- and debtholders demand a higher rate of return from firms with more environmental externalities. Baker, Bergstresser, Serafeim, and Wurgler (2018) find that green municipal bonds have better credit ratings and are priced at a premium. Flammer (2020) finds that corporate green bond issues are positively associated with market reactions, long-run performance, and environmental performance. Bernstein, Gustafson, and Lewis (2019) show that sea-level rise has a negative effect on the value of exposed properties, and sophisticated buyers and communities concerned about global warming contribute to the negative effect. Kim, Wan, Wang, and Yang (2019) find that local institutional investors can influence corporate environmental policies and .

Third, this study contributes to the vast literature examining the effect of state-level regulations on corporate financing policy by analyzing a previously unresearched regulation in this context: the effect of subnational (state-level) climate adaptation plans. Heider and Ljungqvist (2015) find that state policies on corporate income taxes have a significant impact on firms' financial leverage. Klasa, Ortiz-Molina, Serfling, and Srinivasan (2018) show that trade secrets protection is associated with higher leverage in firms located in states that have adopted the Inevitable Disclosure Doctrine. Chava, Danis, and Hsu (2019) study right-to-work (RTW) laws in the United States and find that RTW laws have a significant impact on wages, investment, and leverage. Bartram, Hou, and Kim (2019) study the California cap-and-trade program that affects corporate green activities and show that financially constrained firms reallocate emissions to plants located outside California. Our study is one of the first to explore the effect of state-level environmental initiatives on corporations. The results provide important insights to policymakers by shedding light on how corporations are effected by state-level comprehensive and detailed plans of environmental regulations and preparedness, and by exploring the role of mediating factors and government subsidies on this relation.

The rest of the paper is organized as follows. Section 2 outlines the background and motivation for this study. Section 3 describes the data and the methodolgy. Section 4 presents the empirical results, followed by an analysis of cross-sectional sensitivities in Section 5 and additional capital structure aspects in Section 6. Section 7 concludes.

2. Literature Review and Motivation

The academic literature discussing the interaction between climate and corporate behavior dates back to Hart (1995), who takes the view that climate-preserving activities create value for the firm. Synthesizing prior work, Haigh and Griffiths (2009) conclude from that the cost of protecting the natural environment is offset by the consequent benefits to the firm's sustainability and Graff Zivin and Neidell (2013) observe that environmental factors, such as pollution affect human health and labor productivity.

In the field of finance, the relation between firm performance and corporate activities aimed at protecting the natural environment is mostly studied in the context of voluntary Corporate Social Responsibility (CSR) initiatives. One of the earlier studies, Klassen and McLaughlin (1996), shows that the market's reaction is significantly positive to a firm winning an environmental award but negative to the news of environmentally damaging events such as news of an oil spill or the imposition of the penalty for exceeding carbon emission limits. Konar and Cohen (2001) show that even legally emitted toxic chemicals have an impact on firm value, and a 10% reduction in such emissions is associated with a $34 million increase in market value. In Ambec and Lanoie (2008), the authors show that innovation, better risk management, and reduction in the cost of capital are some of the sources of firm value increase through better environmental management. Chava (2014) shows that equity-holders and creditors demand a higher rate of return from firms with more serious environmental concerns. Albuquerque, Koskinen, and Zhang (2019) provide both a theoretical model and empirical evidence that firms with strong corporate social responsibility exhibit lower systematic risk, higher firm value and better profitability.

Recently, as climate concerns have become more recognized by institutions (e.g. Kreuger, Sauter, and Starks, 2020) the academic literature is following suit by analyzing the costs and benefits of socially responsible investing (e.g. Pastor, Stambaugh, and Tayor, 2020 and Pedersen, Fitzgibbons, and Pomorski, 2020) and the interaction of climate and corporate policies. A detailed literature review is provided in Liang and Renneboog (2020).

The closest stream of research to this paper is the one that examines a specific aspect of climate risk on corporate financing and capital structure: climate-related regulatory risk. According to survey evidence from over 400 institutional investors, climate risk is an "important or fairly important" concern. Moreover, among the physical, regulatory, and technological aspects of climate risks firms face, regulatory risk is of the most imminent concern (Kreuger, Sauter, and Starks, 2020). Still, the existing literature on climate regulation risk is sparse. Much of the attention in the emerging research has been given to non-US firms, and non-US countries' climate policies. Using the Paris Climate Agreement as their regulation change setting, Seltzer, Starks and Zhu (2020) examine the effect of regulatory risk on corporate bond risk and pricing and Delis, de Greiff, and Ongena (2019) on bank loan pricing of carbon emission risk. Using a broad sample from 27 countries, Fard, Javadi, and Kim (2019) find that banks charge a higher interest rate from firms that face more stringent environmental regulations. They assert that this is the result of environmentally sensitive bank lending practices.

Ginglinger and Quentin (2019) show that French firms facing greater climate risks reduce leverage in the period after the Paris Climate Agreement, concluding that firms facing higher forward-looking climate risks have lower financial leverage. Exploiting Australia' ratification of the Kyoto Protocol that mandates carbon-emitting firms to reduce carbon emissions, Nguyen and

Phan (2020) find that Australian firms, especially financially constrained (or distressed) firms, have significantly lower financial leverage following the ratification.

Distinct from the literature cited above, we study climate regulatory risk by focusing on U.S. domestic climate initiatives. State climate initiatives represent significant and material events in the landscape of environmental regulation in the U.S. and are arguably stronger commitments with more enforceability than trans-national agreements. This approach has the distinct advantage of staggered adaption dates and heterogeneity in the regulatory event and our study design makes use of both of these aspects. Moreover, our study is among the few that study subnational climate action. Before our work, State Climate Adaptation Plans (SCAPs) have primarily been studied in environmental science and related fields and even there, not extensively. Among the examples of research related to SCAPs is Bennear (2007) who compares the effectiveness of SCAPs in mitigating the impact of climate risks in general. Schreurs (2008) discusses the need for local regulation using US and non-US SCAPs as comparative examples. Engel (2009) discusses the long-term legal viability of SCAPs given the dual federal and state jurisdiction over most climate-related issues. Our study brings this topic to the finance literature through the capital structure lens.

3. Data and Methodology

3.1. Data Description

Our dataset consists of a sample of non-financial and non-utility U.S. firms included in the Compustat database from 1998 to 2016. We obtain financial accounting variables for these firms from Compustat and convert all dollar values to 2009 dollars. We require firms to have positive total assets to enter our sample. We obtain firms' historical headquarter information from Edgar 10K filings by matching Compustat with Edgar through the SEC Central Index Key (CIK)[9]. For non-matched firms, we use headquarter information reported by Compustat. The study relies on a plausibly exogenous shock on state-level climate change preparedness, which is the staggered adoption of state climate adaptation plans (SCAP). Dates, when the SCAPs are finalized, are provided by the Georgetown Climate Center.[10]

We download air quality index (AQI) data from the United States Environmental Protection Agency (EPA). The AQI, reported at a daily frequency by each monitor site at the county level for a given state, measures the overall air quality which considers various air pollutants, including ground-level ozone, carbon monoxide (CO), sulfur dioxide (SO2), nitrogen dioxide (NO2), and particulate matter (PM10, PM2.5).[11] We calculate the annual median of the daily AQI of all monitor sites for a given state. The higher the index, the less healthy is the air quality. Industrial carbon dioxide (CO_2) emission data is provided by the U.S. energy information administration. The extreme climate weather data are from SHELDUS maintained by Arizona State University.

Following Raghunandan (2018) and Aobdia, Koester, and Petacchi (2018), we collect subsidy data from Good Jobs First (GJF), a non-profit organization that maintains data on national, state, and local-government subsidies since 1976. For each subsidy, the GJF's *Subsidy Tracker* contains detailed information such as the awarding regulatory body, the subsidy program name, the year of the award, the value of the award, and recipients' names and locations.

[9] Tim Loughran and Bill McDonald have made the 10X file summaries available at https://sraf.nd.edu/textual-analysis/resources/.

[10] https://www.georgetownclimate.org/adaptation/plans.html. According to Ray and Grannis (2015), the plans are initiated by either executive order or legislative action.

[11] More detailed information about the air quality index data can be found here: https://www.epa.gov/outdoor-air-quality-data/about-air-data-reports

Public companies' names from GJF are manually matched to Compustat, which enables us to calculate the total amount of government subsidies each firm-year.[12]

3.2. Methodology

To examine how state climate change adaptation plans affect local firm's financial leverage, our empirical design uses a difference-in-differences (DID) framework. Our treatment group includes firms headquartered in states that have adopted and finalized their SCAPs during the sample period. Once a SCAP is adopted, it is followed by a sequence of legislative and awareness actions by the state government and other entities in the state. Thus, we define all years following the finalization date of a SCAP as post-treatment years. Our control group includes firms headquartered in neighboring states without any finalized state climate adaptation plans.[13]

Following existing studies on capital structure, Graham and Leary (2011) in particular, our model takes the following form:

$$Y_t = \alpha \times Treatment \times Post + \beta \times Treatment + \gamma \times Post + \delta \times Controls_t + Fixed\ Effects + \varepsilon_t$$

In our main analysis, the dependent variables on capital structure include the following financial leverage measures: *Net Market Leverage* and *Net Book Leverage* for a firm in a given state and year. *Net Market Leverage* is the book value of total long-term debt plus total debt in current liabilities minus cash and short-term investments divided by the market value of total assets. *Net*

[12] We are grateful to Cheng Yin from Tsinghua University and Xin Cheng from Renmin University for generously sharing their matched data with us.

[13] One concern in the DID setting is that our results are driven by observable and unobservable confounding economic conditions. However, focusing on the neighboring states helps alleviate such concern because the firms located close to each other are more likely to share similar economic and climate conditions. This approach has been used in the previous literature, such as Heider and Ljungqvist (2015) and Mukherjee et al. (2017). As state climate plan adaptations are staggered, some neighboring states might have their plans finalized following others and become treatment states themselves. We exclude those neighboring states from the control sample. The treatment states in our final sample includes CA, CO, CT, DE, FL, MA, MD, NH, NY, OR, PA, VA, and WA. The control states include AL, AZ, DC, GA, HI, ID, KS, KY, NC, NE, NJ, NM, NV, OH, OK, RI, TN, UT, VT, WV, and WY.

Book Leverage is the book value of total long-term debt plus total debt in current liabilities minus cash and short-term investments divided by the book value of total assets. These measures account for the flexibility provided by the firm's cash and short-term investments (Serfling, 2016; Kasa, Ortiz-Molina, Serfling, and Srinivasan, 2016).[14]

Treatment is an indicator variable for firms headquartered in states with the adoption of state climate adaptation plans. This variable is consumed by state fixed effects and thus not shown in our model once controlling for state fixed effects. *Post* is an indicator variable for the years after the finalization of state climate adaptation plans.[15] Our key variable of interest, *Treatment*×*Post*, captures the difference-in-differences effect from state climate change adaptation plans. If the state climate adaptation plan reduces a firm's exposure to climate risks and increases assets' value, we expect that firms increase their leverage after the climate change adaptation plan is finalized in a state, compared to firms in neighboring states. However, if compliance costs outweigh the benefits and increase a firm's distress risk, we expect that firms lower their leverage in the post-plan period.

Our model includes the following control variables. First, we control for the following firm-level characteristics that might affect financial leverage, as documented in existing studies (for example, Rajan and Zingales, 1995; Lemmon, Roberts, and Zender, 2008). *LnAssets* is the natural logarithm of a firm's total assets. *Tangibility* is net property, plant, and equipment scaled by total assets. *ROA* is net operating income scaled by beginning-period total assets. Large firms, firms with more tangible assets and more profitable firms have more debt capacity and thus can afford higher leverage. *LnAge* is the natural logarithm of one plus firm age. We define age based

[14] Our results are qualitatively similar if we define leverage without netting out cash and short-term investments, as the book value of total long-term debt plus total debt in current liabilities by the market value of total assets.
[15] We define a control state's post-treatment period by its neighboring treatment state's SCAP finalization date. As one state could be adjacent to multiple treatment states with different treatment years, we use the earliest treatment date to define the pseudo post-treatment period for control states.

on the earliest Compustat appearance date of a firm. Many younger firms prefer equity financing and have lower leverage at the beginning of their life cycle. *MB* is the ratio of the market and book value of a given firm's equity. As noted in Graham and Leary (2011), the relation between leverage and many firm-level characteristics is not linear. High growth firms could have either low or high leverage. *Dividend Payer* is an indicator variable which is one if a firm pays an ordinary dividend, and zero otherwise. Paying ordinary dividends is a signal that the firm has little concern about financial constraints and continued profitability. We use the *Modified Altman's Z-Score* without the debt ratio component as a proxy for a firm's bankruptcy risk (Altman, 1968). *R&D* is research and development (R&D) expenses scaled by beginning-period total assets. We replace missing *Modified Altman's Z-Score* and R&D values with zero.[16] Existing studies have suggested that it is challenging for firms to finance R&D with debt, and intensive R&D firms usually have lower leverage (Hall and Lerner, 2010 and Brown, Fazzari, and Petersen, 2009).

Second, we control for macroeconomic conditions and a state's political leaning following recent literature (for instance, Serfling, 2016). *State GDP Growth* is the annual GDP growth rate at the state level. There is extensive academic literature supporting the Democratic versus Republican divide in attitudes towards climate change. Coley and Hess (2012) examine state-level green energy laws and find that Republicans' support for these laws is significantly less than Democrats'. However, they find that the level of Republicans' support also varies with state characteristics such as its dependence on the fossil-fuel industry, median household income, and the proportion of Democrats in the state legislature. To control for political differences in the legislative support of climate initiatives, we add an indicator variable, labeled *Blue,* in our model

[16] Our results are consistent if we delete missing observations of the *Modified Altman's Z-Score* from the sample. Those results are available upon request.

for states where the majority of the votes belong to a Democratic candidate during the most recently available presidential election.

3.3. Summary Statistics

Table 1 presents the summary statistics with continuous variables winsorized at the top and bottom 1% levels. Our final sample includes 55,461 firm-year observations. The average (median) firm in the sample has 2.5 billion (168.8 million) dollars of assets and has 16.7 (12.0) years of financial history available. The average (median) firm's net market leverage is -1.0% (-1.3%) with a standard deviation of 28.2% and inter-quartile range between -13.8% and 15%. The average (median) firm's net book leverage is -7.9% (-3.2%) with a standard deviation of 39.3%. Long-term debt constitutes 11.7% (15.8%) of the market value (book) value of assets, while short-term debt amounts to 3.0% (4.0%) of the market (book) value of assets, respectively, for the average firm. These numbers suggest that the sample firms have a fair amount of flexibility in their financing choices, although there is considerable cross-sectional variation.

The average (median) market-to-book ratio is 5.0 (2.2). The average (median) sample firm spends 9.5% (0.9%) on research and development. 21.8% of sample firms pay dividends, and the total payout ratio, which includes dividends and repurchases, is negative, indicating that the average firm repurchases more than it pays out. Estimates of financial constraints (developed by Whited and Wu, 2006; Hadlock and Pierce, 2010; and Kaplan and Zingales, 1997) exhibit considerable variations among sample firms.

Business conditions change both over time and across states. In our panel setting, the average state-level GDP growth is 4.6%. Most of the sample period represents quarters with economic growth, though our sample includes the financial crisis of 2008. About 75.5% of our sample observations cover firms headquartered in states that voted for a Democratic candidate in the previous presidential election. About 42.5% of our sample firms operate in industries prone to litigation. The table also provides statistics for state-level variables representing climate concerns. These variables are used in tests for cross-sectional variations to assess climate change risks.

[Insert Table 1 here]

4. Main Results

4.1 Regulatory risk and net firm leverage

To assess the effect of state climate adaption plans on firms' financial policy, we report results of multivariate regressions for two different leverage measures: *Net Market Leverage* and *Net Book Leverage*. In the difference-in-differences (DID) framework, the key variable of interest is the interaction term *Treatment*×*Post*, which describes the incremental change in net leverage for treatment firms relative to the change in net leverage for control firms around the SCAPs finalization year. The coefficient on *Post* indicates changes, if any, around SCAPs on the net leverage of control firms. We add a set of firm and state-level variables to control for differences in firm and state characteristics both between and within treatment and control firms. *Treatment* captures the difference between treatment and control firms' average level of leverage pre-event. We also add industry fixed effects at the four-digit SIC level, year fixed effects, and state fixed effects to control for unobservable factors that could potentially contaminate the main effect of state climate adaptation plans. We report the combined *Post* and *Treatment*×*Post* coefficient with the corresponding p-value to assess the overall change in net leverage for treatment firms from pre-event to post-event.

The results are reported in Panel A of Table 2. Columns (1) and (2) present models on *Net Market Leverage* for different model specifications. Column (1) presents the model with control variables and industry fixed effects and year fixed effects. The coefficient estimate on the interaction term *Treatment*×*Post* is positive and statistically significant, indicating that on average, firms located in states with finalized climate adaptations plans increase their *Net Market Leverage* by 3.3% more compared with firms located in neighboring states without such plans. The negative and significant coefficient on *Treatment* indicates that firms in SCAP states have lower net market leverage, on average, prior to the plan's finalization than firms in states that do not adopt SCAPs.[17] In the post-SCAPs period, net leverage among control firms decreases (that is, the coefficient estimates on *Post* is negative) while the net leverage among the treated firm increases as indicated by the combined (*Post* plus *Treatment*×*Post*) effect of positive 1.6%. In Column (2), we add state fixed effects to the models to control for time-invariant state-level factors.[18] The coefficient estimates remain similar in both economic magnitude and statistical significance. We repeat the analysis in Columns (3) and (4) using *Net Book Leverage* as our dependent variable and find similar results. Overall, our evidence suggests that climate adaptation policies initiated by state governments encourage local firms to adjust their leverage upward.

The coefficient estimates on control variables are largely consistent with the existing literature (see, for example, Klasa et al. 2016). Larger firms (*LnAssets*), profitable firms (*ROA*), and firms with more net fixed assets (*Tangibility*) are capable of taking on more debt. It appears that firms with higher market to book ratios (*MB*) also have higher net leverage. Firms having larger R&D expenses or higher bankruptcy risks (*Modified Altman's Z-Score*) maintain lower

[17] To further alleviate potential concerns that firm characteristics might drive our results, we also conduct DID tests in a matched sample setting, the results of which are discussed later in this section.
[18] State fixed effects subsume *Treatment*.

leverage. Similarly, we find that dividend-paying firms use less leverage, possibly due to adequate internal funds or external equity financing. Firms located in states with high GDP growth rates and blue states keep lower financial leverage.

[Insert Table 2 here]

Studying the effect of state-level policies on corporate decision using a framework similar to the one used in the current study is a well-established practice in the field of finance. Still, without further robustness analysis, one cannot rule out the possibility that the current results are a function of our particular choice of empirical approach and specification. To allay such concerns, we run our analysis through a battery of robustness tests.

First, we address the concern that a pre-event trend of increasing leverage might be responsible for our results and investigate if the change in leverage is permanent or transitory. We estimate a dynamic DID model in which indicator variables for individual years prior to and post-event are interacted with *Treatment*. Panel B of Table 2 shows that the coefficients on our pre-event indicator variables for the treated group, *Treatment*×*T(-i)*, are insignificant for all four pre-treatment years i. The coefficients on these indicator variables are much smaller in magnitude than the corresponding coefficients on post-year interactions and they are not consistently moving in one direction. The indicator variables for the event and post-event period of the treatment group show a statistically significant permanent effect of SCAPs on leverage in line with our baseline results, without any evidence of a reversal.

Second, in our main analysis, all firms in the treated states are compared with all firms in the adjacent states. While our multivariate regression specifications control for relevant firm characteristics, one might still argue that this is not an apples-to-apples comparison. To address this concern, we conduct a matched-sample analysis. To each firm in the treated group, we match firms from the control states that are in the same industry and are in the same tercile according to size, age, market-to-book, profitability, R&D expense to assets ratio, and leverage in the year prior to the SCAP finalization date. We then re-estimate our baseline regressions on this restricted sample. Panel A of Appendix A3.1 validates the matching procedure by showing that the matched control and treatment groups are statistically similar at t-1, the year before SCAP finalization. Panel B of the same table shows that the results of our baseline DID models stay qualitatively the same in the matched sample both in terms of sign and magnitude, however, the statistical significance is reduced due to the smaller sample size.

Third, to further eliminate the possibility of finding significant results due to random chance, we run a set of placebo tests. We first randomly pick SCAP finalization dates and re-do our analysis. Columns (1) and (3) of Appendix A3.2 show that resulting DID coefficient estimates are insignificant for both net market and book leverage. This supports our assertion that SCAP finalization is the catalyst for leverage increase in the treated firms and further alleviates concerns that an underlying trend in leverage is responsible for our findings. Second, we randomly assign firms into treatment and control samples while maintaining the true SCAP finalization dates as the event dates. The DID results of this exercise are presented in Columns (2) and (4) of Appendix A3.2. The net market and book leverage of the randomly assigned treated firms is not significantly different from the leverage of the randomly assigned control firms in the post SCAP-finalization period, further supporting our main results.

Fourth, a possible alternative explanation for an increase in leverage in our sample of treated firms can be one or more economy-wide confounding shocks in the post period mistakenly ascribed to SCAPs. We do not put a lot of weight on this explanation because SCAP adaptation dates are staggered over time across different states. We still need to empirically rule this possibility out, as much as possible. One such confounding event is the 2008 financial crisis that drove down equity values affecting market leverage. We, therefore, add an indicator variable, *Crisis*, which equals one if a firm-year is in the financial crisis period (that is, 2007 and 2008) and zero otherwise and repeat our analysis. Federal level environmental regulatory activities in the post-SCAP adaptation period represent another set of possible confounding events. To isolate the effect of SCAP from this confounder, we control for federal environmental legislations introduced by home-state politicians. We obtain congressional bills on environment-related regulations from the Congressional Bills Project. We then code an indicator variable, *FedEnviLegislation*, as one for year t+1 to year t+5 if environmental bills introduced by politicians representing a firm's home state become laws in year t, and zero otherwise. Overall, we obtain evidence supporting our baseline results after controlling for these potential confounding events (see Appendix A3.3).

Fifth, corporate financing activities reverse-causing the SCAP adaptation is very unlikely. Our dynamic model in Table 2 already shed light on that since we see no pre-trend ahead of SCAP adaption. Nevertheless, for the sake of completeness, we follow Png (2017) and Guernsey, John, and Litov (2019), and perform a Cox discrete-time proportional hazard model to predict the adoption of SCAPs. We include a set of one-year lagged firm-level and state-level macroeconomic variables in the model. The estimation results are presented in Appendix A3.4. All leverage related variables are statistically insignificant, indicating that the timing of SCAPs is not predictable based on historical leverage.

Sixth, to remove any bias introduced by including the intermediate years between the SCAP initiation and finalization years, such as, the SCAP initiation lowering the leverage and the plan finalization reversing it back, we re-do our analysis after removing the intermediate years. Appendix A3.5 shows that our baseline results are not affected by any of these reasons. Additionally, to check if our results are driven by a particular choice of event window, we re-estimate our analysis using alternative event windows of (-3, +3) and (-5, +5) years around SCAP finalization dates. Appendix A3.6 shows that our results do not materially change as a result.

Seventh, following extant literature studying financial policies, our main identification relies on headquarter (HQ) locations. However, some might wonder if a SCAP in a firm's location of operation is more effective on leverage than a SCAP in the HQ state. To address this issue, we split our sample into firms operating in one state and firms operating in multiple states.[19] As shown in Appendix A3.7, the DID estimates are positive and significant for both subsamples. This implies that our results are not sensitive to firms' geographical dispersion and further confirms the validity of HQ location as the main source of state policy effect.

Eighth, we deploy alternative clustering methods. The significance of DID estimates remains, either when we cluster at the firm level, or when we double cluster at the state and year level (Appendix A3.8).

In summary, we are able to address challenges to our baseline results by performing a variety of robustness tests and in each case, our main results do not change. This gives us confidence to explore further dimensions of SCAPs' effect on capital structure through additional analysis.

4.2 SCAP heterogeneity

[19] We appreciate Scott D. Dyreng from the Duke University for kindly providing the division location data on his website.

Having established the robustness of our main results, we now turn to the question of the possible mechanism behind it. So far, our results have established that firms adjust their net leverage in response to SCAP adoptions immediately and permanently without any reversal, indicating that the leverage increase is not just a short-lived funding of one-time regulatory adjustment costs.

State Level Climate Adaptation Plans are quite heterogenous in terms of their scope. We take that as an opportunity to shed light, albeit, indirectly, on the mechanism behind our results. We postulate that the increase in leverage is a parallel effect to the one studied by Serfling (2016) in the context of state-level labor protection laws. In the case of Serfling's study, the introduction of labor-protection laws increased operational risk, crowding out financial leverage capacity. In our case, a resolution of climate regulation risk has the opposite effect. To provide indirect evidence for this mechanism, we use the specificity of a SCAP as measured through the number of goals listed in the plan as a proxy of the level of risk reduction. The number of goals listed ranges from 28 (Florida) to 373 (Massachusetts).[20] The higher the number of goals, the less ambiguous the regulatory environment going forward even though in the near term, it might be more onerous for the firm to meet those goals. Column 1 and 5 of Table 3 shows results in line with this conjecture. The triple interaction term between *Treatment* indicator, *Post* indicator variable and the natural log of stated plan *Goals* that replaces our *Treatment*×*Post* term in the baseline model is statistically significant for both *Net Market* and *Book Leverage*. This result holds when use goals listed in the subcategories of *Planning*, *Law*, and *Monitoring* separately instead of the aggregate number of goals in the remaining columns of the same table.

[Insert Table 3 here]

[20] Ray and Grannis (2015)

These results support the interpretation that more specific state adaptation plans help resolve regulatory uncertainty better and provide a clearer commitment of the state to act toward climate preparedness, both of which reduce firm's climate risk and allow for higher financial risk.

5. Cross-Sectional Analyses

Having established the net leverage increasing effect of state climate adaptation plans, we explore what circumstances and characteristics influence the strength of this result. In this section we present cross-sectional sensitivity test of the baseline result in relation to climate risk, distress risk, and government subsidies.

5.1. Physical Climate Risks

Our baseline results have shown a positive relation between state climate adaptation plans and financial leverage. Next, we provide results on how regulatory and physical climate risks interact in affecting corporate leverage. Specifically, we explore the effect of state-level climate policies on a firm's leverage conditional on the extent of a firm's climate risk exposure. Similar to the baseline predictions, ex-ante, this conditional effect of SCAPs is equivocal. On one hand, the adoption of SCAP could trigger the enforcement of more stringent environmental regulations and raise compliance costs to firms that are exposed to greater climate risks, resulting in larger changes in firms' capital structures. On the other hand, SCAP could heighten the overall climate risk awareness in the state and optimize the allocation of state resources to combat its impact, reducing climate risks and increasing debt capacity for firms. It is also possible that firms located in areas exposed to more severe climate risks might proactively be in compliance with the new regulations due to their historical exposure resulting in less compliance requirement-triggered adjustments to capital structure. In summary, the net effect on leverage conditional on existing climate risk requires empirical testing.

Our first proxy for a local firm's physical exposure to climate risks, Air Quality Index (*AQI*), is a state's overall air quality assessment and a direct indicator of air pollution. The higher the *AQI* index, the poorer is the air quality. The United States EPA suggests that climate change affects air quality through an increase in ground-level ozone, and the emission of air pollutants into the atmosphere warms or cools the climate.[21] Therefore, we use the AQI index as a proxy for climate risks. Columns (1) and (2) of Panel A in Table 4 present the results on the high *AQI* sub-sample, and Columns (3) and (4) present the results on the low *AQI* sub-sample. The coefficient estimates on the interaction term *Treatment*×*Post* are positive and statistically significant for the high *AQI* sub-sample in Columns (1) and (2), where the dependent variables are *Net Market Leverage* and *Net Book Leverage*, respectively. In comparison, the coefficient estimates on the interaction term in Columns (3) and (4) are insignificant for the low *AQI* sub-sample. The finding suggests that the positive relation between state climate adaptation plans and leverage is more pronounced for firms located in poor air quality regions.

[Insert Table 4 here]

Our second proxy of climate risks is carbon emissions, one of the primary concerns for global warming.[22] Though energy consumption could be largely attributed to economic growth and production expansion, climate challenges such as extended extreme weather can also increase energy demand and consumption for both industrial sectors and residential sectors

[21] See https://www.epa.gov/air-research/air-quality-and-climate-change-research.
[22] NASA concluded CO_2 as "…the most important long-lived "forcing" of climate change.", https://climate.nasa.gov/causes/

(Mansur, Mendelsohn, and Morrison, 2008).[23] van Ruijven, De Cian, and Wing (2019) estimate that "vigorous (moderate) warming increases global climate-exposed energy demand before adaptation around 2050 by 25–58% (11–27%), on top of a factor 1.7–2.8 increase above present-day due to socioeconomic developments." On the opposite side, a higher level of energy consumption could increase carbon emission and exacerbate climate risks. Due to data limitations on carbon emissions at the firm level, we use industrial carbon dioxide (CO_2) emissions at the state level as a proxy for climate risk. We expect that financial leverage in firms located in states with high industrial carbon emissions is more sensitive to regulations and policies targeting climate challenges.

Panel B of Table 4 presents our findings. We conduct subsample analysis using CO_2%, which is the CO_2 emission in a given state scaled by the U.S. total for year t. If a state's CO_2 emission is higher (lower) than the sample median for a given year, we classify sample observations into the high (low) CO_2% subsample. Columns (1) and (2) show results for the high CO_2% subsample, where the coefficient estimates on the interaction terms (4.1%) are positive and statistically significant. However, the coefficient estimates on the interaction terms in the low CO_2% group are insignificant and much smaller in economic magnitude in Columns (3) and (4).[24]

Our third proxy of climate risk is constructed based on extreme weather events, which often impose large economic losses to local communities. Extreme weather events often result in immediate and severe impacts on people's lives and livelihoods in a short time window and are powerful channels through which people learn the influence of climate risk. We select the

[23] The U.S. Energy Information Administration's report on primary energy consumption states that energy consumption in the United States reached a historical high in 2018. The report is at https://www.eia.gov/todayinenergy/detail.php?id=39092.

[24] Our results hold robust using the level CO_2 for each state.

agricultural produce losses caused by hurricanes as the measure for the severity of extreme weather events.[25] Using data from SHELDUS and following the same approach used in previous tables, we divide the sample based on annual sample medians into two groups: one with high economic losses and the other with low economics losses from hurricanes. Panel C of Table 4 reports the results. We find stronger treatment effects (3.8%-5.6%) of SCAPs on net leverage in the high damage subsample for *Net Market Leverage*.[26]

Altogether, our subsample analysis on climate risks is consistent with the interpretation that climate adaptation plans initiated by state governments in the United States could mitigate firms' exposure to climate risks and allow them to move to a higher level of leverage to meet the financing need of compliance. Our results imply that when firms are situated in greater climate risk areas, they are more likely to see the necessity of taking actions to meet new climate regulations.

5.2. Financial Flexibility

We have shown that SCAPs influence a firm's net leverage more when the firm is exposed more to climate risks. The effect of climate-induced regulation on capital structure works in conjunction with other constraints operating on a firm's financing flexibility. In particular, the decision to increase leverage is heavily dependent on firms' funding needs, alternative funding sources, as well as its distress and litigation risk.

5.2.1. Financial Constraints

[25] Hurricanes account for a large portion of the severe natural disasters. For instance, in Barrot and Sauvagnat (2016), 27 out of 41 (65%) major natural disasters in 1980-2013 were hurricanes. Dessaint and Matray (2017), and Rehse et al. (2019) only look into hurricane events and examine corporate cash holdings in the nearby counties, and stock market liquidity, respectively.

[26] In untabulated analysis we classify samples based on whether a state has ever experienced a hurricane in history and find consistent results. We have qualitatively similar findings when we analyze subsamples for economic damages from tornados, winter weather and heatwaves.

As existing studies have shown that financial constraints also determine a firm's financial leverage, we examine how a firm's financial status affects leverage in the setting of climate policies. We expect that climate policies have a larger impact on firms with more financial constraints. We argue that financially constrained firms gain the most from the relaxation of debt-capacity constraint as a result of SCAPs. Following Whited and Wu (2006), Hadlock and Pierce (2010), Kaplan and Zingales (1997), and Farre-Mensa and Ljungqvist (2016), we construct the following financial constraints indices: *WW Index*, *SA Index*, *KZ Index,* and *Credit Rating*. We divide our sample into highly financially constrained firms versus less financially constrained firms based on the median of each index for each industry and year.

Table 5 provides our findings. We find consistent results that more financially constrained firms increase their leverage by 2.4%-4.3% more compared to control firms once their states finalize climate adaptation plans. Control firms with high financial constraints exhibit a decrease in both net market and book leverage. For net market leverage, financially constrained treatment firms' increase is larger both economically and statistically than the control firms' decrease, resulting in a significantly positive net leverage increase of 1.5%-2.6% (combined effect). For net book leverage of financially constraint firms, the incremental effect is positive and significant while the net combined effect is unchanged for treatment firms.

[Insert Table 5 here]

5.2.2. Litigation Risk

If SCAPs enhance states' preparedness to deal with climate events and compel firms to adopt environmental protection strategies preemptively, firms located in these states will be less subject to climate-related litigation risk, allowing them to use a higher level of financial leverage. It is also possible that firms in states with SCAPs become more susceptible to litigation risk because they must meet more restrictive standards and regulations. In this case, we would expect that firms in industries prone to litigation risk would need to conserve debt capacity and reduce leverage.

To test our conjectures, we again conduct subsample analyses based on the degree of litigation risk at the industry level.[27] The results in Table 6 provide evidence in support of the first argument. The coefficient on *Treatment*×*Post* in the subsample of firms from litigation-prone industries is positive as well as both economically and statistically significant. This contrasts with the negative and significant trend among litigation-prone firms in adjacent states to reduce their net leverage by about 3% (significant at the 5% level). There is no evidence of a change in net leverage in the less-litigation-prone subsample regardless of the firm's headquarter state formulating a SCAP. The evidence implies that state climate adaptation plans create a greater need for additional debt financing for firms exposed to greater litigation risk possibly due to a greater need to be in compliance with regulations.

[Insert Table 6 here]

5.2.3. Government Subsidies

A natural question to ask is how local governments could make businesses prioritize investments in climate-related projects where positive NPVs are not guaranteed. As it is widely known, various federal and state-level funding and grants have been committed to motivating research and actions in fighting climate changes. For example, New York City planned a $19.6 billion investment in climate adaptation in 2013.[28] Since capital structure is strongly influenced by the supply of funds, we extend our analysis to study the availability of alternative sources of funding, government subsidies, on the impact of financial leverage.

[27] Adopting Bamber, Jiang, and Wang's (2010) method, high litigation risk firms are identified as those with the following four-digit SIC codes: 2833 to 2836, 3570 to 3577, 3600 to 3674, 5200 to 5961, to 7374 and 8731 to 8734.
[28] See https://insideclimatenews.org/news/20130620/6-worlds-most-extensive-climate-adaptation-plans

To understand the impact of government support, we perform subsample analysis based on whether firms have received any government subsidy or not.[29] Table 7 shows the results. Columns (1) and (2) present results on *Net Market Leverage and Net Book Leverage* for firms without government subsidies. We see a positive effect of SCAPs on treatment firms' net leverage: the interaction term of *Treatment* and *Post* is positive and significant in both models. On the contrary, Columns (3) and (4) show no significant influence of SCAPs on the net leverage for firms supported by government subsidies. The result suggests that government subsidies are substitutes for firm borrowing, and firms without government subsidies adjust leverage upward in response to state climate adaptation policies.

Aobdia, Koester, and Petacchi (2018) suggest that the state subsidy awards could be an inefficient allocation of government resources, transferring funds toward the benefit of politically connected companies. Existing studies such as Ginglinger and Quentin (2019) and Ngyuen and Phan (2018) assert that climate risk increases firms' credit risk and limits their ability to borrow. Our evidence suggests that local climate policies help mitigate the impact of climate risks. In the presence of government subsidies, firms save their debt capacity and build slack for future growth by using government subsidy as an alternative source of funding for climate adaptation, likely due to cost efficiency.

[Insert Table 7 here]

6. Additional Tests

[29] Ideally, we would like to define our sub-samples based on whether firms have received any environment-related grants in a firm-year. Unfortunately, we do not have detailed information. Since subsidies cover bonds, grants, government loans, infrastructure assistance, tax breaks, et cetera, the total subsidies can serve as a good indication of government's supports on environment and climate issues. We assume the total amount of subsidies is highly correlated with government support on climate issues.

Capital structure has other important facets besides the proportion of debt. In this section, we briefly explore two aspects not discussed earlier. First, we are interested in how firms change their specific funding components (debt, equity, cash) in response to state-level climate action that results in a net leverage increase. Second, we test how treatment firms alter the mix of short- and long-term debt in their capital structure post state climate adaptation plan finalization.

6.1. Financing Mix

One natural question behind our baseline results is how firms adjust their net financial leverage upward. Net leverage is measured as book value of debt minus cash holdings and short-term investments divided by the market value of the firm (or book value of the firm's assets). Thus, higher net leverage can be achieved by increasing the relative amount of debt or by decreasing the relative amount of cash holdings. To shed some light on this question, we follow the DID approach and examine firms' financial policies, including cash holdings, net equity issuance, and net debt issuance. The results are reported in Table 8. While there is an overall trend to increase both cash holdings in Column (1) and net equity issues in Column (2) as evident from the positive and significant coefficient on *Post* (*Cash holdings*: 1.5% and *Net Equity Issues*: 3.7%), the coefficient estimates on the interaction term, *Treatment*×*Post*, are negative and significant (*Cash holdings*: -1% and *Net Equity Issues*: -3.2%), indicating that firms following SCAPs follow the negative trend to a lesser degree. The combined effect of the two coefficient is insignificant. In Column (3) we find a significant increase (0.6%) in net debt issues following SCAP adoption for the treated firms relative to the control firms, while there is no change in net debt issues among the control firms (that is, coefficient estimate on *Post* is insignificant). Altogether, we show that SCAPs encourage firms to adopt less conservative cash and financing policies. This finding is consistent with the explanation that the increase in leverage in our baseline results is a result of an additional need for funds for compliance instead of providing a source of precautionary cash.

[Insert Table 8 here]

6.2. Debt Maturity

Given that exposure to climate risk is long-term, we expect firms to adjust their debt maturity structure to meet the expectation of a long-term commitment to address climate challenges.[30] Additionally, environmental legislations are binding in the long term. For instance, as firms adapt to the new legislative environment, they need to make fundamental changes in their production process, like buying new machines to make greener products. We, therefore, expect firms to match long-term borrowing to long-term investment needs.

First, we report the effect of SCAPs on long-term versus short-term leverage in Table 9. Our findings are largely in line with our expectations. The coefficient estimates on *Treatment×Post* are significantly positive in the models on *Long-Term Market Leverage*, with or without state fixed effects even though *Long-Term Market Leverage* is only significant in the model without state fixed effects. Firms increase their long-term leverage following SCAP adoptions by 0.9%-1.5%. However, for both *Short-Term Market Leverage* and *Short-term Book Leverage*, we do not see any statistically and economically significant evidence of change. Such asymmetric effect indicates that adapting to climate challenges is a long-term commitment. Furthermore, long-term debt is usually financed by large institutions. The results imply that institutional investors support climate adaptation policies, in line with Krueger, Sautner, and

[30] For instance, Chava and Purnanandam (2010) found that CFOs' risk-decreasing incentives lead to more long-term leverage, which they interpret as adopting less risky leverage as short-term debts expose firms to refinancing risks and interest rate risks.

Starks (2019) who suggest that institutional investors actively manage climate risks rather than divest firms with greater climate risks from their portfolios.

[Insert Table 9 here]

Second, following Dang and Phan (2016), we construct measures to quantify the proportion of debt maturing in the short run and conduct the DID estimation using these as the dependent variables. STNP is debt in current liabilities minus the current portion of long-term debt, divided by total debt. ST1 through ST5 are the proportions of debt maturing in 1, 2, 3, 4, and 5 years, respectively, as a percentage of total debt. Table 10 reports the results. Supporting our previous findings, the proportion of short-term debt decreases significantly by a little over 2% for local firms following SCAP finalization compared to firms located in neighboring states. The results suggest that firms increase leverage by tilting the corporate debt structure more towards long-term debt in response to climate adaptation plans.

[Insert Table 10 here]

7. Conclusions

The effect of climate change on corporate policies is increasingly gaining attention in the field of business research. In this study, we seek to fill the existing gap in the literature on the effect of climate regulation on corporate policies by examining how state climate adaptation plans (SCAPs) affect a local firm's capital structure decisions. Taking advantage of SCAPs staggered adoption across different states, we conduct difference-in differences analyses and find that firms increase their net market (book) leverage after their respective headquarter state finalizes a SCAP. We provide indirect evidence in support of our conjecture that this effect is driven by reduction in climate regulation risk by showing that the effect is directly proportional to the degree of specificity of the plan details. The results are robust to different specifications, such as a matched sample, a dynamic model, and different clustering, and indicate a permanent change. The effect is more pronounced for firms exposed to greater climate risks and for firms more vulnerable to distress risk.

Additional analysis reveals that firms located in SCAP states significantly reduce their cash holdings and net equity issuance, and increase their debt issuance following SCAPs, in comparison to firms in adjacent states. Those firms also adopt more long-term leverage following the finalization of SCAPs. This evidence suggests that climate adaptation is a long-term commitment and are consistent with SCAPs reducing regulatory uncertainty going forward allowing for taking on more financing risk.

Overall, our study is the first to provide insights into how corporations alter their capital structure in response to state level climate adaptation plans. Given the important role states play in environmental regulation, oversight, and strategy in the United States, studying the implications of state initiatives on corporate financial decisions remains a topic of importance to policymakers, regulators, and investors alike.

References

Albuquerque, R. A., Koskinen, Y., Zhang, C., 2019. Corporate social responsibility and firm risk: Theory and empirical evidence. Management Science 65, 4451 - 4469.

Altman, Edward I., 1968. Financial ratios, discriminant analysis, and the prediction of corporate bankruptcy. Journal of Finance 23, 589-609

Ambec, S. and Lanoie, P. 2008. Does it pay to be green? A systematic overview. The Academy of Management Perspectives, 45-62

Aobdia, Daniel and Koester, Allison and Petacchi, Reining, 2018. Political Connections and Government-Awarded Economic Incentives: State-level Evidence. Working paper. Available at https://ssrn.com/abstract=3127038 or http://dx.doi.org/10.2139/ssrn.3127038

Baker, M., Bergstresser, D., Serafeim, G., Wurgler, J., 2018. Financing the response to climate change: The pricing and ownership of US green bonds. National Bureau of Economic Research.

Bamber, L.S., Jiang, J. and Wang, I.Y., 2010. What's my style? The influence of top managers on voluntary corporate financial disclosure. The Accounting Review, 85, 1131-1162

Bartram, S. M. and Hou, K. and Kim, S., Real Effects of Climate Policy: Financial Constraints and Spillovers (December 10, 2018). Fisher College of Business Working Paper No. 2019-03-004. Available at SSRN: https://ssrn.com/abstract=3262211

Bennear, L.S., 2007. Are Management-Based Regulations Effective? Evidence from State Pollution Prevention Programs. Journal of Policy Analysis and Management 26, 327–348

Bernstein, A., Gustafson, M. T. and Lewis, R. 2019, Disaster on the horizon: The price effect of sea level rise. Journal of Financial Economics 134, 253-272

Brown, J.R., Fazzari, S.M., Petersen, B.C., 2009. Financing Innovation and Growth: Cash Flow, External Equity, and the 1990s R&D Boom. The Journal of Finance 64, 151-185

Chava, S., 2014. Environmental externalities and cost of capital. Management Science 60, 2223-2247

Chava, S., Danis, A. and Hsu, A., 2019. The impact of right-to-work laws on worker wages: evidence from collective bargaining agreements. Journal of Financial Economics 137, 451-479

Chava, S., Purnanandam, A., 2010. CEOs versus CFOs: Incentives and corporate policies. Journal of financial Economics 97, 263-278

Chen, Y.S.,2008. The Positive Effect of Green Intellectual Capital on Competitive Advantages of Firms. Journal of Business Ethics, 77(3), 271-286

Coley, J. S., and Hess, D. J., 2012. Green energy laws and Republican legislators in the United States. Energy Policy, 48, 576-583

Dang, V.A., Phan, H.V., 2016. CEO inside debt and corporate debt maturity structure. Journal of Banking and Finance 70, 38-54

Delis, M, K. de Greiff, and S. Ongena. 2019. Being stranded with fossil fuel reserves? Climate p olicy risk and the pricing of bank loans. Working Paper, Montpellier Business School

Dessaint, O., Matray, A., 2017. Do managers overreact to salient risks? Evidence from hurricane strikes. Journal of Financial Economics 126, 97-121

Engel, K. H., 2009. Whither Subnational Climate Change Initiatives in the Wake of Federal Climate Legislation? Publius: The Journal of Federalism 39, 432–454

Fard, A., Javadi, S., and Kim, I., 2019. Environmental Regulation and the Cost of Bank Loans: International Evidence. Available at SSRN: https://ssrn.com/abstract=3348758

Farre-Mensa, J., Ljungqvist, A., 2016. Do measures of financial constraints measure financial constraints? The Review of Financial Studies 29, 271-308

Flammer, C., 2020. Corporate Green Bonds. Journal of Financial Economics, Forthcoming

Ginglinger, E. and Moreau, Q., 2019. Climate risk and capital structure. Available at SSRN 3327185

Graff Zivin, J., Neidell, M., 2013. Environment, Health, and Human Capital. Journal of Economic Literature 51, 689-730

Graham, John R. and Mark T. Leary, 2011. A Review of Empirical Capital Structure Research and Directions for the Future. Annual Review of Financial Economics 3, 309–345

Guernsey, S.B., John, K. and Litov, L.P., 2019. Are Some Things Best Kept Secret? The Effect of the Uniform Trade Secrets Act on Financial Leverage. Available at SSRN: https://ssrn.com/abstract=3063466.

Hadlock, C. J., and Pierce, J. R., 2010. New evidence on measuring financial constraints: Moving beyond the KZ index. The Review of Financial Studies 23, 1909-1940

Haigh, N. and Griffiths, A. 2009. The natural environment as a primary stakeholder: the case of climate change. Business Strategy and the Environment 18, 347-359

Hall, B.H., Lerner, J., 2010. Chapter 14 - The Financing of R&D and Innovation. In: Hall BH and Rosenberg N (eds.) Handbook of the Economics of Innovation. North-Holland, pp. 609-639

Hart S. L., 1995. A natural-resource-based view of the firm. Academy of Management Review 20, 986–1014

Heider, F., Ljungqvist, A., 2015. As certain as debt and taxes: Estimating the tax sensitivity of leverage from state tax changes. Journal of Financial Economics 118, 684-712

Hong, H., Karolyi, G., and J., Scheinkman, 2020, Climate Finance, The Review of Financial Studies, 33(3), 1011-1023

Kaplan, Steven N, and Luigi Zingales, 1997, Do investment-cash flow sensitivities provide useful measures of financing constraints?, The Quarterly Journal of Economics 112, 169-215

Kim, I., Wan, H., Wang, B., Yang, T., 2019, Institutional Investors and Corporate Environmental, Social, and Governance Policies: Evidence from Toxics Release Data. Management Science 65, 4901-4926.

Klasa, S., Ortiz-Molina, H., Serfling, M., Srinivasan, S., 2018. Protection of trade secrets and capital structure decisions. Journal of Financial Economics 128, 266-286

Klassen, Robert D. and Curtis P. McLaughlin, 1996. The Impact of Environmental Management on Firm Performance. Management Science 42, 1093-1227

Konar, S., and M. A. Cohen. 2001. Does the market value environmental performance? Review of Economics and Statistics 83 (2), 281-289

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

Lemmon, Michael L., Michael R. Roberts, and Jaime F. Zender, 2008. Back to the beginning: Persistence and the cross-section of corporate capital structure, Journal of Finance 63, 1575-1608

Liang, H., Renneboog, L., 2020. Corporate Social Responsibility and Sustainable Finance: A Review of the Literature. European Corporate Governance Institute, finance working paper #701/2020

Mansur, E.T., Mendelsohn, R., Morrison, W., 2008. Climate change adaptation: A study of fuel choice and consumption in the US energy sector. Journal of Environmental Economics and Management 55, 175-193

Mukherjee, A., Singh, M. and Žaldokas, A., 2017. Do corporate taxes hinder innovation?. Journal of Financial Economics 124, 195-221

Nguyen, J.H., and Phan, H.V., 2020. Carbon Risk and Corporate Capital Structure. Journal of Corporate Finance, Forthcoming. Available at SSRN: https://ssrn.com/abstract=3074035

Pastor, L. and Stambaugh, R. F. and Taylor, L. A., 2020. Sustainable Investing in Equilibrium. Journal of Financial Economics, forthcoming

Pedersen, L.H., Fitzgibbons, S., Pomorski, L., 2020. Responsible investing: The ESG-efficient frontier?, Journal of Financial Economics, forthcoming

Png, I.P., 2017. Law and innovation: evidence from state trade secrets laws. Review of Economics and statistics 99, 167-179

Porter, M., and C. van der Linde, 1995a. Toward a new conception of the environment competitiveness relationship. Journal of Economic Perspective 9, 97–118

Porter, M., and C. van der Linde, 1995b. Green and competitive: Ending the stalemate. Harvard Business Review. 120–134

Raghunandan, A., 2018. Government Subsidies and Corporate Fraud. Available at https://ssrn.com/abstract=3035254 or http://dx.doi.org/10.2139/ssrn.3035254

Rajan, R. G. and Zingales, L. 1995. What Do We Know about Capital Structure? Some Evidence from International Data. Journal of Finance 50, 1421-1460

Ray, A.D., and Grannis, J., 2015. From Planning to Action: Implementation of State Climate Change Adaptation Plans, Michigan Journal of Sustainability 3, 5-28

Rehse, D., Riordan, R., Rottke, N., Zietz, J., 2019. The effects of uncertainty on market liquidity: Evidence from Hurricane Sandy. Journal of Financial Economics 134, 318-332

van Ruijven, B.J., De Cian, E., Wing, I.S., 2019. Amplification of future energy demand growth due to climate change. Nature Communications 10, 2762

Schreurs, Miranda A., 2008. From the Bottom Up: Local and Subnational Climate Change Politics. The Journal of Environment and Development 17, 343-355

Seltzer, L., Starks, L., and Q. Zhu, 2020. Climate Regulatory Risks and Corporate Bonds, Working Paper. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3563271

Serfling, M. 2016. Firing costs and capital structure decisions. Journal of Finance 71, 2239-2286

Whited, Toni M., and Guojun Wu, 2006. Financial constraints risk, Review of Financial Studies 19, 531-559

Table 1 Summary Statistics

This table provides summary statistics for the paper. The sample includes non-financial and non-utility U.S. firms that belong to our treatment group and control group for the period 1998-2016. All variables are as defined in Appendix A1. All dollar-valued variables are expressed in2009 dollars.

	N	Mean	Median	St.Dev	p25	p75
Net Market Leverage	55461	-0.010	-0.013	0.282	-0.138	0.150
Net Book Leverage	55461	-0.079	-0.032	0.393	-0.343	0.217
Long-Term Market Leverage	55461	0.117	0.044	0.156	0.000	0.185
Long-Term Book Leverage	55461	0.158	0.085	0.185	0.000	0.273
Short-Term Market Leverage	55461	0.030	0.003	0.065	0.000	0.025
Short-Term Book Leverage	55461	0.040	0.006	0.078	0.000	0.040
Total Assets ($Millions)	55461	2473.236	168.809	16880.020	35.770	845.250
LnAssets	55461	5.162	5.129	2.286	3.577	6.740
LnAge	55461	2.583	2.565	0.775	2.079	3.135
MB	55461	5.023	2.212	10.678	1.223	4.241
ROA	55461	-0.074	0.084	0.641	-0.064	0.162
R&D	55461	0.095	0.009	0.198	0.000	0.106
Modified Altman's Z	55461	-0.625	0.883	6.133	-0.246	2.141
Tangibility	55461	0.249	0.147	0.283	0.057	0.337
Dividend Payer	55461	0.218	0.000	0.413	0.000	0.000
Investment	55461	0.062	0.030	0.101	0.013	0.066
Litigation	55461	0.425	0.000	0.494	0.000	1.000
Blue	55461	0.755	1.000	0.430	1.000	1.000
State GDP Growth	55461	0.046	0.045	0.026	0.032	0.062
AQI *(State Median)*	55292	41.592	42.000	5.101	38.000	45.000
CO_2 *Emission*	55461	27.831	14.200	25.542	9.200	62.700
CO_2*%*	55461	0.029	0.015	0.027	0.010	0.065
Hurricane Damage ($Millions)	55461	9.542	0.000	76.922	0.000	0.000
WW	53191	-0.144	-0.224	0.468	-0.318	-0.115
SA	55461	-3.058	-3.132	0.935	-3.644	-2.540
KZ	52009	-20.944	-1.236	94.260	-8.092	1.019
Government Subsidiary	55461	0.109	0.000	0.311	0.000	0.000
STNP	42918	0.186	0.059	0.271	0.004	0.249
ST1	42918	0.326	0.167	0.354	0.025	0.563
ST2	42918	0.449	0.343	0.385	0.075	0.886
ST3	42918	0.546	0.532	0.394	0.149	1.000
ST4	42918	0.627	0.733	0.385	0.257	1.000
ST5	42918	0.621	0.724	0.376	0.268	1.000

Table 2 State Climate Adaptation Plans and Net Leverage

This table presents estimations of the impact of state climate adaptation plans on net leverage in a difference-in-differences (DID) framework. Panel A presents the baseline model and Panel B presents a dynamic model. The dependent variables are *Net Market Leverage* and *Net Book Leverage,* respectively. *Treatment* is an indicator variable for firms headquartered in states that finalize climate adaptation plans. The control group includes firms headquartered in adjacent states without climate adaptation plans. *Post* is an indicator variable for the years after state climate adaptation plans are finalized. In Panel B we define a series of binary variables that represent the years relative to the years that state climate adaptation plans (SCAPs) are finalized. *T(0)* is the year in which SCPAs are finalized. *T(-n)* represent *n* years ahead of the SCAPs' finalization year, where n=1, 2, 3, 4. *T(m)* represent *m* years following the SCAPs' finalization year, where m=1, 2, 3, 4. We define *T(>=5)* as 5 years or more than 5 years following the SCAPs' finalization year. Years T(<=-5), years 5 years or more than 5 years prior to the SCAPs' finalization year constitute the baseline. We include industry, year, and state fixed effects as indicated and cluster standard errors at the state level. T-values are reported in parentheses below the coefficients. *, **, *** indicates statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Baseline regression

	(1)	(2)	(3)	(4)
	Net Market Leverage		*Net Book Leverage*	
Treatment×Post (β)	0.033***	0.030***	0.026**	0.022**
	(3.84)	(3.01)	(2.63)	(2.21)
Treatment	-0.031***	-	-0.042***	-
	(-3.29)	-	(-3.40)	-
Post (λ)	-0.017*	-0.014*	-0.018	-0.015*
	(-1.88)	(-1.86)	(-1.51)	(-1.88)
LnAssets	0.027***	0.027***	0.034***	0.035***
	(12.89)	(12.46)	(10.02)	(9.77)
LnAge	0.007	0.004	0.031***	0.027**
	(1.23)	(0.69)	(3.04)	(2.73)
MB	0.003***	0.003***	0.003***	0.003***
	(8.24)	(8.07)	(12.58)	(11.82)
ROA	0.019***	0.021***	0.032***	0.034***
	(3.86)	(4.32)	(6.14)	(6.95)
Tangibility	0.209***	0.209***	0.315***	0.313***
	(15.39)	(15.72)	(14.79)	(14.76)
Dividend Payer	-0.058***	-0.061***	-0.064***	-0.068***
	(-7.84)	(-8.47)	(-7.56)	(-8.26)
Modified Altman's Z	-0.002**	-0.002**	-0.002***	-0.003***
	(-2.39)	(-2.62)	(-5.55)	(-6.62)
R&D	-0.081***	-0.070***	-0.425***	-0.408***
	(-3.47)	(-3.27)	(-22.00)	(-24.43)
State GDP Growth	-0.335***	-0.107*	-0.467***	-0.163**
	(-5.78)	(-2.00)	(-5.14)	(-2.25)
Blue	-0.035***	-0.017***	-0.050***	-0.014*
	(-4.21)	(-2.78)	(-4.03)	(-1.99)
Industry Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
State Fixed Effects		Yes		Yes
Observations	55458	55458	55458	55458
Adj. R^2	0.3605	0.3673	0.4871	0.4943
Combined effect (β+λ)	0.016**	0.016**	0.008	0.007
P-Value of the Wald Test on β+λ=0	(0.0148)	(0.0467)	(0.4955)	(0.5474)

Panel B: Dynamic Model

	(1)	(2)	(3)	(4)
	Net Market Leverage		*Net Book Leverage*	
Treatment×T(-4)	0.005	0.004	0.002	0.000
	(0.97)	(0.68)	(0.23)	(0.04)
Treatment×T(-3)	0.009	0.009	0.004	0.004
	(1.40)	(1.03)	(0.48)	(0.67)
Treatment×T(-2)	0.010	0.014	0.004	0.010
	(1.27)	(1.54)	(0.33)	(1.31)
Treatment×T(-1)	0.002	0.005	0.011	0.015
	(0.18)	(0.68)	(0.83)	(1.61)
Treatment×T(0)	0.013	0.019**	0.008	0.013
	(0.77)	(2.31)	(0.38)	(1.40)
Treatment×T(1)	0.033***	0.031**	0.029**	0.028**
	(2.77)	(2.70)	(2.06)	(2.34)
Treatment×T(2)	0.035***	0.033***	0.037**	0.034**
	(3.20)	(2.83)	(2.63)	(2.47)
Treatment×T(3)	0.040***	0.038***	0.033**	0.030**
	(3.68)	(3.27)	(2.49)	(2.19)
Treatment×T(4)	0.039***	0.038***	0.032**	0.030**
	(4.10)	(3.10)	(2.67)	(2.49)
Treatment×T(>=5)	0.034***	0.031**	0.018	0.012
	(3.37)	(2.22)	(1.01)	(1.04)
Observations	55458	55458	55458	55458
Adj. R^2	0.3605	0.3673	0.4871	0.4943
Controls	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
State Fixed Effects		Yes		Yes

Table 3 Intensity of State Climate Adaptation Plans

This table presents the effect of intensity of state climate adaptation plans. The dependent variables are *Net Market Leverage* in columns (1)-(4) and *Net Book Leverage* in columns (5)-(8), respectively. *Treatment* is an indicator variable for firms headquartered in states that finalize climate adaptation plans. The control group includes firms headquartered in adjacent states without climate adaptation plans. *Post* is an indicator variable for the years after state climate adaptation plans are finalized. Following Ray and Grannis (2015), for each state with SCAPs, we count the total number of goals in each SCAP. We also follow Ray and Grannis (2015) to count the number of goals by each SCAP category: the Planning and Capacity Building category, the Law and Policy category, and the Monitoring Category. In the state-year that SCAPs are finalized, we take the natural logarithms of one plus number of goals (i.e. *Ln(Goals)*), and interact *Ln(Goals)* with *Treatment* and *Post* (i.e. *Treatment×Post×Ln(Goals)*). We set *Ln(Goals)* in the state-year without the finalized SCAPs as 0. We include industry, year, and state fixed effects as indicated and cluster standard errors at the state level. T-values are reported in parentheses below the coefficients. *, **, *** indicates statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Net Market Leverage				*Net Book Leverage*		
Treatment×Post×Ln(Goals)	0.007***	0.008***	0.009***	0.013***	0.005***	0.005***	0.006**	0.011***
	(4.51)	(4.54)	(4.79)	(5.21)	(2.81)	(2.80)	(2.66)	(4.99)
Treatment	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
Post (λ)	-0.018**	-0.018**	-0.016**	-0.005	-0.017**	-0.017**	-0.015*	-0.010
	(-2.26)	(-2.27)	(-2.10)	(-0.87)	(-2.16)	(-2.17)	(-1.84)	(-1.34)
SCAP Goals	All Goals	Planning	Law	Monitoring	All Goals	Planning	Law	Monitoring
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	55458	55458	55458	55458	55458	55458	55458	55458
Adj. R^2	0.3675	0.3676	0.3675	0.3675	0.4943	0.4943	0.4943	0.4944

Table 4 Climate Risk

This table presents analyses of how state climate adaptation plans affect the net leverage of firms as a function of climate risks in their headquarter states. *Treatment* is an indicator variable for firms headquartered in states that finalize climate adaptation plans. The control group includes firms headquartered in adjacent states without climate adaptation plans. *Post* is an indicator variable for the years after state climate adaptation plans are finalized. The dependent variables are *Net Market Leverage* and *Net Book Leverage*, respectively. *AQI* is the state median of the daily Air Quality Index (AQI) measure of all monitor sites for a state. We divide the sample into two groups, high AQI versus low AQI based on the median of the *AQI*. CO_2% is the industrial carbon dioxide emission in a given state divided by the U.S. total. We divide the sample into two groups, high CO2% emission versus low CO_2% emission based on the median of CO_2%. Hurricane Damage measures the damage to the crop loss caused by hurricanes in U.S. dollars aggregated at the state level for each year. We divide the sample into two groups, high hurricane damage versus low hurricane damage based on the median of hurricane damage. We include industry, year, and state fixed effects and cluster standard errors at the state level. T-values are reported in parentheses below the coefficients. *, **, *** indicates statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
	Net Market Leverage	*Net Book Leverage*	*Net Market Leverage*	*Net Book Leverage*
Panel A: Air Quality Index (AQI)	High		Low	
Treatment×*Post* (β)	0.036***	0.032**	0.015	0.010
	(3.54)	(2.55)	(1.18)	(0.97)
Post (λ)	-0.007	-0.013	-0.018*	-0.016
	(-0.55)	(-0.96)	(-1.83)	(-1.48)
Observations	27620	27620	27662	27662
Adj. R^2	0.3950	0.5178	0.3670	0.4827
Combined effect (β+λ)	0.029***	0.019	-0.003	0.006
P-Value of the Wald Test on β+λ=0	(0.0015)	(0.1892)	(0.6619)	(0.4134)
Panel B: CO_2% Emission	High		Low	
Treatment×*Post* (β)	0.041***	0.041***	0.014	0.002
	(3.50)	(3.08)	(1.08)	(0.16)
Post (λ)	-0.009	-0.013	-0.013	-0.014
	(-0.73)	(-1.10)	(-1.15)	(-1.10)
Observations	27376	27376	28072	28072
Adj. R^2	0.4089	0.5333	0.3615	0.4797
Combined effect (β+λ)	0.032***	0.028***	0.001	-0.012
P-Value of the Wald Test on β+λ=0	(0.0013)	(0.0070)	(0.8846)	(0.2536)
Panel C: Hurricane Damage	High		Low	
Treatment×*Post* (β)	0.056***	0.038***	0.019**	0.015
	(4.31)	(3.16)	(2.11)	(1.22)
Post (λ)	-0.031	-0.018	-0.005	-0.012
	(-1.61)	(-0.86)	(-0.66)	(-1.15)
Observations	13483	13483	41960	41960
Adj. R^2	0.3603	0.5114	0.3701	0.4887
Combined effect (β+λ)	0.025	0.020*	0.014	0.003
P-Value of the Wald Test on β+λ=0	(0.1422)	(0.0654)	(0.3166)	(0.7734)
Controls	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes

Table 5 Litigation Risk

This table presents analyses of how state climate adaptation plans affect the net leverage of firms as a function of a firm being exposed to litigation risk. *Treatment* is an indicator variable for firms headquartered in states that finalize climate adaptation plans. The control group includes firms headquartered in adjacent states without climate adaptation plans. *Post* is an indicator variable for the years after state climate adaptation plans are finalized. The dependent variables are *Net Market Leverage* and *Net Book Leverage*, respectively. We include industry, year, and state fixed effects and cluster standard errors at the state level. T-values are reported in parentheses below the coefficients. *, **, *** indicates statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
	Net Market Leverage	*Net Book Leverage*	*Net Market Leverage*	*Net Book Leverage*
	High Litigation Risk		Low Litigation Risk	
Treatment×*Post* (β)	0.052***	0.053***	0.011	-0.001
	(5.00)	(3.74)	(0.90)	(-0.10)
Post (λ)	-0.030**	-0.037**	-0.003	-0.002
	(-2.52)	(-2.71)	(-0.34)	(-0.18)
Observations	23565	23565	31892	31892
Adj. R^2	0.2842	0.4236	0.3502	0.4289
Combined effect (β+λ)	0.022**	0.016	0.008	-0.003
P-Value of the Wald Test on β+λ=0	(0.0226)	(0.3028)	(0.4348)	(0.7860)
Controls	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes

Table 6 Government Subsidies

This table presents analyses of how state climate adaptation plans affect the net leverage of firms as a function of the firm receiving government subsidies. *Treatment* is an indicator variable for firms headquartered in states that finalize climate adaptation plans. The control group includes firms headquartered in adjacent states without climate adaptation plans. *Post* is an indicator variable for the years after state climate adaptation plans are finalized. The dependent variables are *Net Market Leverage* and *Net Book Leverage,* respectively. We define our subsamples based on whether a firm receives any form of government subsidy in a given year. We include industry, year, and state fixed effects and cluster standard errors at the state level. T-values are reported in parentheses below the coefficients. *, **, *** indicates statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
	Net Market Leverage	*Net Book Leverage*	*Net Market Leverage*	*Net Book Leverage*
	Without Government Subsidy		With Government Subsidy	
Treatment×*Post* (β)	0.025**	0.018*	0.017	-0.008
	(2.40)	(1.71)	(1.63)	(-0.45)
Post (λ)	-0.009	-0.013	-0.003	0.009
	(-1.01)	(-1.45)	(-0.24)	(0.60)
Observations	49433	49433	5993	5993
Adj. R^2	0.3645	0.4883	0.5031	0.6009
Combined effect (β+λ)	0.016*	0.005	0.014	0.001
P-Value of the Wald Test on β+λ=0	(0.0703)	(0.6522)	(0.1463)	(0.9236)
Controls	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes

Table 7 Financial Constraints

This table presents analyses of how state climate adaptation plans affect the net leverage of firms as a function of firms' financial constraints. *Treatment* is an indicator variable for firms headquartered in states that finalize climate adaptation plans. The control group includes firms headquartered in adjacent states without climate adaptation plans. *Post* is an indicator variable for the years after state climate adaptation plans are finalized. The dependent variables are *Net Market Leverage* and *Net Book Leverage*, respectively. We divide the sample into two groups based on the median of the WW index, the SA index, and the KZ index, and the firm's credit rating status. We include industry, year, and state fixed effects and cluster standard errors at the state level. T-values are reported in parentheses below the coefficients. *, **, *** indicates statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
	Net Market Leverage	*Net Book Leverage*	*Net Market Leverage*	*Net Book Leverage*
	High WW Index		Low WW Index	
Treatment×*Post* (β)	0.041***	0.038**	0.009	-0.004
	(3.16)	(2.26)	(0.97)	(-0.43)
Post (λ)	-0.017	-0.025*	-0.007	-0.001
	(-1.57)	(-1.72)	(-0.86)	(-0.06)
Observations	28375	28375	24795	24795
Adj. R^2	0.3122	0.4327	0.3663	0.4525
Combined effect (β+λ)	0.024***	0.013	0.002	-0.005
P-Value of the Wald Test on β+λ=0	(0.0056)	(0.3933)	(0.7659)	(0.6741)
	High SA Index		Low SA Index	
Treatment×*Post* (β)	0.043***	0.037*	0.009	0.002
	(3.54)	(1.92)	(0.74)	(0.18)
Post (λ)	-0.024**	-0.029	-0.001	0.002
	(-2.04)	(-1.54)	(-0.09)	(0.17)
Observations	28383	28383	27064	27064
Adj. R^2	0.2973	0.4243	0.3529	0.4021
Combined effect (β+λ)	0.019***	0.008	0.008	0.004
P-Value of the Wald Test on β+λ=0	(0.0054)	(0.5504)	(0.4179)	(0.7348)
	High KZ Index		Low KZ Index	
Treatment×*Post* (β)	0.035***	0.024*	0.022*	0.021
	(3.24)	(1.70)	(1.82)	(1.66)
Post (λ)	-0.009	-0.006	-0.018*	-0.024**
	(-0.78)	(-0.46)	(-1.84)	(-2.43)
Observations	27660	27660	24329	24329
Adj. R^2	0.3901	0.5174	0.4124	0.5273
Combined effect (β+λ)	0.026***	0.018	0.004	-0.003
P-Value of the Wald Test on β+λ=0	(0.0036)	(0.1677)	(0.6775)	(0.8323)
	Without Credit Rating		With Credit Rating	
Treatment×*Post* (β)	0.035***	0.029**	0.006	-0.002
	(3.15)	(2.66)	(0.45)	(-0.13)
Post (λ)	-0.020**	-0.025***	0.016**	0.019*
	(-2.12)	(-2.75)	(2.56)	(1.94)
Observations	44650	44650	10795	10795
Adj. R^2	0.3182	0.4464	0.4826	0.5115
Combined effect (β+λ)	0.015*	0.004	0.022*	0.017
P-Value of the Wald Test on β+λ=0	(0.0671)	(0.1753)	(0.0671)	(0.7305)
Controls	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes

Table 8 Financial Mix

This table presents the impact of state climate adaptation plans on financial policies. *Treatment* is an indicator variable for firms headquartered in states that finalize climate adaptation plans. The control group includes firms headquartered in adjacent states without climate adaptation plans. *Post* is an indicator variable for the years after state climate adaptation plans are finalized. The dependent variables are *Cash*, *Net Equity Issue*, and *Net Debt Issue*, respectively. We include industry, year, and state fixed effects and cluster standard errors at the state level. T-values are reported in parentheses below the coefficients. *, **, *** indicates statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)
	Cash	*Net Equity Issue*	*Net Debt Issue*
Treatment×*Post* (β)	-0.010**	-0.032*	0.006**
	(-2.28)	(-1.98)	(2.38)
Post (λ)	0.015***	0.037*	-0.002
	(3.11)	(1.89)	(-0.46)
LnAssets	-0.005**	0.036***	0.002***
	(-2.08)	(9.41)	(3.04)
LnAge	-0.028***	-0.143***	-0.008***
	(-4.92)	(-9.82)	(-8.60)
MB	0.001***	-0.001***	0.000
	(7.08)	(-3.58)	(1.65)
Debt Ratio	-0.348***	-0.420***	0.236***
	(-23.49)	(-10.07)	(29.69)
ROA	-0.020***	-1.254***	-0.014***
	(-4.33)	(-39.31)	(-5.77)
Tangibility	-0.161***	0.775***	0.120***
	(-11.06)	(13.58)	(11.00)
Dividend Payer	-0.003	-0.016**	0.004*
	(-1.15)	(-2.24)	(1.87)
Modified Altman's Z	-0.001**	0.031***	-0.000
	(-2.18)	(23.18)	(-0.97)
R&D	0.264***	1.386***	0.023***
	(25.87)	(10.28)	(3.26)
State GDP Growth	0.097**	1.146***	-0.002
	(2.55)	(3.12)	(-0.05)
Blue	0.006	-0.007	0.009*
	(1.42)	(-0.63)	(1.77)
Industry Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes
Observations	55458	55458	55458
Adj. R^2	0.5365	0.6258	0.1377
Combined effect (β+λ)	0.005	0.005	0.004
P-Value of the Wald Test on β+λ=0	(0.2241)	(0.7341)	(0.1821)

Table 9 Long-Term vs. Short-Term Leverage

This table presents the impact of state climate adaptation plans on long-term versus short-term leverage. *Treatment* is an indicator variable for firms headquartered in states that finalize climate adaptation plans. The control group includes firms headquartered in adjacent states without climate adaptation plans. *Post* is an indicator variable for the years after state climate adaptation plans are finalized. The dependent variables are *Long-Term Market Leverage*, *Long-Term Book Leverage*, *Short-Term Market Leverage*, and *Short-Term Book Leverage*, respectively. We include industry, year, and state fixed effects as indicated and cluster standard errors at the state level. T-values are reported in parentheses below the coefficients. *, **, *** indicates statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Long-Term Market Leverage		*Long-Term Book Leverage*		*Short-Term Market Leverage*		*Short-Term Book Leverage*	
Treatment×Post (β)	0.015***	0.014**	0.009*	0.008	0.002	0.001	0.002	0.002
	(3.11)	(2.68)	(1.80)	(1.66)	(0.85)	(0.65)	(0.88)	(0.62)
Treatment	-0.020***	-	-0.020***	-	-0.002	-	-0.002	-
	(-4.58)	-	(-4.38)	-	(-0.83)	-	(-0.68)	-
Post (λ)	-0.010*	-0.006	-0.007	-0.003	0.000	0.001	0.002	0.003
	(-1.88)	(-1.43)	(-1.12)	(-0.57)	(0.01)	(0.47)	(0.82)	(1.13)
LnAssets	0.017***	0.017***	0.026***	0.026***	-0.004***	-0.004***	-0.005***	-0.005***
	(13.69)	(14.00)	(20.49)	(21.21)	(-15.68)	(-16.42)	(-15.78)	(-15.22)
LnAge	0.004	0.003	0.001	-0.001	0.002***	0.002***	0.002*	0.001*
	(1.44)	(1.06)	(0.14)	(-0.15)	(3.27)	(2.99)	(1.98)	(1.77)
MB	-0.001***	-0.001***	0.002***	0.002***	-0.000***	-0.000***	0.001***	0.001***
	(-4.29)	(-4.17)	(12.81)	(12.72)	(-10.72)	(-10.63)	(9.13)	(8.94)
ROA	0.003*	0.003*	0.015***	0.015***	-0.000	-0.000	-0.002**	-0.002**
	(1.77)	(1.81)	(7.30)	(7.27)	(-0.28)	(-0.14)	(-2.19)	(-2.11)
Tangibility	0.073***	0.073***	0.110***	0.110***	0.004*	0.004**	0.012***	0.013***
	(11.85)	(12.03)	(16.39)	(16.53)	(1.83)	(2.21)	(5.13)	(5.43)
Dividend Payer	-0.053***	-0.054***	-0.048***	-0.049***	-0.014***	-0.014***	-0.012***	-0.012***
	(-9.31)	(-9.72)	(-9.59)	(-9.99)	(-9.57)	(-9.26)	(-6.79)	(-6.59)
Modified Altman's Z	-0.002***	-0.002***	-0.002***	-0.003***	-0.000	-0.000	-0.000**	-0.000**
	(-12.11)	(-12.74)	(-19.40)	(-18.87)	(-0.46)	(-0.61)	(-2.62)	(-2.69)
R&D	-0.074***	-0.072***	-0.081***	-0.078***	-0.027***	-0.027***	-0.040***	-0.039***
	(-10.39)	(-10.03)	(-11.91)	(-11.60)	(-8.61)	(-8.62)	(-8.44)	(-8.86)
State GDP Growth	-0.176***	-0.071*	-0.143***	-0.029	-0.028*	-0.021	-0.021	-0.019
	(-4.03)	(-1.77)	(-4.14)	(-0.91)	(-2.03)	(-1.47)	(-1.10)	(-0.97)
Blue	-0.013***	-0.002	-0.015***	-0.002	-0.002	-0.004***	-0.002	-0.005**

	(-4.05)	(-0.71)	(-3.57)	(-0.67)	(-0.95)	(-3.00)	(-1.04)	(-2.37)
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects		Yes		Yes		Yes		Yes
Observations	55458	55458	55458	55458	55458	55458	55458	55458
Adj. R^2	0.3526	0.3577	0.3430	0.3478	0.1553	0.1574	0.1359	0.1377
Combined effect ($\beta+\lambda$)	0.005	0.008*	0.002	0.005	0.002	0.002	0.004*	0.005**
P-Value of the Wald Test on $\beta+\lambda=0$	(0.2069)	(0.0958)	(0.6773)	(0.2527)	(0.3180)	(0.1723)	(0.0520)	(0.0440)

Table 10 Debt Maturity Structure

This table presents the impact of state climate adaptation plans on debt maturity structure. *Treatment* is an indicator variable for firms headquartered in states that finalize climate adaptation plans. The control group includes firms headquartered in adjacent states without climate adaptation plans. *Post* is an indicator variable for the years after state climate adaptation plans are finalized. The dependent variables are *STNP*, *ST1*, *ST2*, *ST3*, *ST4*, and *ST5*, respectively. We include industry, year, and state fixed effects and cluster standard errors at the state level. T-values are reported in parentheses below the coefficients. *, **, *** indicates statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	STNP	*ST1*	*ST2*	*ST3*	*ST4*	*ST5*
Treatment×Post (β)	-0.022**	-0.020**	-0.021*	-0.024**	-0.023**	-0.021**
	(-2.20)	(-2.05)	(-1.82)	(-2.13)	(-2.24)	(-2.48)
Post (λ)	0.009	0.013	0.014	0.016	0.013	0.009
	(0.95)	(1.03)	(1.02)	(1.21)	(1.03)	(1.02)
LnAssets	-0.026***	-0.061***	-0.074***	-0.075***	-0.067***	-0.062***
	(-30.61)	(-27.19)	(-41.27)	(-52.84)	(-46.47)	(-40.37)
LnAge	-0.010*	-0.008	-0.006	-0.003	-0.001	-0.005
	(-1.74)	(-1.02)	(-0.74)	(-0.37)	(-0.20)	(-0.82)
MB	-0.001***	-0.001***	-0.001***	-0.002***	-0.002***	-0.002***
	(-7.99)	(-3.12)	(-6.43)	(-8.22)	(-8.43)	(-7.90)
ROA	0.015***	-0.036***	-0.030***	-0.026***	-0.020***	-0.017***
	(3.65)	(-4.85)	(-4.49)	(-3.91)	(-3.50)	(-2.84)
Tangibility	-0.082***	-0.150***	-0.155***	-0.140***	-0.127***	-0.100***
	(-13.66)	(-14.18)	(-14.43)	(-11.82)	(-11.73)	(-9.19)
Dividend Payer	0.004	0.025**	0.028***	0.027***	0.022***	0.016**
	(0.73)	(2.66)	(3.32)	(3.38)	(2.78)	(2.20)
Modified Altman's Z	-0.000	-0.001	0.001	0.002***	0.003***	0.002***
	(-0.05)	(-1.34)	(1.02)	(3.48)	(4.83)	(3.47)
R&D	0.190***	0.012	0.077***	0.083***	0.059**	0.071***
	(11.05)	(0.53)	(3.60)	(3.67)	(2.70)	(3.10)
State GDP Growth	-0.010	-0.108	-0.063	-0.018	0.002	-0.050
	(-0.24)	(-1.11)	(-0.70)	(-0.17)	(0.02)	(-0.57)
Blue	0.006	-0.003	-0.001	-0.008	-0.004	-0.004
	(1.02)	(-0.31)	(-0.12)	(-0.94)	(-0.46)	(-0.51)
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	42916	42916	42916	42916	42916	42916
Adj. R^2	0.1408	0.2666	0.2911	0.2668	0.2172	0.1953
Combined effect (β+λ)	-0.013	-0.007	-0.007	-0.008	-0.010	-0.012
P-Value of the Wald Test on β+λ=0	(0.2421)	(0.4494)	(0.6070)	(0.4966)	(0.3885)	(0.1774)

Appendix A1 Variable List

Variable	Description
Firm-level characteristics	
Net Market Leverage	The book value of total long-term debt plus total debt in current liabilities minus cash and short-term investments divided by the market value of total assets.
Net Book Leverage	The book value of total long-term debt plus total debt in current liabilities minus cash and short-term investments scaled by the book value of total assets.
Long-Term Book Leverage	Total long-term debt scaled by the book value of total assets.
Long-Term Market Leverage	Total long-term debt divided by the market value of total assets.
Short-Term Book Leverage	Total debt in current liabilities scaled by the book value of total assets.
Short-Term Market Leverage	Total debt in current liabilities divided by the market value of total assets.
Assets	The book value of total assets ($million).
LnAssets	The natural logarithm of the book value of total assets.
Age	The number of years from the first fiscal year of available accounting data.
LnAge	The natural logarithm of the number of years from the first fiscal year of available accounting data
MB	The market value of equity divided by the book value of equity.
ROA	Net operating income scaled by beginning-period total assets.
Tangibility	Net property, plant, and equipment divided by beginning-period total assets.
Dividend Payer	An indicator variable which is one if a firm pays an ordinary dividend in year t, and zero otherwise.
Modified Altman's Z	The modified Altman's (1968) Z-score = 1.2(working capital/total assets) + 1.4(retained earnings/total assets) + 3.3(EBIT/total assets) + 0.999(sales/total assets).
R&D	Research and development expenses scaled by beginning-period total assets. We replace missing research and development expense with zero.
Debt Ratio	The book value of total long-term debt plus total debt in current liabilities scaled by the book value of total assets.
Government Subsidy	An indicator variable on whether a firm is a subsidy recipient based on data from GJF's *Subsidy Tracker*.
Single State	An indicator variable on whether a firm operates in a single state or multiple states.
Investment	Capital expenditures scaled by beginning-period total assets.
WW	The WW index is computed as -0.091*(cash and short-term investments/total assets) - 0.062*(dividend payer) + 0.021*(total long-term debt/total assets) - 0.044*(LnAssets)+ 0.102*(Industry Sales Growth) - 0.035*(Sales Growth) following Whited and Wu (2006).
SA	The SA index is calculated as (-0.737* WSIZE) + (0.043* WSIZE*WSIZE) - (0.040*WAGE) following Hadlock and Pierce (2010).
KZ	The KZ index is constructed as -1.0019099*(IB+DP)/LPPENT + 0.2826389*(AT + PRCC_F*CSHO - CEQ - TXDB)/AT +

	3.139193*(DLTT + DLC)/(DLTT+ DLC + SEQ) - 39.3678*(DVC+DVP)/LPPENT - 1.314759*CHE/LPPENT following Kaplan and Zingales (1997).
Credit Rating	An indicator variable for a firm with a long-term S&P credit rating from Compustat.
Litigation	An indicator variable for firms with the four-digit SIC code: 2833 to 2836, 3570 to 3577, 3600 to 3674, 5200 to 5961, to 7374 and 8731 to 8734.
STNP	Total debt in current liabilities minus the current proportion of long-term debt divided by total debt. Missing input values are replaced with zero.
ST1	Total debt in current liabilities divided by total debt. Missing input values are replaced with zero.
ST2	Total debt in current liabilities plus debt maturing in two years divided by total debt. Missing input values are replaced with zero.
ST3	Total debt in current liabilities plus debt maturing in two and three years divided by total debt. Missing input values are replaced with zero.
ST4	Total debt in current liabilities plus debt maturing in two, three, and four years divided by total debt. Missing input values are replaced with zero.
ST5	Total debt in current liabilities plus debt maturing in two, three, four, and five years divided by total debt. Missing input values are replaced with zero.
State-level Characteristics	
State GDP Growth	The annual GDP growth rate at the state level. The data source is the US Bureau of Economic Analysis (BEA).
Blue	An indicator variable for states where the majority of the votes belong to a Democratic candidate during the presidential election.
AQI	The median of the daily air quality index reported by all air quality monitor sites for a given state in year t. The data is provided by the United States Environmental Protection Agency at https://www.epa.gov/outdoor-air-quality-data.
CO_2 Emission	The total industrial carbon dioxide emission in million metric tons for a given state in year t. The data is reported by the U.S. energy information administration at https://www.eia.gov/environment/emissions/state/.
CO_2%	The total industrial carbon dioxide emission in a given state scaled by the U.S. total for year t.
FedEnviLegislation	An indicator variable that is equal to one for year t+1 to year t+5 if environmental bills introduced by politicians representing a firm's home state become laws in year t, and zero otherwise.
Hurricane Damage	Damage to the crop caused by hurricanes in U.S. dollars aggregated at the state level for each year.

Appendix A2 State Climate Adaptation Plans

The information on state climate adaptation plans is compiled by the Georgetown Climate Center at https://www.georgetownclimate.org/adaptation/plans.html. In our final sample, AK is not counted due to the lack of neighboring states. In our final sample, ME is also not included because the only neighboring state of ME, NH, also finalized SCAP in our sample period. Therefore, ME has no control state and is disqualified from entering our sample.

State Abbreviated	Year Plan Initiated	Year Plan Finalized
AK	2007	27-Jan-2010
CA	2008	30-Sep-2009
CO	2008	5-Nov-2011
CT	2008	15-Jul-2013
DE	2013	2-Mar-2015
FL	2007	15-Oct-2008
ME	2009	5-Feb-2010
MD	2007	31-Jul-2008
MA	2008	27-Sep-2011
NH	2007	25-Mar-2009
NY	2009	9-Nov-2010
OR	2009	2-Dec-2010
PA	2008	1-Jan-2011
VA	2007	15-Dec-2008
WA	2009	30-Apr-2012

Appendix A3.1 Matched Sample

This table presents matched sample results. *Treatment* is an indicator variable for firms headquartered in states that finalize climate adaptation plans. The control group includes firms headquartered in adjacent states without climate adaptation plans. We also require the treatment and the control firms to be in the same 2-digit SIC industry and in the same tercile of the following characteristics: assets, market-to-book ratio, firm age, R&D expenses scaled by assets, ROA, and leverage in the year prior to the finalization of state climate adaptation plans. *Post* is an indicator variable for the years after state climate adaptation plans are finalized. The dependent variables are *Net Market Leverage* and *Net Book Leverage*, respectively. In Panel A, we present diagnostic statistics that compare the mean-value differences between treatment and control firms in the year prior to the finalization of state climate adaptation plans. In Panel B, we present the DID regression analysis results based on the matched sample. We include industry, year, and state fixed effects and cluster standard errors at the state level. T-values are reported in parentheses below the coefficients. *, **, *** indicates statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Comparison of the Matched Treatment and Control Group

	Treatment (*Mean Value*)	*Control* (*Mean Value*)	Difference (*Treatment* minus *Control*)	P-value of the Difference
Net Market Leverage	-0.003	-0.011	0.009	0.771
Net Book Leverage	-0.059	-0.037	0.023	0.544
LnAssets	5.895	5.509	0.386	0.128
LnAge	2.934	2.875	0.058	0.422
MB	3.749	3.797	-0.048	0.935
ROA	-0.016	0.012	-0.028	0.451
Tangibility	0.189	0.225	-0.036	0.147
Dividend Payer	0.306	0.315	-0.010	0.835
Modified Altman's Z	-1.159	-0.135	-1.023	0.161
R&D	0.087	0.073	0.014	0.395

Panel B: Regression Analysis

	(1)	(2)
*Treatment*Post* (β)	0.039*	0.053*
	(1.85)	(1.96)
Treatment	-0.032	-0.069
	(-0.82)	(-0.95)
Post (λ)	-0.043***	-0.030
	(-2.92)	(-1.63)
Observations	5335	5335
Adj. R^2	0.0036	0.0058
Combined effect (β+λ)	-0.004	0.023
P-Value of the Wald Test on β+λ=0	(0.8263)	(0.2732)

Appendix A3.2 Placebo Tests

This table presents placebo tests. *Treatment* is an indicator variable for firms headquartered in states that finalize climate adaptation plans. The control group includes firms headquartered in adjacent states without climate adaptation plans. Post is an indicator variable for the years after state climate adaptation plans are finalized. To perform placebo tests, we randomly assign firms into "pseudo-treatment" and "pseudo-control" subgroups. We define *Pseudo-Treat* as an indicator variable that equals one is a firm is assigned into "pseudo-treatment" subgroup, and zero if a firm is assigned into "pseudo-control" subgroup. We also randomly assign each calendar year into "pseudo-post" and "pseudo-pre" subgroups. We define *Pseudo-Post* as an indicator variable that equals one is a year is assigned into "pseudo- post" subgroup, and zero if a year is assigned into "pseudo-pre" subgroup. The dependent variables are *Net Market Leverage* and *Net Book Leverage*, respectively. We include industry, year, and state fixed effects and cluster standard errors at the state level. T-values are reported in parentheses below the coefficients. *, **, *** indicates statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
	Net Market Leverage		*Net Book Leverage*	
*Treatment*Pseudo-Post*	0.005		0.004	
	(1.08)		(0.90)	
Pseudo-Post	-0.003		-0.007	
	(-0.65)		(-1.62)	
*Pseudo-Treatment*Post*		0.007		0.003
		(1.27)		(0.37)
Pseudo-Treatment		-0.004		-0.003
		(-1.37)		(-0.81)
Post		0.002		-0.002
		(0.22)		(-0.17)
Observations	55458	55458	55458	55458
Adj. R^2	0.3669	0.3669	0.4942	0.4942
Controls	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes

Appendix A3.3 Confounding Events

This table presents analyses controlling for the financial crisis and federal environmental legislation. *Treatment* is an indicator variable for firms headquartered in states that finalize climate adaptation plans. The control group includes firms headquartered in adjacent states without climate adaptation plans. *Post* is an indicator variable for the years after state climate adaptation plans are finalized. The dependent variables are *Net Market Leverage* and *Net Book Leverage*, respectively. We add an indicator variable for the 2007-2008 financial crisis (*Crisis*) in Columns (1) and (2), and federal environmental legislation introduced by home-state politicians (*FedEnviLegislation*) in Columns (3) and (4). We include industry, year, and state fixed effects and cluster standard errors at the state level. T-values are reported in parentheses below the coefficients. *, **, *** indicates statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
	Net Market Leverage	*Net Book Leverage*	*Net Market Leverage*	*Net Book Leverage*
*Treatment*Post* (β)	0.030***	0.022**	0.029***	0.022**
	(3.01)	(2.21)	(2.95)	(2.20)
Post (λ)	-0.014*	-0.015*	-0.013*	-0.015*
	(-1.80)	(-1.86)	(-1.77)	(-1.88)
LnAssets	0.027***	0.035***	0.027***	0.035***
	(12.46)	(9.77)	(12.46)	(9.77)
LnAge	0.004	0.027**	0.004	0.027**
	(0.69)	(2.73)	(0.69)	(2.73)
MB	0.003***	0.003***	0.003***	0.003***
	(8.07)	(11.81)	(8.07)	(11.81)
ROA	0.021***	0.034***	0.021***	0.034***
	(4.32)	(6.96)	(4.29)	(6.92)
Tangibility	0.209***	0.313***	0.209***	0.313***
	(15.71)	(14.75)	(15.73)	(14.76)
Dividend Payer	-0.061***	-0.068***	-0.061***	-0.068***
	(-8.47)	(-8.26)	(-8.46)	(-8.25)
Modified Altman's Z	-0.002**	-0.003***	-0.002**	-0.003***
	(-2.62)	(-6.62)	(-2.62)	(-6.62)
R&D	-0.070***	-0.408***	-0.071***	-0.408***
	(-3.27)	(-24.44)	(-3.27)	(-24.42)
State GDP Growth	-0.108**	-0.164**	-0.101**	-0.164**
	(-2.05)	(-2.24)	(-2.05)	(-2.18)
Blue	-0.017***	-0.014*	-0.018**	-0.014*
	(-2.79)	(-1.99)	(-2.73)	(-1.89)
Crisis	0.009	0.004	0.009	0.004
	(1.27)	(0.50)	(1.21)	(0.49)
FedEnviLegislation			0.004	0.000
			(1.14)	(0.03)
Industry Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes
Observations	55458	55458	55458	55458
Adj. R^2	0.3673	0.4943	0.3673	0.4943
Combined effect (β+λ)	0.016**	0.007	0.016**	0.007
P-Value of the Wald Test on β+λ=0	(0.0422)	(0.5408)	(0.023)	(0.5441)

Appendix A3.4 Predicting State Climate Adaptation Plans

This table presents the Cox proportional hazard model that predicts the adoption of the State Climate Adaptation Plans. The sample is constructed using the full Compustat sample over the period 1998 to 2016 and aggregated at the state-year level. The dependent variable is an indicator variable, which is one for states that adopt a State Climate Adaptation Plan in year t and zero otherwise. State-year observations are excluded from the sample after a state adopts the State Climate Adaptation Plan. Independent variables are one-year lagged variables. *STYR_NML* is the state-year median of the firm-level *Net Market Leverage*. *STYR_MTOB* is the state-year median of the firm-level *Market-to-Book-Ratio*. *Unemployment* is the annual average of the monthly unemployment rate from the Department of Labor. *LnStatePopulation* is the natural logarithm of the state-level population from the National Cancer Institute. *State_GDP_Growth* is the state-level GDP growth rate. Continuous variables are winsorized and standardized to have a mean of zero and a variance of 1. We report z-values next to hazard ratios. *, **, *** indicates statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
Variables	Coefficients	*z*-value	Coefficients	*z*-value
STYR_NML	0.526	-1.68		
STYR_NBL			0.509	-1.05
STYR_*MTOB*	0.940	-0.21	0.509	-1.05
Unemployment	1.283	0.64	0.903	-0.37
LnStatePopulation	0.569	-1.61	1.267	0.57
State GDP Growth	1.864	1.55	0.580	-1.57
N		698		698
ln L		-51.82		-52.07
Chi-squared		12.40		9.65

Appendix A3.5 Eliminating the Years between Initiation and Finalization of State Climate Adaptation Plans

This table presents the results based on baseline models specifications, while eliminating the years between initiation and finalization of state climate adaptation plans. *Treatment* is an indicator variable for firms headquartered in states that finalize climate adaptation plans. The control group includes firms headquartered in adjacent states without climate adaptation plans. *Post* is an indicator variable for the years after state climate adaptation plans are finalized. The dependent variables are *Net Market Leverage* and *Net Book Leverage*, respectively. We include industry, year, and state fixed effects and cluster standard errors at the state level. T-values are reported in parentheses below the coefficients. *, **, *** indicates statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
	Net Market Leverage		*Net Book Leverage*	
*Treatment**Post* (β)	0.035***	0.031***	0.028***	0.023**
	(3.86)	(3.00)	(2.74)	(2.18)
Treatment	-0.031***	-	-0.042***	-
	(-3.32)	-	(-3.41)	-
Post (λ)	-0.020	-0.014	-0.031	-0.032
	(-0.94)	(-0.87)	(-1.16)	(-1.58)
Observations	51292	51292	51292	51292
Adj. R^2	0.3609	0.3674	0.4873	0.4942
Combined effect (β+λ)	0.015	0.017	-0.003	-0.009
P-Value of the Wald Test on β+λ=0	(0.4258)	(0.2748)	(0.8916)	(0.6537)
Controls	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
State Fixed Effects		Yes		Yes

Appendix A3.6 Shorter Time Windows

This table presents the results based on baseline model specifications, while using different event windows. *Treatment* is an indicator variable for firms headquartered in states that finalize climate adaptation plans. The control group includes firms headquartered in adjacent states without climate adaptation plans. *Post* is an indicator variable for the years after state climate adaptation plans are finalized. The dependent variables are *Net Market Leverage* and *Net Book Leverage*, respectively. In Columns (1) and (2), we restrict our sample to (-3, +3) years around the year of state climate adaptation plan finalization. In Columns (3) and (4), we restrict our sample to (-5, +5) years around the year of state climate adaptation plan finalization. We include industry, year, and state fixed effects and cluster standard errors at the state level. T-values are reported in parentheses below the coefficients. *, **, *** indicates statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
	(-3,+3) Years around SCAP finalization		(-5,+5) Years around SCAP finalization	
	Net Market Leverage	*Net Book Leverage*	*Net Market Leverage*	*Net Book Leverage*
*Treatment*Post* (β)	0.018**	0.022**	0.019**	0.021**
	(2.21)	(2.12)	(2.70)	(2.31)
Post (λ)	-0.007	-0.023**	-0.010	-0.022***
	(-0.85)	(-2.09)	(-1.48)	(-2.78)
Observations	23946	23946	31355	31355
Adj. R^2	0.3985	0.5062	0.3964	0.5134
Combined effect (β+λ)	0.011	-0.001	0.009	-0.001
P-Value of the Wald Test on β+λ=0	(0.1573)	(0.9430)	(0.2101)	(0.8357)
Controls	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes

Appendix A3.7 Geographical Dispersion

This table presents analyses of how state climate adaptation plans affect the net leverage of firms as a function of firms' geographical dispersion. *Treatment* is an indicator variable for firms headquartered in states that finalize climate adaptation plans. The control group includes firms headquartered in adjacent states without climate adaptation plans. *Post* is an indicator variable for the years after state climate adaptation plans are finalized. The dependent variables are *Net Market Leverage* and *Net Book Leverage*, respectively. We define our subsamples based on whether a firm conducts business in a single state or multiple states. We include industry, year, and state fixed effects and cluster standard errors at the state level. T-values are reported in parentheses below the coefficients. *, **, *** indicates statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
	Net Market Leverage	*Net Book Leverage*	*Net Market Leverage*	*Net Book Leverage*
	Single State		Multiple States	
*Treatment*Post* (β)	0.033**	0.036**	0.027***	0.018*
	(2.32)	(2.29)	(3.29)	(1.91)
Post (λ)	-0.019	-0.024*	-0.006	-0.005
	(-1.68)	(-1.90)	(-0.62)	(-0.59)
Observations	27728	27728	23359	23359
Adj. R^2	0.3379	0.4663	0.3967	0.4945
Combined effect (β+λ)	0.014	0.012	0.021**	0.013
P-Value of the Wald Test on β+λ=0	(0.2589)	(0.4048)	(0.0191)	(0.2045)
Controls	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes

Appendix A3.8 Alternative Clustering

This table presents the results based on baseline models specifications, while standard errors are clustered differently. In Panel A, standard errors are clustered at the firm level. In Panel B, standard errors are double-clustered at the state and year level. *Treatment* is an indicator variable for firms headquartered in states that finalize climate adaptation plans. The control group includes firms headquartered in adjacent states without climate adaptation plans. *Post* is an indicator variable for the years after state climate adaptation plans are finalized. The dependent variables are *Net Market Leverage* and *Net Book Leverage,*. We include industry, year, and state fixed effects. T-values are reported in parentheses below the coefficients. *, **, *** indicates statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Firm Cluster

	(1)	(2)	(3)	(4)
	Net Market Leverage	*Net Market Leverage*	*Net Book Leverage*	*Net Book Leverage*
*Treatment*Post* (β)	0.033***	0.030***	0.026***	0.022**
	(4.47)	(4.05)	(2.68)	(2.26)
Treatment	-0.031***	-	-0.042***	-
	(-4.85)	-	(-5.31)	-
Post (λ)	-0.017**	-0.014*	-0.018*	-0.015
	(-2.02)	(-1.75)	(-1.72)	(-1.57)
Observations	55458	55458	55458	55458
Adj. R^2	0.3605	0.3673	0.4871	0.4943
Combined effect (β+λ)	0.016**	0.016**	0.008	0.007
P-Value of the Wald Test on β+λ=0	(0.0268)	(0.0149)	(0.3841)	(0.4345)
Controls	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
State Fixed Effects		Yes		Yes
Cluster	Firm	Firm	Firm	Firm

Panel B: State and Year Double Cluster

	(1)	(2)	(3)	(4)
	Net Market Leverage	*Net Market Leverage*	*Net Book Leverage*	*Net Book Leverage*
*Treatment*Post* (β)	0.033***	0.030**	0.026***	0.022*
	(3.35)	(2.58)	(2.98)	(1.91)
Treatment	-0.031***	-	-0.042***	-
	(-3.27)	-	(-3.46)	-
Post (λ)	-0.017	-0.014**	-0.018	-0.015**
	(-1.66)	(-2.19)	(-1.23)	(-2.10)
Observations	55458	55458	55458	55458
Adj. R^2	0.3605	0.3673	0.4871	0.4943
Combined effect (β+λ)	0.016**	0.016**	0.008	0.007
P-Value of the Wald Test on β+λ=0	(0.0329)	(0.0262)	(0.5533)	(0.5129)
Controls	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
State Fixed Effects		Yes		Yes
Cluster	State and Year	State and Year	State and Year	State and Year