Climate Risk and Corporate Investment: Transmission Mechanisms and Heterogeneous Effects

This version: April 1, 2026

Abstract

We document a time-varying relationship between aggregate climate risk and corporate investment. Prior to the release of the Stern Review in 2006, increases in climate risk are associated with reductions in capital expenditures. This effect is driven by higher cost of capital and amplified by financial frictions, consistent with real-options theory in which climate risk is perceived as a source of uncertainty. After 2006, the negative relationship disappears as climate issues gain salience and stakeholder pressure becomes the dominant mechanism. In this period, carbon-intensive firms reduce investment less and lower emissions through capital reallocation. We further show that firm-specific climate risk interacts with aggregate climate shocks and attenuates their negative effect on investment.

JEL classification: G14, G31, Q54

Keywords: Climate Change Risk, Corporate Investment, Market Awareness, Stakeholder Pressure

1 Introduction

While much of the academic research has investigated the role of economic uncertainty on corporate investment (Baker et al., 2016; Gulen and Ion, 2016), significantly less work has been done to quantify the effect of climate change on corporate decision-making. Using the Climate Change News index (CCN) introduced by Engle et al. (2020) as our main measure of aggregate climate risk,[1] we aim to answer the following key questions: do economy-wide fluctuations in climate risk affect corporate investment behavior after controlling for economic uncertainty? If so, through which channels does climate risk affect investment decisions? Does the impact of aggregate climate risk differ from that of firm-specific climate risk exposure? Does increased market attention on climate change alter the way climate risk impacts firm investment, and does the effect differ across firms depending on their environmental profile?

Addressing these questions is very important given the existing body of theoretical research highlighting the different characteristics of climate risk relative to economic uncertainty. In particular, theoretical models in the climate-finance literature treat climate-related risks as distinct from standard macroeconomic uncertainty. For example, Bansal and Ochoa (2011*a*) and Bansal et al. (2016) incorporate climate risk within a long-run risk framework in which economic uncertainty enters as a separate risk factor. In these models, climate risks arise from environmental shocks such as natural disasters and temperature dynamics, generating long-run risks to economic growth and asset valuations that are distinct from conventional economic uncertainty.

These features imply that climate risk combines both physical risks, arising from environmental shocks that affect production and supply chains, and transition risks, stemming from regulatory changes, technological shifts, and evolving investor preferences toward low-carbon assets. Moreover, climate-related investments often involve large, irreversible expenditures in long-lived capital assets whose value may be affected by future policy regimes, increasing the risk of asset stranding. In such settings, real-options theory predicts that higher uncertainty raises the value of waiting and can delay investment (Bernanke, 1983; Bloom, 2009). At the same time, the anticipation of stricter

[1] Unless otherwise stated, "climate risk" (or "climate change risk") refers to aggregate, market-wide climate risk in our empirical analysis, proxied by CCN. When discussing prior literature or theoretical mechanisms, the term may be used more broadly. References to firm-level climate risk or climate exposure measures are explicitly identified. Although CCN reflects media attention, prior research shows that it captures climate risk perceptions priced in financial markets (Engle et al., 2020; Huynh and Xia, 2021; Ilhan et al., 2021), making it a suitable proxy for aggregate climate risk.

environmental regulation or technological transition can induce firms to adjust investment strategies proactively. Theoretical models of directed technical change and environmental policy show that expectations of future climate regulation can shift firms' incentives toward cleaner technologies and accelerate investment in low-carbon capital (Acemoglu et al., 2012; Aghion et al., 2016).

Taken together, climate risk generates two opposing forces: while higher uncertainty discourages investment through the option value of waiting, rising transition risk and stakeholder pressure increase the expected costs of inaction and may encourage firms—particularly carbon-intensive ones—to adjust their capital allocation. As a result, the net impact of climate risk on corporate investment may be time-varying, depending on the relative strength of these forces and the degree of market attention and regulatory salience surrounding climate issues. Our empirical framework examines these competing forces by identifying three main channels through which climate risk affects corporate investment decisions: a cost-of-capital channel, whereby firms more exposed to climate risk face higher financing costs; a financial-frictions channel, whereby constrained firms are more sensitive to these costs; and a stakeholder-pressure channel, whereby heightened climate salience and regulatory expectations mitigate the incentive to postpone investment, particularly among brown firms.

The interaction of these mechanisms can be summarized by expressing the marginal effect of climate risk on investment as the sum of two opposing forces as:

$$\frac{\partial \text{Investment}_{i,t+1}}{\partial \text{CR}_t} = -\phi_0 \left(1 + \lambda \text{FF}_{i,t}\right) + \psi_0 \left(1 + \kappa \text{SP}_i \, \text{Salience}_t\right) \tag{1}$$

where $\text{Investment}_{i,t+1}$ denotes future corporate investment for firm i at time $t+1$, CR_t represents aggregate climate risk at time t (e.g., CCN index), $\text{FF}_{i,t}$ captures firm-level financial frictions for firm i at time t, SP_i measures firm i's exposure to stakeholder pressure, Salience_t captures the salience of climate issues at time t. ϕ_0 and ψ_0, which are both non-negative, represent the impact of the cost-of-capital (or discount rate) channel and the stakeholder pressure (or strategic adjustment) channel, respectively. Overall, climate risk raises firms' cost of capital, discouraging investment, and this effect can be amplified by financial frictions (first term on the right-hand side of (1)). At the same time, stakeholder pressure and strategic transition incentives (second term on the right-hand side of the same equation) may offset the discouraging effect of higher financing

costs.

The time-varying nature of these forces suggests that the investment response to climate risk may depend on the degree of market attention and stakeholder pressure surrounding climate issues. The release of the Stern Review in 2006 (Stern, 2008) represents a natural setting to examine this mechanism. By highlighting the macroeconomic costs of climate inaction, the report substantially increases global attention to climate change and the likelihood of future climate policy, allowing us to test whether the relationship between climate risk and corporate investment changes when climate issues become more salient.

Our paper contributes to the climate-finance literature in three ways. First, we show that the relationship between climate risk and corporate investment is time-varying. Second, we identify the mechanisms through which climate risk affects investment, highlighting the roles of the cost of capital, financial frictions, and stakeholder pressure. Third, by focusing on aggregate climate risk shocks, we show how economy-wide changes in climate risk perceptions translate into corporate investment decisions. Importantly, we find that firm-specific climate risk exposure interacts with these aggregate shocks and attenuates their negative impact on investment, highlighting the complementary roles of aggregate and firm-level climate risk measures.

Our baseline results show that aggregate climate risk has a negative and persistent impact on corporate investment. A one-standard-deviation increase in CCN reduces capital expenditures in the following quarter by about 8.27% relative to the average investment rate, and this effect is substantially larger than that of economic policy uncertainty. Moreover, the impact of climate risk is highly persistent, remaining significant for several years.

Next, we examine the role of our three main potential mechanisms to explain the negative relationship between climate risk and corporate investment. We first show that firms more exposed to climate risk earn higher returns, implying a higher cost of equity that raises the hurdle rate for new investment and, in turn, discourages investment. We then show that financial frictions amplify this effect: financially constrained firms are more likely to delay investment when climate risk increases. Finally, we show that stronger regulatory and stakeholder pressure mitigates the negative investment response to climate risk.

To further investigate the stakeholder-pressure mechanism, we examine how the salience of climate risk influences corporate investment decisions by exploiting the release of the Stern Review

in 2006 as a quasi-natural experiment. The Stern Review represents a major policy information shock by formally framing climate change as a significant global economic risk and emphasizing that the economic costs of inaction substantially exceeded the costs of mitigation. By highlighting the macroeconomic consequences of climate inaction, the report significantly increases the attention paid by policymakers, investors, and the media to climate-related risks. This setting allows us to examine whether firms adjust their investment behavior when climate risks become more salient. Using firm-level carbon emissions data from Trucost and environmental scores from the MSCI ESG database, we find that carbon-intensive firms and firms with low environmental scores (i.e., brown firms) reduce investment significantly less than greener firms when climate risk increases in the period following the Stern Review. Importantly, this relative resilience in capital expenditures is accompanied by reductions in emission intensity, suggesting that brown firms reallocate capital toward cleaner production processes. Our evidence further indicates that this pattern is not driven by improvements in financing conditions; rather, it reflects increased stakeholder pressure, which becomes stronger when climate issues receive greater public and market attention. Taken together, these findings suggest that the effect of climate risk on corporate investment evolves as climate issues become more salient. While climate risk initially discourages investment through higher financing costs and uncertainty, greater climate awareness strengthens stakeholder pressure on carbon-intensive firms, encouraging them to adjust their investment strategies and reduce emissions.

Finally, we show that aggregate climate risk captures a different dimension of climate exposure than firm-specific measures. While aggregate climate shocks negatively affect corporate investment over long horizons, firm-specific climate risk exposure predicts higher investment over shorter horizons. Moreover, firms with greater exposure to firm-level climate risk are less sensitive to aggregate climate shocks, suggesting that firm-specific exposure attenuates the negative investment response to aggregate climate risk.

We conduct various robustness tests to validate our main findings. Our results remain consistent when studying investment irreversibility as well as when adopting alternative measures of climate risk that are directly linked to the real economy and cover an extended and more recent sample period. In addition, we apply both instrumental-variable regressions and an exogenous shock caused by a climate disaster (Hurricane Katrina) to mitigate endogeneity concerns. We also confirm our findings when using annual (rather than quarterly) corporate investment data, lags in the outcome

variables to control for their persistence, innovations in climate change risk measures (rather than their levels), and when studying separately transition and physical risks embedded in the CCN index.

Our paper contributes to the growing literature on climate risk and corporate behavior. Prior studies show that climate risk affects firms' real and financial decisions in a variety of ways. For example, higher climate risk influences production allocation (Bartram et al., 2022), affects firms' capital structure decisions (Dang et al., 2023; Ginglinger and Moreau, 2023), increases precautionary cash holdings (Dessaint and Matray, 2017), and reduces corporate profitability and earnings (Addoum et al., 2020; Pankratz et al., 2023). Recent work also shows that firms adjust their climate-related strategies in response to risk exposure, for instance by shifting from mitigation toward adaptation or political engagement (Li and Flammer, 2025). Our study contributes to this literature by examining how climate risk affects corporate investment decisions after controlling for economic uncertainty. Most closely related to our study are Sautner et al. (2023) and Li et al. (2024), who analyze firm-level exposure to climate risk using textual measures derived from earnings calls. These measures typically restrict analyses to the early 2000s onward. Sautner et al. (2023) show that firm-level climate exposure predicts green technology investment and green patenting, while Li et al. (2024) find that firms with proactive transition strategies increase capital expenditures and file more green patents when climate risks rise. In contrast, we focus on aggregate climate risk shocks, which capture changes in economy-wide climate risk perceptions and allow us to examine how common climate shocks affect corporate investment decisions. An advantage of this approach is that aggregate climate risk measures are available over a much longer historical horizon, allowing us to analyze corporate responses since the mid-1980s and to study the dynamic evolution of climate risk's impact on investment. Consistent with the climate-finance models of Bansal and Ochoa (2011*a*) and Bansal et al. (2016), we show that the effect of climate risk on corporate investment is time-varying. Specifically, climate risk initially discourages investment through higher financing costs and uncertainty, but as climate issues become more salient the effect weakens due to increased stakeholder pressure and transition incentives. Our findings highlight that aggregate and firm-specific climate risk capture different dimensions of climate exposure. While firm-level measures typically reflect firms' direct exposure to transition risks, aggregate climate risk proxies capture economy-wide shifts in climate salience and investor perceptions. By examining the inter-

action between the two, we show that firm-specific exposure mitigates the investment response to aggregate climate shocks, underscoring the complementary roles of these two types of climate risk measures.

Our findings also contribute to the literature studying the role of climate risk in the cost of capital. Theoretical work models climate change as a form of long-run risk affecting asset prices and economic growth (Bansal and Ochoa, 2011*a*; Bansal et al., 2016). Consistent with these predictions, empirical studies show that firms with higher carbon emissions earn higher expected returns, consistent with a carbon risk premium (Bolton and Kacperczyk, 2021, 2023; Hsu et al., 2023). Additional evidence indicates that firms associated with environmental concerns face higher costs of capital (Chava, 2014; Heinkel et al., 2001; Hong and Kacperczyk, 2009; Hong et al., 2023; Pástor et al., 2021). Similarly, in fixed-income markets, bonds issued by firms more exposed to climate risk exhibit higher yield spreads and lower credit ratings (Baker et al., 2022; Duan et al., 2023; Huynh and Xia, 2021; Seltzer et al., 2022). Recent work also emphasizes that firms' environmental responses to financing conditions may differ across brown and green firms. Hartzmark and Shue (2024) show that brown firms exhibit large environmental "impact elasticities," meaning their emissions respond strongly to changes in the cost of capital, whereas green firms exhibit little response. We extend this literature by showing that the pricing of climate risk in financial markets has real effects on corporate investment through firms' financing costs. While prior studies document valuation differences between brown and green firms, we show that climate risk also produces heterogeneous effects on firms' investment decisions. In particular, carbon-intensive ("brown") firms reduce capital investment by significantly less than greener firms during periods of heightened climate change awareness, suggesting that financing costs alone cannot fully explain the link between climate risk and corporate investment.

Relatedly, our paper contributes to the literature on stakeholder pressure and corporate environmental behavior. Prior studies show that stakeholder pressure influences firms' environmental strategies, including emissions reductions, disclosure practices, and the adoption of low-carbon operational policies (Block et al., 2024; Cadez et al., 2019; Diaz-Rainey et al., 2024; Liesen et al., 2015; Murillo-Luna et al., 2008). We show that stakeholder pressure also shapes corporate investment decisions: when climate issues become more salient, carbon-intensive firms reduce investment less than greener firms, indicating that stakeholder pressure can partially offset the investment-

dampening effects of higher financing costs and play a central role in shaping firms' responses to climate risk.

The remainder of the paper is organized as follows. Section 2 describes the various datasets used in our study, including climate change risk and uncertainty measures, as well as firm-level investment data. Section 3 reports our main empirical results. Section 4 discusses potential mechanisms to shed a deeper light on the link between climate risk and corporate investment. Section 5 investigates how increased market awareness on climate change affects the link between climate risk and corporate investment. Section 6 discusses robustness tests that confirm our main findings. Section 7 concludes.

2 Data

2.1 Climate change risk and uncertainty measures

To measure the climate change risk, we employ the Climate Change News index (CCN), as developed by Engle et al. (2020). This index is designed to reflect the overall level of market climate change risk, premised on the assumption that an increase in climate risk corresponds with a rise in discussions about climate change. Specifically, the index measures the proportion of the Wall Street Journal's pages devoted to climate change topics. It utilizes a glossary of climate change terms to determine the relevance of each story to climate change. The Wall Street Journal was selected due to its considerable influence on investors, making it one of the most crucial and frequently followed media sources by financial market participants. The climate change terms (aka. climate change vocabulary) that underpin this index are constructed from 74 authoritative documents provided by prominent global climate authorities, including the Intergovernmental Panel on Climate Change (IPCC), the U.S. Environmental Protection Agency (EPA), the National Aeronautics and Space Administration (NASA), and the United Nations, among others. Engle et al. (2020) demonstrate the reliability of CCN through several validation tests, such as its strong correlation with significant climate events. They also illustrate the effectiveness of constructing climate risk hedging portfolios based on this index. Additionally, CCN has been shown to help explain pricing dynamics in the U.S. corporate bond market (Huynh and Xia, 2021) and options markets (Ilhan et al., 2021).

There are several additional reasons for using CCN, which captures climate-related risk and salience at the market level. Our empirical design and regression specification closely follow Gulen

and Ion (2016), who study the effects of aggregate economic policy uncertainty, measured by the Economic Policy Uncertainty index (EPU), on corporate investment. Using a market-level climate measure allows us to analyze climate risk in a manner that is conceptually and empirically aligned with this benchmark, where climate risk is treated as a market-wide factor external to individual firms. In addition, CCN provides a substantially longer sample period beginning in 1984, whereas firm-level textual measures of climate risk exposure are generally available only from the early 2000s onward (Li et al., 2024; Sautner et al., 2023). This longer time span enables us to examine investment responses over several decades and to study longer-run dynamics and regime changes in the relationship between climate risk and corporate investment, including shifts around major changes in market attention to climate change such as the period surrounding the 2006 Stern Review, which we exploit in Section 5.[2]

In addition to CCN, we utilize four alternative indices to measure climate change risk or uncertainty, thereby enhancing the robustness of our study.[3]

2.2 Investment measures and control variables

To measure corporate investment behavior, we follow the literature (e.g., Albuquerque and Zhu, 2019) and examine the following firm-level investment decisions: capital expenditures (CAPX), research and development expenditures (RDINT), and the sum of CAPX and RDINT as a measure of total investment (INVEST). We obtain the relevant data from the Compustat Fundamentals Quarterly file, as our analysis relies on quarterly evidence. All these variables are reported by firms at the end of each quarter and are scaled by total assets from the previous quarter. Note that we also repeat our analysis using annual data obtained from the Compustat Fundamentals Annual files, and the results remain qualitatively similar. Our sample includes all firms listed on the NYSE, AMEX, and NASDAQ.[4]

We incorporate a set of control variables as in the literature (e.g., Gulen and Ion, 2016) to mitigate potential confounding effects and isolate the impact of CCN on corporate investment

[2]In order to investigate how aggregate climate risk interacts with firm-specific climate risk exposure, in Section 6.1 we integrate the firm-specific climate risk measures developed by Li et al. (2024) and Sautner et al. (2023) into our analysis.

[3]See Section 6.3 and Section C of the Online Appendix for more details.

[4]The results are qualitatively similar when the sample is expanded to include all publicly traded firms on U.S. exchanges.

decisions. Specifically, we control for economic uncertainty using the Economic Policy Uncertainty index (EPU) (Baker et al., 2016), and include firm-specific factors such as Tobin's q (Q), operating cash flow (CF), and sales growth (SG). Additionally, we account for macroeconomic influences by considering changes in real GDP (GDP). Detailed definitions for these variables are provided in Section A of the Online Appendix.

2.3 Summary statistics

Our analysis covers the period from the first quarter of 1985 through the second quarter of 2017, during which data for both CCN and EPU are available.[5] We consistently incorporate EPU in our analyses, given its methodological similarity to CCN, where both indices are derived from the proportion of news coverage related to climate and economic uncertainty, respectively. Previous studies have also demonstrated the impact of EPU on corporate investment (Atanassov et al., 2024; Gulen and Ion, 2016).[6] To ensure comparability with EPU and facilitate interpretation, we use the raw CCN, normalize it to have a mean of 100, and apply a logarithmic transformation.[7] Additionally, these indices, originally reported on a monthly basis, are measured quarterly. They are calculated as the natural logarithm of the monthly arithmetic average within each firm's fiscal quarter that ends in the calendar quarter.

Table 1 presents summary statistics for our final samples, including the number of observations (N), mean, standard deviation (SD), minimum, median, and maximum values. Panel A presents the statistics for the risk and uncertainty measures, which are all normalized to a mean of 100, log-transformed, and reported on a quarterly basis. Panel B provides summary statistics for the investment measures (in %). Note that RDINT data is only available from the third quarter of 1988 and contains a large number of missing values. To ensure comparability with other investment decision measures, we replace the missing values of RDINT with 0; however, our results remain robust to this choice. Panel C presents the statistics for the control variables. To minimize the

[5] Given that CCN data terminates in June 2017, we also adopt alternative climate risk and uncertainty measures that extend up to June 2023 and confirm that our main conclusions remain consistent over the longer sample period. See Section 6.3 and Section C of the Online Appendix for more details.

[6] Note that when we replace EPU as a control variable with CCN orthogonalized to EPU in all analyses, our results remain qualitatively similar. Additionally, the estimated effects of CCN remain unchanged when we use the VIX index from the CBOE as an alternative measure of economic uncertainty. The results are reported in Section F of the Online Appendix.

[7] Our results remain robust when using the innovation of CCN and not applying the logarithmic transformation.

impact of outliers, all firm-level characteristics are winsorized at the 1st and 99th percentiles.

In addition to the variables mentioned above, we also use several additional variables in our mechanisms (Section 4), market awareness (Section 5), and further analyses (Section 6). These include measures of the cost of equity, financial constraints, external finance and equity dependence, and policy pressure and reputational exposure, as well as indicators of carbon-intensive firms and firm-level climate risk measures from Li et al. (2024) and Sautner et al. (2023). All these variables are described in the relevant sections, and formal definitions are provided in Section A of the Online Appendix.

3 Empirical analysis: Climate risk and corporate investment

In this section, we examine the impact of aggregate climate change risk on corporate investment behavior. Our main hypothesis is that, after accounting for economic uncertainty, higher climate change risk heightens the risks associated with investment decisions and leads firms to reduce their investment activity. To test this hypothesis, we estimate the following regression model in the spirit of Gulen and Ion (2016):

$$\text{Investment}_{i,q+l} = \alpha_i + \beta_1 \text{CCN}_{i,q} + \beta_2 \text{EPU}_{i,q} + \gamma \text{F}_{i,q} + \delta \text{GDP}_q + \text{QD}_q + \epsilon_{i,q+l}, \tag{2}$$

where i indexes firms, q indexes calendar quarters, and $l \in \{1, 2, 3, 4\}$ represents the quarter lead between the outcome and explanatory variables. Investment decisions at the firm level are measured by CAPX, RDINT, or INVEST. The vector F includes firm-level characteristic controls, such as Tobin's q (Q), operating cash flow (CF), and sales growth (SG).[8] The indices CCN and EPU are measured quarterly and computed as the natural logarithm of the monthly arithmetic average within each firm's fiscal quarter that ends in the calendar quarter q. Note that due to variations in the fiscal quarter endings across firms, $\text{CCN}_{i,q}$ (and $\text{EPU}_{i,q}$) includes a firm index i. However, these variations are minimal and consequently do not permit the inclusion of time fixed effects in our model. In the absence of time fixed effects, GDP is included as a control for possible confounding macroeconomic forces, serving as a proxy for current demand conditions. We also

[8] Our findings remain robust when one-quarter lagged outcome variables (i.e., CAPX, RDINT, or INVEST), representing prior investment decisions, are included as explanatory variables in the regression models.

control for potential seasonality in corporate investment by including a set of calendar and fiscal quarter dummy variables (QD_q), and we include firm fixed effects (α_i). We estimate Equation (2) using OLS, and the standard errors are double clustered by both firm and calendar quarter.

For each investment measure, we conduct four estimations of Equation (2), setting the dependent variable to represent outcomes one, two, three, and four quarters ahead, respectively (i.e., $l \in \{1, 2, 3, 4\}$). This allows us to examine the persistency and potential lagged effects of CCN on corporate investment.

The results are presented in Table 2, delineated separately for CAPX (Panel A), RDINT (Panel B), and INVEST (Panel C). Across these measures, and regardless of the number of quarters ahead, the coefficient on CCN consistently emerges as negative and statistically significant at the 1% or 5% level in most cases. This pattern is supportive of our main hypothesis as it confirms a negative relationship between aggregate climate risk and firm-level corporate investment, suggesting that firms are likely to postpone their investment decisions over subsequent quarters in response to increased risk of the climate change process. In terms of economic magnitude, a one-standard-deviation increase in the log-transformed CCN, corresponding to approximately a 32.18% increase in the original CCN, leads to a reduction of about 28.7 basis points in CAPX in the next quarter. This reduction accounts for 8.27% of the average CAPX observed in the sample. A similar economic impact is observed for INVEST. Although the effect appears smaller when the outcome variable is RDINT, this is attributed to the treatment of RDINT values, which are set to zero when they are missing, thus biasing the coefficient towards 0. Hence, we conclude that firms are likely to delay their investment in response to the heightened risk of climate change.

In terms of the impact of EPU on corporate investment, the coefficient on EPU is negatively significant for the outcome variables CAPX and INVEST. This aligns with previous research (Baker et al., 2016; Gulen and Ion, 2016; Hassett and Metcalf, 1999; Jens, 2017; Julio and Yook, 2012; Koijen et al., 2016), which suggests that firms reduce their capital expenditures in the face of heightened economic uncertainty. Economically, a one-standard-deviation increase in the log-transformed EPU is associated with a reduction of about 9.8 basis points in CAPX in the next quarter, representing 2.82% of the sample mean. Conversely, we do not observe a (positively) significant relationship between EPU and RDINT as demonstrated in some studies (Atanassov et al., 2024; Stein and Stone, 2013). These patterns suggest that economic uncertainty and climate risk are both highly

relevant (as they produce significant effects), but the magnitude of their impact is very different. The documented patterns are consistent with the long-run risk models of Bansal and Ochoa (2011*a*) and Bansal et al. (2016), who separately model the two risk factors.

To strengthen this point further and assess whether climate risk delays rather than permanently reduces investment, we examine investment outcomes over extended horizons. As shown in Figure 1, when leading CAPX, RDINT, and INVEST up to 32 quarters ahead, the effect of CCN remains statistically significant at the 5% level for approximately 25 quarters for CAPX and up to five quarters for RDINT. These patterns suggest that climate risk induces a highly persistent investment response, consistent with prolonged deferral rather than short-lived timing shifts and not with permanent cancellation.[9]

In subsequent analyses, we omit reporting the estimated coefficient estimates on the control variables for brevity, since their signs and magnitudes align with previous findings in the literature. We also focus mostly on reporting two-quarter-ahead investment decision measures in subsequent sections for brevity. The results are largely consistent across different numbers of quarters led.[10]

4 Mechanisms

The negative relationship between the aggregate climate change risk and corporate investment documented in Section 3 may operate through several distinct channels. In this section, we examine three mechanisms that reflect both internal financial constraints and external pressures. These three mechanisms correspond directly to the components summarized in Equation (1): the cost-of-capital channel, its amplification through financial frictions, and the moderating role of stakeholder pressure.

4.1 The cost-of-capital channel

Previous empirical research shows that climate risk reduces the equity valuations of corporations (Bolton and Kacperczyk, 2021, 2023). This evidence aligns with theoretical work by Bansal and

[9]This is in contrast with the effect of EPU which becomes insignificant at much shorter horizons across all investment measures as shown in Figure A1 of the Online Appendix.

[10]We also repeat the analysis in this section by using annual data, wherein the dependent variables are measured concurrently with, or one year following CCN. Our conclusions regarding the impact of climate risk do not alter. Estimation results are provided in Table A14 of the Online Appendix).

Ochoa (2011*b*) and Bansal et al. (2019), which demonstrate that climate risk lowers equity values even after accounting for economic uncertainty. A related strand of research finds that higher costs of capital discourage firms from investing (Abel and Blanchard, 1986; Gilchrist et al., 2005; Gilchrist and Zakrajšek, 2007; Philippon, 2009). Together, these insights suggest that greater climate risk can increase the cost of capital (risk premium), thereby weakening firms' incentives to invest.

In this section, we test this mechanism empirically to explain our main findings. Specifically, we argue that if climate risk is priced in financial markets, firms more exposed to it will face a higher cost of equity (COE). This higher financing cost raises the hurdle rate for new projects, leading firms to delay or reduce investment.

We begin by examining whether climate risk is priced in equity markets. Following Bali et al. (2017), we construct firm-level exposures to climate risk, denoted β^{CCN}, using rolling-window regressions of monthly excess stock returns on CCN. Each month, we estimate these betas over a 60-month window, controlling for the Fama-French five factors (Fama and French, 2015).[11] Firms are then sorted into deciles based on their estimated β^{CCN}, and we compute equal-weighted returns or alphas for each decile portfolio in the subsequent month. Stock return data are obtained from the Compustat Security Monthly files, and factor data are sourced from Kenneth French's data library.

Table 3 presents the return differences across deciles. Firms in the highest climate beta decile earn significantly higher future returns than those in the lowest decile. The right-most column reports the corresponding average excess returns and Fama-French alphas, all of which indicate that the return spread is economically meaningful—approximately 1.3 percent—and statistically significant. This magnitude is comparable to Bali et al. (2017), who document a High-Low spread of about 0.51 to 0.56 percent per month based on economic uncertainty beta sorts. These results suggest that climate risk carries a risk premium, implying that firms more exposed to climate risk face a higher cost of equity, which may in turn discourage investment.

We then examine whether firms with a higher COE invest less. First, building on the results in Table 3, we construct a firm-level measure of COE following the approach in Fama and French (1997) and Lee et al. (2021). For each firm-month, we compute the expected return as the weighted

[11] Our conclusions remain unchanged if we instead use a 12-month or 36-month rolling window to estimate the betas.

sum of the firm's factor loadings and the corresponding risk premia:

$$\text{COE}_{i,t} = \beta_{i,t}^{\text{CCN}} \cdot \lambda^{\text{CCN}} + \sum_{k} \beta_{i,t}^{k} \cdot \lambda^{k}, \tag{3}$$

where $k \in \{\text{MKT}, \text{SMB}, \text{HML}, \text{RMW}, \text{CMA}\}$ refers to the five Fama-French factors: market (MKT), size (SMB), value (HML), profitability (RMW), and investment (CMA). The betas represent the firm's exposures to the corresponding risk factors, and the lambdas denote the associated risk premia. All betas are estimated using a 60-month rolling window. The climate risk premium, λ^{CCN}, is estimated as the average return spread between the highest and lowest climate beta deciles, reported in Table 3, and equals 1.320 percent per month.[12] The risk premia for the other factors are computed as the average monthly returns from January 1985 to June 2017 using data from the Fama-French data library.[13]

Next, we examine whether a higher cost of equity is associated with lower corporate investment. Specifically, we re-estimate Equation (2) by replacing CCN with our firm-level COE. We use a quarterly measure of COE, computed as the average of monthly estimates within each calendar quarter. Table 4 reports the regression results. We find a significant negative coefficient on COE when investment is measured by both CAPX and INVEST, suggesting that firms facing higher equity financing costs tend to reduce their future investment.

Taken together, these findings suggest that climate risk increases the cost of equity for more exposed firms and, in turn, discourages investment. This evidence is consistent with theoretical predictions from investment theory and provides empirical support for the cost-of-equity channel underlying our main results.

4.2 The role of financial frictions

Past research shows that financing frictions, arising from firms' imperfect access to credit, reduce corporate investment (Almeida and Campello, 2007; Bernanke and Gertler, 1989; Bernanke et al., 1996; Gertler and Gilchrist, 1994; Whited, 1992). Gulen and Ion (2016) further demonstrate that

[12] We note that, because CCN is standardized, λ^{CCN} corresponds to a one-standard deviation shock in climate news. The economically relevant compensation equals $\beta^{\text{CCN}} \times \lambda^{\text{CCN}}$, yielding $0.0132 \times 0.0536 \approx 0.07$ percent per month for a representative one-standard deviation exposure, rather than the 1.32 percent portfolio-sort spread.

[13] The average monthly premia over the sample period are as follows: $\lambda^{\text{MKT}} = 0.699\%$, $\lambda^{\text{SMB}} = 0.091\%$, $\lambda^{\text{HML}} = 0.213\%$, $\lambda^{\text{RMW}} = 0.371\%$, and $\lambda^{\text{CMA}} = 0.262\%$.

the option to delay investment under higher economic policy uncertainty depends on the degree of irreversibility in a firm's projects. Reversing investments entails costs, and the burden of these costs is shaped by the extent of a firm's financial constraints and, more generally, the existence of financial frictions. Building on these insights, and given the negative effect of climate risk on corporate investment, we argue that firms that are more subject to financial frictions face stronger incentives to postpone investment because they are less able to absorb the costs of reversing projects.

In this section, we investigate whether financial frictions constitute a channel through which climate risk affects corporate investment. We focus on two dimensions of financial frictions. The first is financing constraints, which capture limited access to external capital. The second is financing dependence, which reflects firms' structural reliance on external finance and equity funding. Both dimensions can amplify the effect of climate risk by restricting firms' flexibility to initiate or sustain investment under heightened uncertainty. This mechanism aligns with predictions from real options theory.

4.2.1 Financial constraints

We first examine whether the negative relationship between climate change risk and corporate investment is more pronounced for financially constrained firms. The rationale is that these firms face greater (less) difficulty in absorbing potential future costs associated with partially irreversible investments, and are therefore more (less) likely to delay investment during periods of elevated risk.

To test this hypothesis, we employ three widely used indices to measure financial constraints: the KZ index (Kaplan and Zingales, 1997), the WW index (Whited and Wu, 2006), and the HP index (Hadlock and Pierce, 2010). For each index, we estimate Equation (2) by including the respective index and its interaction term with CCN. The results are presented in Table 5, where the investment decisions are measured using two-quarter-ahead CAPX, RDINT, or INVEST.

The findings consistently show a negative and significant coefficient on the interaction between CCN and the financial constraint indices as measured by KZ (Panel A), WW (Panel B), and HP (Panel C) when the dependent variable is CAPX. This indicates that, under high climate change risk, financially constrained firms reduce capital expenditures more significantly than less constrained firms, supporting the theoretical framework. No significant effect is observed when the dependent variable is RDINT. Hence, the results indicate that the more financially constrained a

firm is, the more its capital expenditures are negatively impacted by climate change risk. More importantly, this effect is observed after controlling for economic uncertainty levels as done by Gulen and Ion (2016).

4.2.2 External finance and equity dependence

We next examine a complementary dimension of financial frictions: firms' structural reliance on external capital. While financing constraints capture limited access to external funding, financing dependence reflects the extent to which firms require outside resources to support investment. Firms with higher dependence have less flexibility to buffer adverse shocks using internal funds and may be more vulnerable to the effects of climate risk, which can lead them to postpone or scale back investment.

To examine this channel, we construct two measures: external finance dependence (EXTFIN) and equity finance dependence (EXTEQU). Definitions and construction details are provided in Section A of the Online Appendix. Both measures follow the industry-level methodology proposed by Rajan and Zingales (1998), and have been used to capture structural financing needs across firms (e.g., Duchin et al., 2010). Unlike firm-level constraint indices, these variables are plausibly more exogenous to individual firm decisions. In our empirical specification, we estimate Equation (2) by including the interaction between each dependence measure and CCN.

Table 6 presents the results, where investment is measured using two-quarter-ahead CAPX, RDINT, or INVEST. Across all specifications, we find negative and statistically significant coefficients on the interaction terms CCN $\times$ EXTFIN and CCN $\times$ EXTEQU. These results indicate that firms with greater structural reliance on external capital are more exposed to the effects of climate risk. This finding is consistent with the interpretation that financing needs limit firms' ability to sustain investment during periods of heightened climate-related risk. The evidence complements the results in the previous section and supports a broader real option mechanism, whereby firms with high external financing needs and limited flexibility are more likely to delay or reduce investment in response to climate risk.

4.3 Policy pressure and reputational exposure as a stakeholder mechanism

The stakeholder literature highlights the influence of a wide range of actors, including regulators, investors, customers, and NGOs, in shaping corporate behavior, particularly with respect to environmental management and investment (Freeman, 1984; Mitchell et al., 1997). Building on this perspective, institutional theory and related empirical research distinguish between internal pressures from firm owners, top management, and employees, and external pressures from regulators, consumers, investors, suppliers, and the media. Both forms have been shown to play an important role in driving firm responses to climate-related challenges (Buysse and Verbeke, 2003; Cadez et al., 2019; Damert and Baumgartner, 2018; Dhanda et al., 2022; Schmitz et al., 2019). Taken together, these insights suggest that stakeholders may act as both a source of motivation and a source of constraint for corporate decisions, including investment choices under climate risk. Therefore, in this section, we examine stakeholder pressure as a potential determinant of corporate investment decisions in the presence of climate risk.

We begin by focusing on policy pressure as one form of stakeholder influence and use the market-based component of the OECD Environmental Policy Stringency (EPS) index as a proxy, which reflects the stringency of market-oriented environmental regulations.[14] We anticipate that strong policy pressure from regulators and policymakers can encourage firms to sustain or even accelerate investment, particularly in projects aligned with environmental objectives. Such pressure may offset the tendency to delay investment in the face of climate-related risk.

To assess whether policy pressure moderates the effect of climate change risk on investment, we re-estimate Equation (2) including EPS and the interaction term CCN $\times$ EPS. Panel A of Table 7 reports the results, where investment is measured using two-quarter-ahead CAPX, RDINT, and INVEST. Across all specifications, the coefficient on CCN $\times$ EPS is positive and statistically significant. When environmental stringency increases (e.g., policy pressure is higher), the negative association between climate change risk and corporate investment is weaker, consistent with the view that strong regulatory incentives reduce the likelihood of investment deferral. This suggests that some firms might actually react to climate risk with more investment (possibly in green technologies, adaptation infrastructure, or process improvements) due to stronger policy frameworks

[14]The quarterly values are obtained by linearly interpolating the annual EPS values and align with each firm's fiscal quarter-end months.

that create clearer incentives, and reduce policy uncertainty.[15] The results in Table 7 also suggest that, in low stringency environments, higher climate risk reduces investment consistent with the idea that firms are less prepared to absorb climate impacts, they lack adaptation frameworks and face uncertainty without clear policy guidance.

Stakeholder pressure is not limited to formal regulation and may also arise from reputational considerations. Firms operating in highly visible, carbon-intensive industries are subject to greater scrutiny from investors, customers, and the broader public, and may therefore face stronger non-pecuniary incentives to sustain investment in response to climate-related risks. To capture this dimension of stakeholder pressure, we follow Bolton and Kacperczyk (2023) and identify firms in oil and gas, utilities, and motor vehicles as having higher exposure to reputational risk. We augment Equation (2) by interacting CCN with this industry indicator (SALIENT). The results, reported in Panel B of Table 7, show that the interaction term CCN $\times$ SALIENT is positive and statistically significant for CAPX, indicating that firms with higher reputational exposure reduce capital expenditures by less when climate risk increases.[16] The interaction is positive, though not statistically significant, for RDINT and INVEST. These findings suggest that reputational exposure influences firms' investment timing decisions by attenuating their tendency to delay investment in response to climate-related risk, particularly for capital expenditures, consistent with stakeholder pressure operating as a moderating force alongside formal regulatory incentives.

Taken together, these results indicate that stakeholder pressure arising from both regulatory stringency and reputational exposure plays an important moderating role in firms' investment responses to climate risk. When regulatory and reputational pressures are stronger, firms are less likely to postpone investment in the presence of heightened climate risk, particularly with respect to capital expenditures. While reputational exposure is largely time invariant and tied to firms' industry affiliation, policy pressure varies over time and may coincide with periods of elevated public and market awareness of environmental issues. In the next section, we therefore examine how changes in market attention to climate change shape investment responses, and whether such attention differentially affects green and brown firms. In doing so, we employ a more granular,

[15] In Section 5, we show that less environmentally-friendly firms reduce their capital investments by a smaller amount in response to increased market attention and stakeholder pressure.

[16] We test the linear combination of CCN and CCN $\times$ SALIENT to assess the overall marginal effect for salient firms. The estimated total effect equals 0.097 and is statistically indistinguishable from zero (p=0.849).

firm-level classification rather than relying solely on industry affiliation.

5 Climate change salience, stakeholder pressure, and corporate investment

While climate-related news captures continuous variation in market attention to climate issues, the Stern Review represents a shift in the salience and economic interpretation of climate risk. By formally highlighting the macroeconomic costs of climate inaction, the report elevated climate risks in the attention of investors, policymakers, and the media, providing a natural setting to examine whether heightened awareness strengthens stakeholder pressure and alters how firms adjust their investment decisions in response to climate risk.[17] A large literature shows that market attention plays an important role in financial markets. For example, attention shocks have been shown to affect stock prices (Andrei and Hasler, 2015; Da et al., 2011; Lou, 2014) and to help explain earnings-related anomalies (Hirshleifer et al., 2011). More recently, attention to climate-related risks has been shown to influence asset prices in fixed-income markets, such as municipal bonds exposed to climate risks (Painter, 2020). Building on this literature, we examine whether increases in the salience of climate risk also influence real corporate decisions, particularly corporate investment.

Our analysis is also related to the theoretical framework of Pástor et al. (2021), which predicts that stronger investor and customer preferences for environmentally friendly assets can lead green firms to face lower expected returns than brown firms. As awareness of climate risks increases, this mechanism may generate differences in financing conditions across firms depending on their environmental profile. At the same time, greater climate awareness may strengthen incentives for carbon-intensive firms to adjust their investment strategies in order to improve their environmental performance and appeal to investors and customers. Taken together, these forces suggest that the investment response to climate risk may change when climate issues become more salient, particularly for carbon-intensive firms.

Following Painter (2020), we use the 2006 release of the Stern Review (STERN) as a quasi-natural experiment to examine whether firms become less inclined to delay investment when climate risks attract greater attention. As one of the earliest and most comprehensive assessments of

[17] Climate salience reflects economy-wide attention to climate issues, while stakeholder pressure captures the firm-level incentives arising from this attention, particularly for carbon-intensive firms that face greater reputational exposure.

climate risks, the Stern Review represented a turning point in how market participants perceived the economic consequences of climate change and helped bring the case for climate action into corporate boardrooms (Stern and Treasury, 2007).

Following Bolton and Kacperczyk (2021), we assess this hypothesis through two approaches: examining temporal differences within firms and analyzing cross-sectional variations across firms. The temporal analysis involves comparing a firm's investment activities before and after STERN. Specifically, we estimate Equation (2) separately for two distinct periods: before and after 2006Q3, as STERN was published in October 2006. Table 8 presents the results. Consistent with our expectations, we observe that the previously documented negative and significant coefficient on CCN is evident only before STERN for the outcome variables CAPX and INVEST, while it is not significant for RDINT. Hence, firms do not (significantly) reduce investment during periods of increased climate salience.[18]

Next, we examine variations in investment behavior across firms by comparing their activities before and after the STERN implementation, focusing on differences between less environmentally friendly firms and their greener counterparts. We expect that firms with poorer environmental practices will reduce their investments by a smaller amount than their environmentally friendly peers after STERN. These firms are likely to face greater pressure to adjust in response to increased awareness among investors and customers of the risks posed by climate change, and the resulting shift in capital allocation toward greener assets. To assess a firm's environmental friendliness, we use two approaches. First, in line with Bolton and Kacperczyk (2021), we analyze firm-level carbon emissions data provided by Trucost. Second, following the methodologies of Engle et al. (2020) and Huynh and Xia (2021), we evaluate environmental scores from the MSCI ESG database. Specifically, we define firms with lower environmental performance, referred to as treatment firms, as those in the highest quartile of carbon emissions or those with negative net MSCI scores as of the end of 2003.[19] We then match the treat firms with control groups using the propensity score matching (PSM) approach where firms with comparable Q and CF characteristics, which are known to predominantly influence investment behavior (Gulen and Ion, 2016), are matched at the end of

[18] Our conclusions remain unchanged when longer investment horizons are considered, though the negative effect of CCN becomes weaker in the pre-STERN period at longer horizons, which is consistent with Figure 1.

[19] For further details on the calculation of net MSCI scores, see Engle et al. (2020) and Huynh and Xia (2021).

2003 using the Mahalanobis distance method.[20]

We estimate the following difference-in-differences regression model:

$$\text{Investment}_{i,q+2} = \alpha_i + \beta_1 \text{TREAT} \times \text{STERN}_{i,q} + \gamma \text{F}_{i,q} + \delta \text{GDP}_q + \text{QD}_q + \epsilon_{i,q+2}, \tag{4}$$

where TREAT is an indicator variable taking the value of one for firms in the treatment sample, i.e., those in the largest quartile of carbon emissions or firms with negative MSCI net scores at the end of 2003, and zero otherwise. STERN is an indicator variable taking the value of zero for the period 2004Q1 to 2006Q3, and equal to one for the period 2006Q4 to 2009Q4.[21] Investment decisions at the firm level are measured by two-quarter-ahead CAPX, RDINT, or INVEST. The remaining controls are the same as in Equation (2) and include the indicator variables TREAT and STERN, as well as EPU. We also include a set of calendar and fiscal quarter dummy variables and firm fixed effects. The standard errors are double clustered by both firm and calendar quarter.

Table 9 presents the results using different measures of environmental impact: total emissions (Panel A), emissions intensity (Panel B), and MSCI net environment scores (Panel C). Although we do not find significant results for the outcome variable RDINT, we consistently observe a positive and significant coefficient of TREAT × STERN on both CAPX and INVEST. This indicates that less environmentally-friendly firms tend to delay their investment to a lesser extent after STERN compared to their peers.

To assess the timing of these effects and the plausibility of parallel trends, we estimate the event-time specifications. Figure 2 plots the treated-control (defined based on total emissions as in Panel A of Table 9) differentials relative to the omitted baseline year 2006. We do not detect statistically significant differential pre-trends in the three years prior to STERN (joint F-test p = 0.166 for CPAX), supporting the parallel trends assumption. Importantly, the divergence in CAPX and INVEST is concentrated in the first post-STERN year (2007), with estimates attenuating thereafter. This timing pattern—an immediate post-STERN shift without systematic pre-trends—is consistent with STERN acting as a salient information shock rather than reflecting a continuation of pre-existing trends. In contrast, RDINT exhibits no corresponding dynamic response. Taken

[20] The results remain qualitatively similar when employing the nearest neighbor method.

[21] The results are robust when assigning STERN a value of zero for the period from 2004Q1 to 2006Q3, and a value of one from 2006Q4 to 2017Q2, covering the sample period through to the end. Note that the firm-level carbon emissions data provided by Trucost are available starting from 2002.

together, the evidence suggests that the post-STERN adjustment manifests as short-run changes in capital expenditures, concentrated in the period immediately following the STERN.

In addition, we ask whether the attenuated reduction in investment rates of brown firms (i.e., less environmentally-friendly firms) post-STERN is aimed at responding to the rising environmental preferences of investors and customers. To this end, we employ an approach similar to the framework proposed by Fang et al. (2024). Specifically, we regress potential proxies for next-year emissions on financial constraints (FC), as measured by the WW index (Whited and Wu, 2006), STERN, and BROWN (an indicator variable which equals 1 for firms in the highest quartile of total emissions, emission intensity, or those possessing negative net MSCI scores, and 0 otherwise), as well as the double and triple interactions among these variables. Table 10 presents the results. Consistent with the literature's findings (Akey and Appel, 2021; Bartram et al., 2022; Bellon and Boualam, 2024; Fang et al., 2024; Hartzmark and Shue, 2024; Xu and Kim, 2021), we observe that more financially constrained firms exhibit higher emissions. Additionally, the negative and significant coefficients on BROWN $\times$ STERN as well as BROWN $\times$ STERN $\times$ FC suggest that brown firms indeed reduce their emission intensity following STERN and, even more so if they are financially constrained.[22] Overall, our findings support the view that brown firms moderate their reductions in capital expenditures to reduce emissions and better align with the growing environmental preferences of investors and customers. Importantly, the reduction in emissions does not appear to be driven by increased innovative activity. When we replace emission intensity with patent-based measures of innovation, we do not observe statistically significant effects. Together with the absence of systematic changes in R&D intensity, these results suggest that brown firms' response reflects capital reallocation and upgrading of existing production technologies rather than frontier invention.[23]

Finally, we provide evidence that stakeholder pressure constitutes the primary mechanism driving the attenuated investment response of less environmentally friendly firms. We use data on climate-related shareholder proposals from the ISS ESG Voting Analytics database for the period

[22]The results remain consistent when using the HP index as a proxy for financial constraints and when the sample is balanced by ending in 2009, before and after STERN.

[23]We obtain patent data from the Global Corporate Patent dataset (https://patents.darden.virginia.edu). Specifically, we re-estimate Table 10 using (i) an indicator equal to one if a firm is granted at least one patent in a given year and zero otherwise, and (ii) the ratio of patents granted in a given year to the firm's total patent stock. In both cases, the interaction terms analogous to those in Table 10 are statistically insignificant. Detailed results are available upon request.

2006–2017 (Fich and Xu, 2025). About 80% of the firms that received such proposals during this period are among the highest quartile of carbon emitters. This pattern suggests that internal stakeholder pressure is particularly pronounced for firms with greater exposure to climate-related transition risk. Consistent with this interpretation, brown firms in our sample largely overlap with high transition-risk firms (over 90%) as identified in Li et al. (2024).[24] Taken together with the evidence in Section 4.3, these findings indicate that transition-risk firms are more likely to face intensified stakeholder pressure, especially from internal stakeholders, in periods of heightened climate change salience. Reputational concerns associated with high emissions further strengthen this pressure by increasing scrutiny from investors, customers, and employees. Importantly, we find no evidence that this attenuated investment response is driven by looser financial frictions or a lower cost of capital.[25]

In sum, we find that firms are less likely to cut investment when climate change becomes more salient following the Stern Review. Carbon-intensive firms, in particular, exhibit a more attenuated decline in investment relative to their peers. We provide supporting evidence that this adjustment reflects efforts to reduce emissions and align with the growing environmental preferences of investors and customers. Moreover, the evidence suggests that this behavior is driven primarily by stronger pressure from internal stakeholders within firms that face greater exposure to climate-related transition risks.

6 Further analysis

6.1 Aggregate versus firm-specific climate risk measures

While our analysis focuses on aggregate climate risk captured by the CCN index (see Section 2.1 for a detailed rationale), the recent literature has emphasized firm-level measures of climate exposure. For example, Li et al. (2024) construct firm-level transition risk measures based on firms' disclosures, while Sautner et al. (2023) develop climate change exposure indicators using earnings call transcripts. These firm-level measures capture heterogeneity in firms' exposure to

[24] Our results in Table 9 remain qualitatively unchanged when we define TREAT using their transition-risk measure.

[25] In unreported results, we find no consistent evidence that the attenuated reduction in the capital expenditures of less environmentally-friendly firms is driven by looser financial frictions or a lower cost of capital. Interacting financial constraint proxies (FC) with both STERN and TREAT yields an insignificant triple interaction term. Similarly insignificant results are obtained on a triple interaction term between the cost-of-equity proxy (COE), STERN and TREAT.

climate-related risks and opportunities, whereas the CCN index reflects fluctuations in aggregate climate-related uncertainty affecting the overall economic environment. Importantly, the correlation between CCN and these firm-level measures is extremely low (between 0.02 and 0.04), suggesting that they capture distinct dimensions of climate risk. In this section, we examine whether aggregate climate risk provides additional insights beyond firm-level climate exposure.

To do so, we augment Equation (2) by including firm-level climate risk measures and their interactions with CCN, using 2-, 4-, 6-, 8-, 10-, and 12-quarter-ahead CAPX as the dependent variable.[26] We consider firm-level transition risk measures following Li et al. (2024) and climate change exposure measures following Sautner et al. (2023). The interaction terms allow us to assess whether the effect of aggregate climate risk on corporate investment varies with firms' climate-related exposure.

Table 11 reports the results. Panels A and B present the results using the transition risk measure of Li et al. (2024), including the overall transition risk measure (TRANSIT) and its proactive (PROA) and non-proactive (NPROA) components. The coefficient on CCN $\times$ TRANSIT is generally positive and statistically significant at medium to longer horizons (4, 8, and 10 quarters ahead), suggesting that the negative effect of aggregate climate risk on investment is attenuated for firms with greater exposure to transition risk. When transition risk is decomposed into proactive and non-proactive components, the results indicate that this attenuation is driven by proactive firms in the short run but by non-proactive firms at longer horizons.[27] One possible interpretation is that proactive firms respond more promptly to aggregate climate shocks, whereas non-proactive firms adjust more gradually over time.

Panels C and D report the results using the climate change exposure measure of Sautner et al. (2023), including the overall measure (CCE) and its opportunity (CCEOpp), regulatory (CCEReg), and physical risk (CCEPhy) components. Consistent with the results based on the transition risk measure of Li et al. (2024), a similar pattern emerges when using the climate exposure measure of Sautner et al. (2023). The interaction between CCN and the overall climate change exposure measure is positive and statistically significant at the same horizons (4, 8, and 10 quarters ahead).

[26] Results for RDINT are statistically insignificant, while those for INVEST are broadly consistent with the CAPX results and are therefore omitted for brevity.

[27] In a simpler specification that excludes CCN and the interaction terms, the coefficients on both proactive and non-proactive transition-risk measures are positive, but only the proactive measure is statistically significant, consistent with the pattern documented in Li et al. (2024).

When CCE is decomposed into its components, the positive interaction is mainly driven by the opportunity-related measure. This pattern is consistent with the interpretation that firms more exposed to climate-related opportunities respond more actively to aggregate climate shocks.

Overall, these findings provide suggestive evidence that firms with greater climate-related exposure respond differently to aggregate climate shocks. The generally positive interaction terms indicate that firm-level climate exposure tends to mitigate, rather than amplify, the negative effect of aggregate climate risk on investment. This is consistent with the stakeholder-pressure mechanism discussed in Section 4.3: firms facing greater climate-related exposure may have stronger incentives to respond to aggregate climate shocks through capital reallocation, thereby reducing the extent to which investment contracts in response to heightened climate risk.

6.2 Endogeneity issues

A key identification concern is that CCN may reflect shifts in firms' investment conditions rather than cause them, meaning that lower capital expenditures could mechanically induce greater climate-related reporting (reverse causality). Moreover, economy-wide events may simultaneously increase climate news intensity and reduce investment, which would create correlated movements unrelated to climate risk itself. To mitigate these concerns, we use an instrumental-variable approach based on global mean surface temperature (GMST) to address reverse causality, and employ Hurricane Katrina as an exogenous shock to distinguish climate-related salience from broader disruptions. These additional tests confirm our baseline findings that, based on the whole sample period, climate risk has a negative impact on capital investment. Further details are provided in Section B of the Online Appendix.

6.3 Alternative measures of climate risk and uncertainty

We employ a number of alternative indices that measure either climate risk or uncertainty and corroborate a negative relationship between climate risk and corporate investment during our sample period (matching the availability of our main climate risk proxy, the CCN index) as well a over an extended sample period ending in June 2023. More details are provided in Section C of the Online Appendix.

6.4 Investment irreversibility

Our main analysis focuses on the role of financial frictions as an amplifying mechanism of the cost-of-capital channel and its impact on corporate investment decisions, including both CAPX and R&D (Atanassov et al., 2024; Brown et al., 2009). However, real options theory emphasizes the role of irreversibility of investments as a likely explanation for their postponement. In Section D of the Online Appendix, we also document that the negative impact of climate risk on investment is stronger in industries with greater irreversibility.

6.5 CCN decomposition into physical and transition risks

Our main measure of climate risk, the CCN index, may respond to climate-related physical events such as droughts, floods, and heatwaves, indicating an increase in physical risk. It may also reflect discussions around policy responses to climate change, like the introduction of carbon taxes or stricter emissions regulations, which signify an increase in transition risk. In Section E of the Online Appendix, we decompose the CCN index into two main components to separately capture physical and transition risk. We then study their individual impact on corporate investment and find that both components have a similar negative impact on investment.

7 Conclusion

We document that aggregate climate risk has a large and persistent negative impact on corporate investment, distinct from and substantially larger than the effect of economic uncertainty. We investigate three mechanisms underlying this relationship. First, climate risk increases firms' cost of capital, raising the hurdle rate for new projects. Second, this effect is amplified by financial frictions, as financially constrained firms are more likely to delay investment when climate risk rises. Third, low policy pressure on climate issues exacerbates underinvestment, particularly among firms facing weaker stakeholder scrutiny. To further examine the role of climate risk salience, we exploit the release of the Stern Review in 2006 as a quasi-natural experiment. We show that carbon-intensive firms reduce investment significantly less than greener firms when climate risk increases in the period following the Stern Review. At the same time, these firms reduce their emission intensity, suggesting that they adjust through capital reallocation toward cleaner production processes rather

than through increased innovation. Our findings are consistent with stronger stakeholder pressure when climate issues receive greater public and market attention, which mitigates the investment-dampening effect associated with higher financing costs. Finally, we show that aggregate climate risk captures a different dimension of climate exposure than firm-specific measures. Importantly, firm-specific climate risk interacts with aggregate climate shocks and attenuates their negative effect on corporate investment, highlighting the complementary roles of aggregate and firm-level climate risk in shaping corporate responses to climate change.

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Table 1. Summary statistics

This table presents summary statistics for our final samples, including the number of observations (N), mean, standard deviation (SD), minimum, median, and maximum values. Panel A details the statistics for the risk and uncertainty measures, which are all normalized to a mean of 100 and log-transformed. These indices are measured and reported quarterly, calculated as the natural logarithm of the monthly arithmetic average within each quarter. Panel B provides summary statistics for the investment measures, while Panel C lists the statistics for the control variables. All variables are defined in Section A of the Online Appendix.

Panel A: Uncertainty measures						
	N	Mean	SD	Min	Median	Max
CCN	418,158	4.566	0.275	4.066	4.565	5.542
CEI	418,158	4.603	0.067	4.427	4.606	4.698
CEVI	418,158	4.580	0.225	4.230	4.486	4.917
CPU	400,716	4.556	0.304	3.872	4.571	5.685
EPU	418,158	4.568	0.269	4.070	4.536	5.302
Panel B: Investment measures						
	N	Mean	SD	Min	Median	Max
CAPX	418,158	3.468	4.732	0.000	1.798	27.277
RDINT	392,381	1.150	2.556	0.000	0.000	15.139
INVEST	392,381	4.606	5.500	0.000	2.858	30.633
Panel C: Control variables						
	N	Mean	SD	Min	Median	Max
Q	418,158	2.013	1.689	0.622	1.438	11.322
CF	418,158	0.010	0.053	-0.289	0.019	0.109
SG	418,158	0.057	0.286	-0.650	0.025	1.704
GDP	418,158	2.624	1.676	-4.000	2.700	5.200

Table 2. Climate change risk and corporate investment: baseline results

This table presents the results from estimating Equation (2), separately for the dependent variables CAPX (Panel A), RDINT (Panel B), and INVEST (Panel C). Columns 1 to 4 (5 to 8, 9 to 12) correspond to one to four quarters ahead for the dependent variables, respectively. CCN and EPU refer to the Climate Change News and Economic Policy Uncertainty indices, respectively. Definitions for the remaining variables are provided in Section A of the Online Appendix. Quarter dummies refer to a set of calendar and fiscal quarter dummy variables. Parentheses contain t-statistics, computed using standard errors clustered at the firm and calendar quarter levels. The sample period is from 1985Q1 to 2017Q2 (1988Q3 to 2017Q2) for Panel A (Panels B and C). Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively.

	Panel A: CAPX				*Panel B: RDINT*				*Panel C: INVEST*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CCN	-1.044***	-1.026***	-1.006***	-0.905***	-0.094**	-0.071*	-0.085**	-0.094**	-0.989***	-0.965***	-1.020***	-0.932***
	(-6.00)	(-6.06)	(-6.44)	(-4.97)	(-2.47)	(-1.73)	(-2.28)	(-2.41)	(-5.18)	(-5.02)	(-5.58)	(-4.51)
EPU	-0.364**	-0.326**	-0.353**	-0.337**	0.012	-0.010	-0.037	-0.039	-0.535***	-0.515***	-0.531***	-0.482***
	(-2.28)	(-2.21)	(-2.57)	(-2.46)	(0.40)	(-0.27)	(-1.00)	(-1.02)	(-3.19)	(-3.15)	(-3.53)	(-3.06)
Q	0.416***	0.399***	0.376***	0.361***	0.178***	0.121***	0.089***	0.064***	0.655***	0.558***	0.490***	0.443***
	(19.46)	(19.32)	(18.74)	(17.36)	(15.23)	(10.36)	(7.78)	(5.67)	(22.74)	(19.83)	(17.79)	(15.43)
CF	3.575***	5.033***	5.494***	5.791***	-6.169***	-5.227***	-4.398***	-4.079***	-5.313***	-2.332***	-0.707	0.182
	(9.54)	(13.14)	(14.25)	(14.48)	(-17.50)	(-15.92)	(-13.96)	(-13.02)	(-8.90)	(-4.02)	(-1.23)	(0.31)
SG	0.076**	0.094***	0.270***	0.165***	0.084***	0.090***	0.057***	0.086***	0.188***	0.216***	0.372***	0.269***
	(2.32)	(2.88)	(8.19)	(4.96)	(6.20)	(6.68)	(4.34)	(5.91)	(5.04)	(5.35)	(9.91)	(7.39)
GDP	0.067**	0.079***	0.080***	0.084***	-0.005	-0.002	-0.001	0.001	0.039	0.058*	0.063*	0.075**
	(2.34)	(2.95)	(2.70)	(2.81)	(-0.90)	(-0.28)	(-0.28)	(0.09)	(1.24)	(1.89)	(1.95)	(2.25)
Investment ahead by	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.54	0.55	0.55	0.55	0.78	0.77	0.77	0.77	0.57	0.57	0.57	0.57
N	418,158	409,070	401,898	395,340	392,330	386,201	381,629	377,494	392,330	386,201	381,629	377,494

Table 3. Univariate portfolios of stocks sorted by the climate change risk beta

This table reports average next-month returns or alphas for portfolios sorted by firm-level exposure to climate risk (β^{CCN}). Each month, we estimate β^{CCN} using rolling-window regressions of monthly excess stock returns on the CCN index, controlling for the Fama-French five factors. Firms are then sorted into deciles based on their estimated β^{CCN}, and equal-weighted returns or alphas for each decile are calculated for the subsequent month. Panel A reports average excess returns (Ret-Rf) across deciles. Panels B, C, and D report average alphas from the CAPM (α_1), Fama-French three-factor (α_3), and Fama-French five-factor (α_5) models, respectively. The right-most column in each panel shows the return or alpha spread between the highest and lowest deciles. All returns and alphas are expressed in monthly percentage terms. Stock return data are obtained from the Compustat Security Monthly files, and factor data are sourced from Kenneth French's data library. The sample period is from January 1985 to June 2017. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	Low	Decile2	Decile3	Decile4	Decile5	Decile6	Decile7	Decile8	Decile9	High	High-Low
					Panel A: Excess return						
Ret-Rf	0.699	0.971***	1.031***	1.162***	1.161***	1.220***	1.321***	1.446***	1.655***	2.019***	1.320**
	(1.62)	(3.05)	(3.73)	(4.62)	(4.88)	(4.88)	(5.22)	(4.92)	(4.73)	(4.16)	(2.31)
					Panel B: CAPM alpha						
α_1	-0.157	0.217	0.332**	0.508***	0.528***	0.596***	0.689***	0.775***	0.920***	1.171***	1.328**
	(-0.50)	(1.10)	(2.18)	(4.15)	(4.40)	(4.64)	(4.81)	(4.18)	(3.89)	(3.26)	(2.32)
					Panel C: FF 3-factor alpha						
α_3	-0.094	0.208	0.291***	0.446***	0.467***	0.513***	0.601***	0.691***	0.855***	1.187***	1.281**
	(-0.33)	(1.33)	(2.63)	(5.89)	(7.06)	(7.26)	(7.22)	(5.43)	(4.59)	(3.68)	(2.29)
					Panel D: FF 5-factor alpha						
α_5	0.096	0.244	0.275**	0.420***	0.403***	0.454***	0.538***	0.611***	0.799***	1.367***	1.271**
	(0.33)	(1.52)	(2.28)	(4.91)	(5.37)	(6.00)	(6.14)	(4.74)	(4.19)	(4.07)	(2.25)

Table 4. Cost of equity and corporate investment

This table presents the results from estimating Equation (2) by replacing the CCN index with the firm-level cost of equity (COE), separately for the dependent variables CAPX (Panel A), RDINT (Panel B), and INVEST (Panel C). Columns 1 to 4 (5 to 8, 9 to 12) correspond to one to four quarters ahead for the dependent variables, respectively. COE is computed at the firm-month level as the weighted sum of factor loadings and average factor premia, including market, size, value, profitability, investment, and climate risk factors, and then aggregated to the quarterly frequency by averaging across months within each quarter. Definitions for the remaining variables are provided in Section A of the Online Appendix. Quarter dummies refer to a set of calendar and fiscal quarter dummy variables. Parentheses contain t-statistics, computed using standard errors clustered at the firm and calendar quarter levels. The sample period is from 1987Q3 to 2017Q2 (1988Q3 to 2017Q2) for Panel A (Panels B and C). Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively.

	Panel A: CAPX				*Panel B: RDINT*				*Panel C: INVEST*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
COE	-2.091*	-2.447**	-2.683**	-2.542**	-0.524	-0.865	-0.874	-0.784	-2.027	-2.992**	-3.065**	-2.916*
	(-1.68)	(-2.00)	(-2.27)	(-2.22)	(-0.89)	(-1.41)	(-1.38)	(-1.22)	(-1.31)	(-2.01)	(-2.05)	(-1.95)
EPU	-0.353**	-0.279*	-0.292**	-0.282**	0.017	-0.002	-0.023	-0.023	-0.467**	-0.427**	-0.425***	-0.383**
	(-2.12)	(-1.86)	(-2.01)	(-2.04)	(0.52)	(-0.06)	(-0.59)	(-0.60)	(-2.54)	(-2.54)	(-2.63)	(-2.37)
Q	0.402***	0.388***	0.363***	0.346***	0.192***	0.133***	0.099***	0.074***	0.659***	0.559***	0.485***	0.436***
	(19.23)	(19.20)	(18.21)	(17.52)	(14.91)	(10.27)	(7.81)	(5.92)	(23.37)	(20.08)	(17.72)	(15.94)
CF	3.239***	4.677***	5.093***	5.255***	-6.229***	-5.270***	-4.410***	-4.073***	-5.749***	-2.726***	-1.089*	-0.304
	(8.70)	(12.07)	(13.13)	(13.02)	(-17.01)	(-15.36)	(-13.32)	(-12.31)	(-9.41)	(-4.56)	(-1.83)	(-0.50)
SG	0.003	0.031	0.222***	0.134***	0.099***	0.105***	0.068***	0.101***	0.134***	0.167***	0.340***	0.264***
	(0.10)	(0.93)	(6.81)	(4.03)	(6.74)	(7.18)	(4.67)	(6.56)	(3.48)	(3.91)	(8.58)	(6.70)
GDP	0.104***	0.121***	0.122***	0.124***	0.001	0.003	0.004	0.006	0.086***	0.106***	0.115***	0.123***
	(3.63)	(4.84)	(4.48)	(4.60)	(0.13)	(0.43)	(0.62)	(1.06)	(2.69)	(3.75)	(3.83)	(4.07)
Investment ahead by	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.54	0.54	0.55	0.55	0.78	0.77	0.77	0.77	0.57	0.57	0.57	0.57
N	369,779	361,947	355,545	349,717	352,288	346,962	342,731	338,860	352,288	346,962	342,731	338,860

Table 5. Climate change risk and corporate investment: the effect of financial constraints

This table presents the results from estimating Equation (2) incorporating interaction terms between CCN and three different financial constraint indices: the KZ index (Panel A), the WW index (Panel B), and the HP index (Panel C), separately for the two-quarter-ahead dependent variables CAPX, RDINT, and INVEST. KZ (WW, HP) is the financial constraint index based on Kaplan and Zingales (1997) (Whited and Wu (2006), Hadlock and Pierce (2010)). All other variables are consistent with those outlined in Table 2, and are defined in Section A of the Online Appendix. The controls, which are omitted for brevity, include EPU, Q, CF, SG, and GDP. Quarter dummies refer to a set of calendar and fiscal quarter dummy variables. Parentheses contain t-statistics, computed using standard errors clustered at the firm and calendar quarter levels. The sample period is from 1985Q1 to 2017Q2 (1988Q3 to 2017Q2) for CAPX (RDINT and INVEST). Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively.

Panel A: KZ index			
	CAPX	RDINT	INVEST
	(1)	(2)	(3)
CCN	-1.078***	-0.033	-0.973***
	(-5.98)	(-0.83)	(-4.81)
CCN×KZ	-0.014***	0.002	-0.011*
	(-2.64)	(1.10)	(-1.88)
KZ	0.077***	0.001	0.075***
	(3.06)	(0.20)	(2.65)
Investments ahead by	Two quarters	Two quarters	Two quarters
Controls	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes
Adj. R-squared	0.54	0.77	0.57
N	373,639	353,550	353,550
Panel B: WW index			
	CAPX	RDINT	INVEST
	(1)	(2)	(3)
CCN	-1.251***	-0.068	-1.147***
	(-5.71)	(-0.55)	(-3.98)
CCN×WW	-1.512***	-0.279	-1.580**
	(-2.96)	(-0.85)	(-2.34)
WW	11.551***	3.244**	13.997***
	(4.96)	(2.08)	(4.52)
Investments ahead by	Two quarters	Two quarters	Two quarters
Controls	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes
Adj. R-squared	0.55	0.77	0.57
N	398,460	376,438	376,438
Panel C: HP index			
	CAPX	RDINT	INVEST
	(1)	(2)	(3)
CCN	-0.772**	0.125	-0.371
	(-2.57)	(0.49)	(-0.82)
CCN×HP	-0.146*	-0.002	-0.087
	(-1.77)	(-0.02)	(-0.71)
HP	1.817***	0.364	1.977***
	(4.74)	(1.06)	(3.42)
Investments ahead by	Two quarters	Two quarters	Two quarters
Controls	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes
Adj. R-squared	0.55	0.77	0.58
N	409,068	386,199	386,199

Table 6. Climate change risk and corporate investment: the effect of external finance and equity dependence

This table presents the results from estimating Equation (2), incorporating interaction terms between CCN and external finance dependence (external equity dependence), separately for the two-quarter-ahead dependent variables: CAPX, RDINT, and INVEST. EXTFIN (EXTEQU) denotes the industry-level external finance dependence (external equity dependence). All other variables are consistent with those outlined in Table 2, and are defined in Section A of the Online Appendix. The controls, which are omitted for brevity, include EPU, Q, CF, SG, and GDP. Quarter dummies refer to a set of calendar and fiscal quarter dummy variables. Parentheses contain t-statistics, computed using standard errors clustered at the firm and calendar quarter levels. The sample period is from 1988Q3 to 2017Q2. Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively.

Panel A: External finance dependence			
	CAPX	RDINT	INVEST
	(1)	(2)	(3)
CCN	-0.901***	-0.073*	-0.982***
	(-5.46)	(-1.75)	(-5.07)
CCN×EXTFIN	-0.013**	-0.002*	-0.015**
	(-2.04)	(-1.76)	(-2.07)
EXTFIN	0.065**	0.008*	0.073**
	(2.14)	(1.76)	(2.16)
Investments ahead by	Two quarters	Two quarters	Two quarters
Controls	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes
Adj. R-squared	0.56	0.77	0.57
N	386,050	386,050	386,050
Panel B: External equity dependence			
	CAPX	RDINT	INVEST
	(1)	(2)	(3)
CCN	-0.887***	-0.071*	-0.965***
	(-5.39)	(-1.73)	(-5.01)
CCN×EXTEQU	-0.004*	-0.000*	-0.004*
	(-1.81)	(-1.72)	(-1.95)
EXTEQU	0.018*	0.002	0.020*
	(1.74)	(1.58)	(1.87)
Investments ahead by	Two quarters	Two quarters	Two quarters
Controls	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes
Adj. R-squared	0.56	0.77	0.57
N	385,720	385,720	385,720

Table 7. Climate change risk and corporate investment: the effect of policy pressure and reputational exposure

This table reports estimates of Equation (2) that incorporate interaction terms between CCN and EPS (Panel A) and between CCN and SALIENT (Panel B). The dependent variables are measured two quarters ahead and include CAPX, RDINT, and INVEST. EPS is the market-based component of the OECD Environmental Policy Stringency Index, measuring the stringency of market-oriented environmental regulations. SALIENT is an indicator variable equal to one for firms operating in carbon-intensive and highly scrutinized industries, namely oil and gas, utilities, and motor vehicles, and zero otherwise (Bolton and Kacperczyk, 2023). All other variables are consistent with those outlined in Table 2, and are defined in Section A of the Online Appendix. The controls, which are omitted for brevity, include EPU, Q, CF, SG, and GDP. Quarter dummies refer to a set of calendar and fiscal quarter dummy variables. Parentheses contain t-statistics, computed using standard errors clustered at the firm and calendar quarter levels. The sample period in Panel A covers 1990Q1 to 2017Q2, starting from when EPS data first became available. The sample period in Panel B is from 1985Q1 to 2017Q2 (1988Q3 to 2017Q2) for CAPX (RDINT and INVEST). Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively.

Panel A: Policy pressure			
	CAPX	RDINT	INVEST
	(1)	(2)	(3)
CCN	-8.364***	-0.779**	-9.441***
	(-3.96)	(-2.05)	(-3.81)
CCN×EPS	1.660***	0.151*	1.877***
	(3.54)	(1.81)	(3.42)
EPS	-8.900***	-0.821**	-10.052***
	(-3.73)	(-1.99)	(-3.60)
Investments ahead by	Two quarters	Two quarters	Two quarters
Controls	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes
Adj. R-squared	0.57	0.78	0.59
N	346,947	346,947	346,947
Panel B: Reputational exposure			
	CAPX	RDINT	INVEST
	(1)	(2)	(3)
CCN	-1.152***	-0.076*	-1.048***
	(-6.40)	(-1.74)	(-5.16)
CCN×SALIENT	1.248**	0.053	0.826
	(2.30)	(1.11)	(1.41)
Investments ahead by	Two quarters	Two quarters	Two quarters
Controls	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes
Adj. R-squared	0.55	0.77	0.57
N	409,070	386,201	386,201

Table 8. Market awareness of climate change risk and corporate investment: sub-periods

This table presents the results from estimating Equation (2) with sub-periods, separately for the two-quarter-ahead dependent variables CAPX, RDINT, and INVEST. Columns 1, 3, 5 (2, 4, 6) correspond to the sample period before (after) STERN. The index CCN refers to the Climate Change News index. All other variables are consistent with those outlined in Table 2, and are defined in Section A of the Online Appendix. The controls, which are omitted for brevity, include EPU, Q, CF, SG, and GDP. Quarter dummies refer to a set of calendar and fiscal quarter dummy variables. Parentheses contain t-statistics, computed using standard errors clustered at the firm and calendar quarter levels. The sample period is from 1985Q1 to 2006Q3 (1988Q3 to 2006Q3, 2006Q4 to 2017Q3) for Column 1 (Columns 3 and 5, Columns 2, 4, 6). Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively.

	CAPX		RDINT		INVEST	
	(1)	(2)	(3)	(4)	(5)	(6)
CCN	-0.835***	-0.042	-0.026	0.004	-0.681*	-0.031
	(-2.94)	(-0.23)	(-0.33)	(0.21)	(-1.98)	(-0.16)
Period	Before STERN	After STERN	Before STERN	After STERN	Before STERN	After STERN
Investments ahead by	Two quarters	Two quarters	Two quarters	Two quarters	Two quarters	Two quarters
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.54	0.63	0.74	0.86	0.56	0.67
N	252,474	156,453	229,605	156,453	229,605	156,453

Table 9. Market awareness of climate change risk and corporate investment: difference-in-differences estimation

This table presents the results from estimating Equation (4) using different measures of environmental impact: total emissions (Panel A), emissions intensity (Panel B), and MSCI net environment scores (Panel C), separately for the two-quarter-ahead dependent variables CAPX, RDINT, and INVEST. TREAT is an indicator variable taking the value of one for firms in the treatment sample, i.e., those in the largest quartile of carbon emissions or firms with negative MSCI net scores at the end of 2003, and zero otherwise. STERN is an indicator variable taking the value of zero for the period 2004Q1 to 2006Q3 and equal to one for the period 2006Q4 to 2009Q4. All other variables are consistent with those outlined in Table 2, and are defined in Section A of the Online Appendix. The controls, which are omitted for brevity, include EPU, Q, CF, SG, and GDP. Quarter dummies refer to a set of calendar and fiscal quarter dummy variables. Parentheses contain t-statistics, computed using standard errors clustered at the firm and calendar quarter levels. The sample period is from 2004Q1 to 2009Q4. Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively.

Panel A: Total emissions			
	CAPX	RDINT	INVEST
	(1)	(2)	(3)
TREAT×STERN	0.750**	0.043	0.825**
	(2.45)	(1.41)	(2.54)
Investments ahead by	Two quarters	Two quarters	Two quarters
Controls	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes
Adj. R-squared	0.74	0.73	0.72
N	5,312	5,312	5,312
Panel B: Emission intensity			
	CAPX	RDINT	INVEST
	(1)	(2)	(3)
TREAT×STERN	0.838**	0.020	0.904**
	(2.21)	(0.46)	(2.39)
Investments ahead by	Two quarters	Two quarters	Two quarters
Controls	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes
Adj. R-squared	0.73	0.72	0.71
N	5,364	5,364	5,364
Panel C: MSCI net environmental score			
	CAPX	RDINT	INVEST
	(1)	(2)	(3)
TREAT×STERN	0.803**	0.015	0.828**
	(2.32)	(0.28)	(2.48)
Investments ahead by	Two quarters	Two quarters	Two quarters
Controls	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes
Adj. R-squared	0.65	0.57	0.63
N	4,053	4,053	4,053

Table 10. Market awareness and emission intensity in brown firms

This table presents the results from regressing four-quarter ahead emission intensity on financial constraints (FC), proxied by the WW index (Whited and Wu, 2006), STERN, and BROWN (an indicator variable which equals 1 for firms in the highest quartile of total emissions, emission intensity, or those possessing negative net MSCI scores, and 0 otherwise), as well as the double and triple interactions among these variables. Quarter dummies refer to a set of calendar and fiscal quarter dummy variables. Parentheses contain t-statistics, computed using standard errors clustered at the firm and calendar quarter levels. The sample period is from 2002Q1 to 2017Q2. Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively.

	(1) Total emissions	(2) Emission intensity	(3) MSCI score
FC	1.174***	1.255***	1.081***
	(3.16)	(3.22)	(2.74)
BROWN	0.527*	0.720***	0.270
	(1.70)	(2.69)	(0.93)
STERN	0.033	-0.008	-0.077
	(0.22)	(-0.05)	(-0.48)
BROWN×STERN	-0.515*	-0.695***	-0.493*
	(-1.84)	(-3.03)	(-1.69)
BROWN×FC	0.436	0.457	1.023
	(0.66)	(0.78)	(1.57)
STERN×FC	1.103***	0.960***	0.840**
	(2.88)	(2.80)	(2.19)
BROWN×STERN×FC	-1.558**	-2.004***	-1.779***
	(-2.44)	(-3.67)	(-2.74)
Quarter Dummies	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes
Adj. R-squared	0.95	0.95	0.95
N	38,617	38,617	30,422

Table 11. Climate change risk and corporate investment: Aggregate versus firm-specific measures

This table presents the results from estimating Equation (2) augmented with firm-specific climate risk measures and their interactions with CCN, using CAPX as the dependent variable. Panels A and B report the results using the transition risk measure of Li et al. (2024), including the overall transition risk measure (TRANSIT) and its proactive (PROA) and non-proactive (NPROA) components. Panels C and D report the results using the climate change exposure measure of Sautner et al. (2023), including the overall measure (CCE) and its opportunity (CCEOpp), regulatory (CCEReg), and physical risk (CCEPhy) components. CCN and the firm-specific measures are demeaned so that the main effects can be interpreted at the average level of the interacting variable. Columns 1 to 6 (7 to 12) correspond to 2-, 4-, 6-, 8-, 10-, and 12-quarter-ahead CAPX, respectively. All other variables are consistent with those outlined in Table 2 and are defined in Section A of the Online Appendix. The controls, which are omitted for brevity, include EPU, Q, CF, SG, and GDP. Quarter dummies refer to a set of calendar and fiscal quarter dummy variables. Parentheses contain t-statistics computed using standard errors clustered at the firm and calendar quarter levels. The sample period is from 2002Q1 (2001Q1) to 2017Q2 for Panels A and B (Panels C and D). Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively.

	Panel A: Transition risk						*Panel B: Proactive and nonproactive transition risk*					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CCN	-0.115	-0.080	-0.204	-0.384**	-0.577***	-0.440***	-0.115	-0.080	-0.204	-0.384**	-0.577***	-0.440***
	(-0.86)	(-0.63)	(-1.61)	(-2.34)	(-2.84)	(-2.84)	(-0.86)	(-0.64)	(-1.62)	(-2.34)	(-2.84)	(-2.84)
CCN×TRANSIT	0.027	0.133*	0.098	0.179**	0.149**	0.157						
	(0.38)	(1.76)	(1.28)	(2.09)	(2.42)	(1.58)						
TRANSIT	0.042*	0.043**	0.024	0.029	0.028	0.014						
	(1.94)	(2.21)	(1.13)	(1.50)	(1.43)	(0.65)						
CCN×PROA							0.056*	0.054	0.064	-0.018	0.013	-0.011
							(1.73)	(1.24)	(1.50)	(-0.45)	(0.44)	(-0.24)
CCN×NPROA							-0.011	0.097	0.057	0.194**	0.142**	0.166**
							(-0.17)	(1.48)	(0.85)	(2.57)	(2.50)	(2.07)
PROA							0.018	0.018*	0.009	0.004	0.008	-0.009
							(1.50)	(1.72)	(0.81)	(0.42)	(0.86)	(-1.04)
NPROA							0.029	0.031*	0.018	0.028	0.022	0.020
							(1.52)	(1.68)	(0.87)	(1.49)	(1.13)	(0.95)
Investment ahead by	2 quarters	4 quarters	6 quarters	8 quarters	10 quarters	12 quarters	2 quarters	4 quarters	6 quarters	8 quarters	10 quarters	12 quarters
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.66	0.66	0.68	0.68	0.69	0.69	0.66	0.66	0.68	0.68	0.69	0.69
N	116,774	114,353	89,577	83,886	77,543	72,684	116,774	114,353	89,577	83,886	77,543	72,684

	Panel C: Overall climate change exposure						*Panel D: Exposure by shock type*					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CCN	-0.133	-0.100	-0.249*	-0.416**	-0.594***	-0.450***	-0.130	-0.098	-0.247*	-0.415**	-0.593***	-0.451***
	(-0.97)	(-0.77)	(-1.96)	(-2.56)	(-2.94)	(-2.77)	(-0.95)	(-0.75)	(-1.95)	(-2.55)	(-2.94)	(-2.77)
CCN×CCE	0.027	0.056**	0.038	0.069**	0.054*	0.047						
	(1.06)	(2.08)	(1.37)	(2.05)	(1.96)	(1.43)						
CCE	0.023***	0.026***	0.013	0.006	0.008	-0.005						
	(2.80)	(3.21)	(1.31)	(0.70)	(0.91)	(-0.45)						
CCN×CCEOpp							0.044	0.079**	0.055	0.082*	0.081*	0.076
							(1.22)	(2.39)	(1.38)	(1.95)	(1.90)	(1.50)
CCN×CCEReg							-0.130	-0.099	0.176	0.362	0.217	-0.126
							(-0.97)	(-0.80)	(1.06)	(1.47)	(1.13)	(-1.03)
CCN×CCEPhy							0.186	0.149	0.108	-0.156	0.095	0.352
							(1.10)	(0.86)	(0.45)	(-1.04)	(0.52)	(1.48)
CCEOpp							0.032**	0.031**	0.023	0.013	0.012	0.001
							(2.28)	(2.13)	(1.27)	(0.82)	(0.75)	(0.04)
CCEReg							0.007	0.051	-0.035	0.032	0.022	0.004
							(0.14)	(1.01)	(-0.91)	(0.68)	(0.48)	(0.07)
CCEPhy							0.018	0.001	0.012	-0.150**	-0.120*	-0.102
							(0.24)	(0.02)	(0.15)	(-2.60)	(-1.75)	(-1.45)
Investment ahead by	2 quarters	4 quarters	6 quarters	8 quarters	10 quarters	12 quarters	2 quarters	4 quarters	6 quarters	8 quarters	10 quarters	12 quarters
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.65	0.65	0.67	0.68	0.68	0.68	0.65	0.65	0.67	0.68	0.68	0.68
N	138,668	135,617	108,009	101,511	93,964	88,168	138,668	135,617	108,009	101,511	93,964	88,168

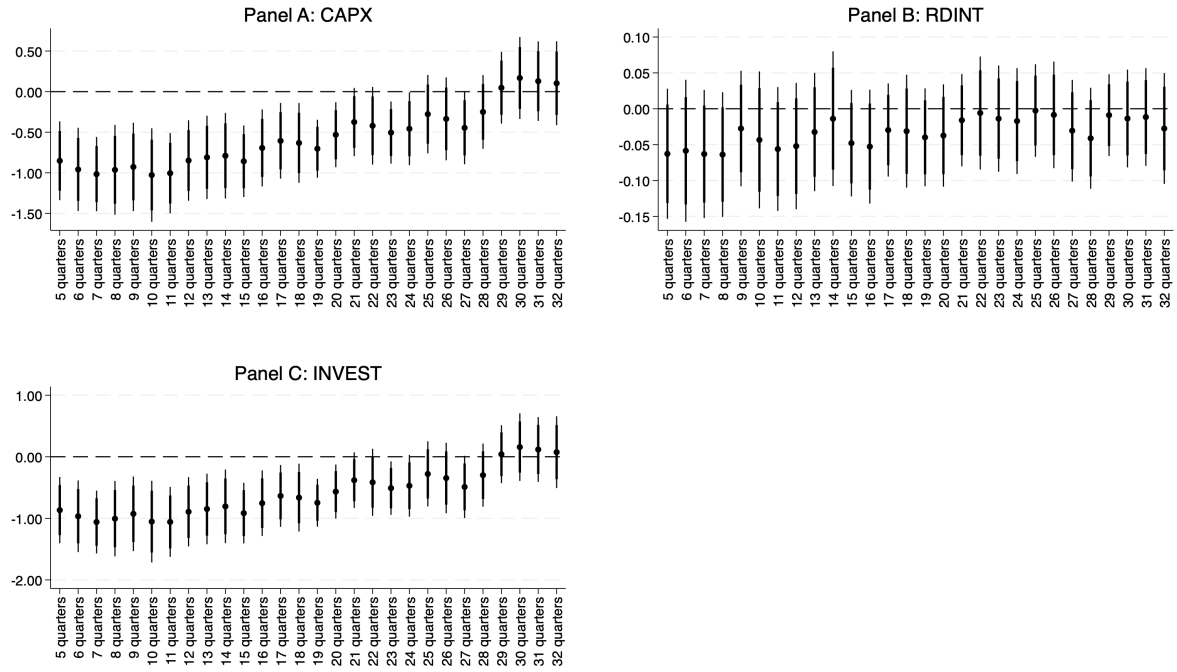


Figure 1. Investment responses to CCN at extended horizons

This figure reports coefficient estimates from regressions of future investment on CCN at alternative horizons. Panels A, B, and C present results for CAPX, RDINT, and INVEST, respectively. The horizontal axis indicates the number of quarters ahead for the dependent variable, extending up to 32 quarters. All regressions follow the specification in Equation (2), with investment measured at different future horizons. The dots represent point estimates, and the vertical bars denote 95% and 99% confidence intervals, respectively, based on standard errors double clustered by firm and calendar quarter.

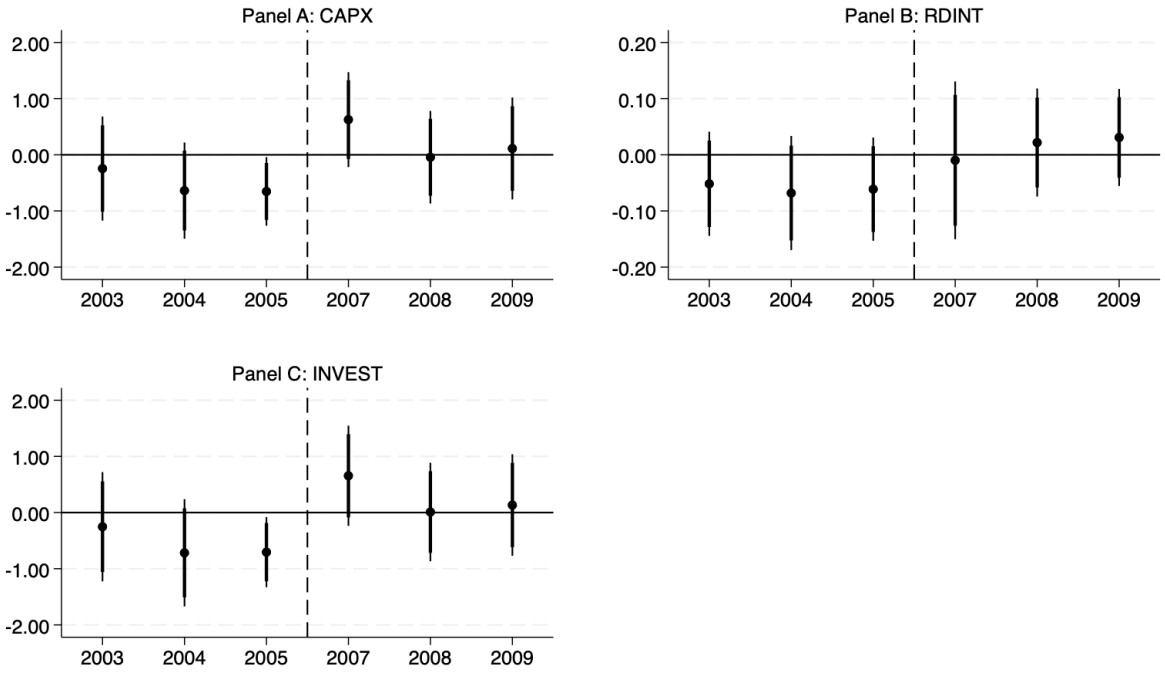


Figure 2. Investment dynamics around the Stern review

This figure reports the point estimates and the 90% and 95% confidence intervals of the annual-binned dynamic treatment effects around the Stern Review. The omitted baseline year is 2006. The dependent variables are the two-quarter-ahead CAPX (Panel A), RDINT (Panel B), and INVEST (Panel C). Coefficients represent the differential response of treated (brown) firms relative to control firms in each year relative to 2006. All regressions include controls as those in Equation (4). Standard errors are clustered at the firm and calendar quarter levels.

Online Appendix for "Climate Risk and Corporate Investment: Transmission Mechanisms and Heterogeneous Effects"

Abstract

Section A defines all variables used in the analysis. Section B discusses the endogeneity tests. Section C examines alternative measures of climate risk. Section D discusses the results related to investment irreversibility. Section E presents the decomposition of CCN into physical and transition risks. Section F presents additional tables and figures. The corresponding tables and figures are reported within each section.

A Definition of variables

Variable	Definition	Source
	Risk and uncertainty indices (quarterly)	
CCN	The Climate Change News index created by Engle et al. (2020).	Stefano Giglio's website or Johannes Stroebel's website
CEI	The U.S. annual carbon dioxide emissions (in tonnes) from energy. The quarterly values are estimated by linear interpolation from annual values and align with each firm's fiscal quarter-end months.	Energy Institute Statistical Review of World Energy
CEVI	The volatility of country-level CEI, which measures the cross-sectional dispersion of carbon emissions worldwide, is calculated as: $\text{CEVI}_t = \sqrt{\frac{1}{N_c}\sum_{c=1}^{N_c}\left(\text{CEI}_{ct} - \frac{1}{N_c}\sum_{c=1}^{N_c}\text{CEI}_{ct}\right)^2}$, where CEI_{ct} represents the carbon dioxide emissions for country c at month t, and N_c represents the total number of countries in month t.	Energy Institute Statistical Review of World Energy
CPU	The Climate Policy Uncertainty index created by Gavriilidis (2021).	policyuncertainty.com
EPU	The Economic Political Uncertainty index created by Baker et al. (2016).	policyuncertainty.com
	Firm-level characteristics and macroeconomic factor	
CAPX	Capital expenditures divided by the book value of the assets from the previous period (in %).	Compustat
RDINT	Research and development expenditures divided by the book value of the assets from the previous period (in %). Missing values for RDINT are replaced with zero in the default setting.	Compustat
INVEST	The sum of CAPX and RDINT	Compustat
Q	Tobin's Q, defined as the market value of equity plus the book value of assets minus the book value of equity, divided by the book value of the asset.	Compustat
CF	Firm's cash flows, defined as income before extraordinary items plus depreciation and amortization, divided by the book value of the asset.	Compustat
SG	Sales growth, defined as the growth in quarterly sales.	Compustat
LEV	The firm's leverage ratio (book value of debt divided by book value of total assets) adjusted by subtracting the firm's average leverage ratio over the sample period.	Compustat
KZ	Financial constraint index based on Kaplan and Zingales (1997), calculated as: $-1.0019 \times \frac{\text{CF}}{\text{PP\&E}} + 0.2826 \times \text{Q} + 3.1391 \times \frac{\text{DEBT}}{\text{DEBT+EQUITY}} - 39.3678 \times \frac{\text{DIV}}{\text{PP\&E}} - 1.3147 \times \frac{\text{CASH}}{\text{PP\&E}}$, where CF is cash flow, Q is Tobin's Q, DEBT is the book value of debt, EQUITY is stockholders' equity, DIV is cash dividends, CASH is cash and short-term investments, and PP&E is net property, plant, and equipment, measured as of the previous quarter.	Compustat
WW	Financial constraint index based on Whited and Wu (2006), calculated as: $-0.091 \times \frac{\text{CF}}{\text{Asset}} - 0.062 \times \text{DIVPOS} + 0.021 \times \text{TLTD} - 0.044 \times \text{LNTA} + 0.102 \times \text{ISG} - 0.035 \times \text{SG}$, where $\frac{\text{CF}}{\text{Asset}}$ represents cash flow divided by the book value of the asset, DIVPOS is an indicator variable equal to one if the firm pays cash dividends, TLTD is the ratio of long-term debt to total assets, LNTA is the natural logarithm of total book assets, ISG is the industry sales growth (measured at the 3-digit SIC level), and SG is the firm's sales growth.	Compustat
HP	Financial constraint index based on Hadlock and Pierce (2010), calculated as: $-0.737 \times \text{Size} + 0.043 \times \text{Size}^2 - 0.040 \times \text{Age}$, where Size is the natural logarithm of total book assets, capped at the logarithm of \$4.5 billion, and Age represents the number of years a firm has appeared in Compustat with non-missing total assets.	Compustat

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Variable	Definition	Source
EXTFIN	External finance dependence is calculated as the difference between the sum of capital expenditures and R&D, and funds from operations, scaled by the sum of capital expenditures and R&D. If funds from operations are missing, they are imputed as the sum of income before extraordinary items, depreciation and amortization, deferred taxes, equity in net loss or earnings, gains or losses from the sale of property, plant, and equipment and investments, and other funds from operations. The industry-level measure of external finance dependence is constructed by taking the cross-sectional median of firm-level external finance dependence within each three-digit SIC industry in each quarter. The final industry-level series is defined as the time-series median of these quarterly values for each industry.	Compustat
EXTEQU	External equity dependence is calculated as the difference between the sale and purchase of common and preferred stock, scaled by the sum of capital expenditures and R&D. The industry-level time series of external equity dependence is constructed by taking the cross-sectional median of firm-level external equity dependence within each three-digit SIC industry in each quarter. Each industry's external equity dependence is defined as the time-series median of these quarterly values.	Compustat
IR	IR is the industry-level investment irreversibility, measured as the ratio of the total industry investment (CAPX, RDINT, or INVEST) to the total industry assets, where industries are defined at the three-digit SIC level.	Compustat
COE	The firm-level cost of equity is computed as the weighted sum of factor loadings and average factor premia, including market, size, value, profitability, investment, and climate risk factors, and then aggregated to the quarterly frequency by averaging across months within each quarter.	Compustat & Kenneth French's data library.
EPS	The market-based component of the OECD Environmental Policy Stringency (EPS) index, which captures the degree of stringency in market-oriented environmental regulations. The quarterly values are obtained by linearly interpolating the annual EPS values and align with each firm's fiscal quarter-end months.	OECD website
SALIENT	SALIENT is an indicator variable equal to one for firms operating in carbon-intensive and highly scrutinized industries, namely oil and gas, utilities, and motor vehicles, and zero otherwise (Bolton and Kacperczyk, 2023). Specifically, oil and gas firms are identified using SIC codes 131–138 and 291–299, utilities using SIC codes 491–497, and motor vehicles using SIC codes 371–379.	Compustat
GDP	Percentage change in real GDP from one year ago.	Federal Reserve Bank of St. Louis
	Other variables	
GMST	The Global Mean Surface Temperature.	NASA website
PD	The population density in the United States, measured as the number of individuals per square kilometer.	macrotrends.net
Stock return	Firm-level monthly stock return, measured in percentage terms.	Compustat
Fama-French five factors	Monthly returns on the market, size (SMB), value (HML), profitability (RMW), and investment (CMA) factors.	Kenneth French's data library
TRANSIT	Transition risk measure of Li et al. (2024), including the overall transition risk measure (TRANSIT) and its proactive (PROA) and non-proactive (NPROA) components.	Yuehua Tang's website
CCE	The climate change exposure measure of Sautner et al. (2023), including the overall measure (CCE) and its opportunity (CCEOpp), regulatory (CCEReg), and physical risk (CCEPhy) components.	University of Zurich Data Center
ACI	The Actuaries Climate Index (ACI) for the United States.	actuariesclimateindex.org
NDI	The natural disasters index developed by Faccini et al. (2023).	Renato Faccini's website

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Variable	Definition	Source
ISI	The international summits index developed by Faccini et al. (2023).	Renato Faccini's website

B Endogeneity

B.1 Instrumental-variable regressions

We employ an instrumental variable analysis as commonly used in the literature to address the possibility that CCN reflects rather than causes shifts in investment (reverse causality). We utilize global mean surface temperature (GMST) as the instrument, as GMST provides plausibly exogenous variation in climate-related attention that is independent of firm-level investment dynamics. GMST is measured on a quarterly basis, calculated as the monthly average of the value within each firm's fiscal quarter that ends in the calendar quarter q, similar to CCN.

We perform a two-stage model regression, where the first stage involves regressing CCN on GMST and a set of control variables as outlined in Equation (2), and the second stage entails regressing each investment measure on the residuals obtained from the first stage along with the control variables. Table A2 presents the results. Columns 1-3 display the benchmark results using two-quarter-ahead investment measures (same as in Table 2). Column 4 reports the first-stage results where the coefficient on GMST is positive and statistically significant at the 1% level, indicating that higher GMST correlates with a higher CCN. The Kleibergen-Paap F-statistics are above 19, suggesting that our two-stage model regressions are not subject to weak identification problems. Columns 5-7 detail the second-stage results. These estimates demonstrate that the relationship between CCN and investment measures remains significantly negative under this alternative instrumental-variable specification. Next, following Huang et al. (2018), we also use the U.S. population density as an alternative instrumental variable in our analysis, yielding results that are qualitatively consistent. Model estimates are presented in Table A3.

Overall, the results confirm that our benchmark findings—the effect of CCN on firm-level corporate investment—are valid and reliable.

B.2 Exogenous shock of Hurricane Katrina as a climate disaster

We utilize Hurricane Katrina, a significant climatic disaster that substantially impacted the U.S. economy and financial markets (Massa and Zhang, 2021), as an exogenous shock to assess whether the CCN-investment relationship reflects disaster-driven disruptions. By focusing on this natural disaster, we distinguish broad disruption effects that are not captured by CCN. We expect that

firms affected by Hurricane Katrina will notably reduce their investment activities compared to those unaffected. We analyze these effects employing a difference-in-differences regression model, following Bourveau and Law (2021):

$$\text{Investment}_{i,q+2} = \alpha_i + \beta_1 \text{KATRINA} \times \text{POST}_{i,q} + \gamma \text{F}_{i,q} + \delta \text{GDP}_q + \text{QD}_q + \epsilon_{i,q+2}, \tag{B.1}$$

where KATRINA is an indicator variable taking the value of one for firms based in one of the states affected by the Katrina hurricane, and zero otherwise.[1] POST is an indicator variable taking the value of zero for the period 2004Q1 to 2005Q3, and equal to one for the period 2005Q4 to 2007Q4.[2] Investment decisions at the firm level are measured by two-quarter-ahead CAPX, RDINT, or INVEST. Control variables are consistent with those in Equation (2), including the indicators KATRINA and POST, as well as EPU. We also include a set of calendar and fiscal quarter dummy variables and firm fixed effects. The standard errors are double clustered by both firm and calendar quarter.

Table A4 presents the results in Panel A. The interaction term KATRINA $\times$ POST yields a significantly negative coefficient for CAPX, RDINT, and INVEST. These findings align with our expectation that firms in states affected by Hurricane Katrina reduce their investment activities significantly compared to firms in unaffected states. This supports the validity and reliability of our benchmark results on the influence of CCN on firm-level corporate investment.

Moreover, the findings in Panel B confirm the robustness of our conclusions using the PSM approach to estimate Equation (B.1). In this analysis, KATRINA is redefined as an indicator variable that assigns a value of one to firms located in states affected by Hurricane Katrina, and zero to comparable firms in other states. As in Section 5, we match firms based on their Q and CF values at the end of 2003 using the Mahalanobis distance, and results remain qualitatively similar when using the nearest neighbor method.

[1] The affected states include AL, AR, FL, GA, IN, KY, LA, MI, MS, OH, TN.

[2] We employ a short sample period from 2004Q1 to 2007Q4 for this analysis to precisely examine the impact of an exogenous shock, comparing effects before and after the event. Note that our conclusions still hold when we estimate the regression model in Equation (B.1) using an extended sample period.

Table A2. Climate change risk and corporate investment: two-stage instrumental variable analysis

This table presents the results of the instrumental variable analysis. Columns 1-3 display the benchmark results using two-quarter-ahead investment measures (as in Table 2). Column 4 reports the first-stage results, while Columns 5-7 detail the second-stage results. GMST is the Global Mean Surface Temperature. All other variables are consistent with those outlined in Table 2, and are defined in Section A of the Online Appendix. The controls, which are omitted for brevity, include EPU, Q, CF, SG, and GDP. Parentheses contain t-statistics, calculated using standard errors that are clustered at the firm and calendar quarter levels. The sample period is from 1985Q1 to 2017Q2 (1988Q3 to 2017Q2) for CAPX (RDINT and INVEST). Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	OLS: CAPX	OLS: RDINT	OLS: INVEST	2SLS: Stage 1: CCN	2SLS: Stage 2: CAPX	2SLS: Stage 2: RDINT	2SLS: Stage 2: INVEST
CCN	-1.026***	-0.071*	-0.965***		-4.691***	-0.358***	-4.979***
	(-6.06)	(-1.73)	(-5.02)		(-5.35)	(-2.97)	(-4.63)
GMST				0.466***			
				(4.91)			
Investment ahead by	Two quarters	Two quarters	Two quarters		Two quarters	Two quarters	Two quarters
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.55	0.77	0.57	0.42	0.17	0.05	0.15
N	409,070	386,201	386,201	409,070	409,070	386,201	386,201
Weak Identification Test (Kleibergen-Paap)					24.14	19.20	19.20

Table A3. Climate change risk and corporate investment: employing PD to perform two-stage instrumental variable analysis

This table presents the results of the instrumental variable analysis. Columns 1-3 display the benchmark results using two-quarter-ahead investment measures (as in Table 2). Column 4 reports the first-stage results, while Columns 5-7 detail the second-stage results. PD is the population density in the United States. All other variables are consistent with those outlined in Table 2, and are defined in Section A of the Online Appendix. The controls, which are omitted for brevity, include EPU, Q, CF, SG, and GDP. Parentheses contain t-statistics, calculated using standard errors that are clustered at the firm and calendar quarter levels. The sample period is from 1985Q1 to 2017Q2. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	OLS: CAPX	OLS: RDINT	OLS: INVEST	2SLS: Stage 1: CCN	2SLS: Stage 2: CAPX	2SLS: Stage 2: RDINT	2SLS: Stage 2: INVEST
CCN	-1.026***	-0.071*	-0.965***		-5.097***	-0.379***	-5.498***
	(-6.06)	(-1.73)	(-5.02)		(-8.42)	(-2.69)	(-6.87)
PD				0.053***			
				(9.00)			
Investment ahead by	Two quarters	Two quarters	Two quarters		Two quarters	Two quarters	Two quarters
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.55	0.77	0.57	0.46	0.15	0.05	0.14
N	409,070	386,201	386,201	409,070	409,070	386,201	386,201
Weak Identification Test (Kleibergen-Paap)					80.94	52.77	52.77

Table A4. Climate change risk and corporate investment: exogenous climate disaster of Hurricane Katrina

This table presents the results from estimating Equation (B.1) using unmatched (Panel A) and matched sample (Panel B), separately for the two-quarter-ahead dependent variables CAPX, RDINT, and INVEST. KATRINA is an indicator variable taking the value of one for firms based in one of the states affected by the Katrina hurricane, and zero otherwise. POST is an indicator variable taking the value of zero for the period 2004Q1 to 2005Q3 and equal to one for the period 2005Q4 to 2007Q4. All other variables are consistent with those outlined in Table 2, and are defined in Section A of the Online Appendix. The controls, which are omitted for brevity, include EPU, Q, CF, SG, and GDP. Quarter dummies refer to a set of calendar and fiscal quarter dummy variables. Parentheses contain t-statistics, computed using standard errors clustered at the firm and calendar quarter levels. The sample period is from 2004Q1 to 2007Q4. Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively.

Panel A: Katrina-affected firms vs. Non-affected firms			
	CAPX	RDINT	INVEST
	(1)	(2)	(3)
KATRINA×POST	-0.178**	-0.064**	-0.243**
	(-2.15)	(-2.20)	(-2.72)
Investments ahead by	Two quarters	Two quarters	Two quarters
Controls	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes
Adj. R-squared	0.71	0.87	0.72
N	57,256	57,256	57,256
Panel B: Post-match: Katrina-affected firms vs. Non-affected firms			
	CAPX	RDINT	INVEST
	(1)	(2)	(3)
KATRINA×POST	-0.209*	-0.093**	-0.324**
	(-1.76)	(-2.37)	(-2.53)
Investments ahead by	Two quarters	Two quarters	Two quarters
Controls	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes
Adj. R-squared	0.70	0.82	0.70
N	16,538	16,538	16,538

C Alternative measures of climate risk and uncertainty

Our primary measure for climate change risk is the CCN index developed by Engle et al. (2020). Given that this index is derived from newspaper searches rather than direct assessments of environmental impacts, we employ two supplementary measures designed to reflect climate risk with direct relevance to the real economy. The first index is the U.S. Annual Carbon Emissions Index (CEI) from energy. The second measure, consistent with the theoretical model by Bansal and Ochoa (2011*a*), is represented by the global mean surface temperatures (GMST). Similar to the influence of the CCN, we anticipate that heightened environmental impacts, as reflected by elevated carbon dioxide emissions in the U.S. or global temperatures, lead firms to postpone their investment decisions.

While our climate risk proxies capture elements of uncertainty that affect corporate investment decisions, we also focus on more direct proxies of climate change uncertainty to relate more narrowly to the real option literature. We utilize the Climate Policy Uncertainty index (CPU), developed by Gavriilidis (2021). Similar to the CCN measure, this index is also derived from textual analyses of articles from eight leading U.S. newspapers, but it follows the methodology established by Baker et al. (2016) for the EPU index. We also use the volatility of the country-level CEI (CEVI), which quantifies the cross-sectional dispersion of carbon emissions globally.[3]

We substitute the CCN with these four alternative measures of climate change risk and uncertainty to re-examine the impact on corporate investment. Table A5 presents the results, divided into four panels: CAPX (Panel A), RDINT (Panel B), and INVEST (Panel C). Aligned with the discussions in Section 3, the results of these alternative measures confirm a negative impact of climate change on CAPX, RDINT, and INVEST. The results also indicate that climate change risk/uncertainty produces a similar effect on corporate investment. While there are minor variations in significance levels such as the lack of significance of both CEI and CPU on R&D expenditures, the overall pattern remains consistent. In Table A6, we also use the media-based climate change concern index developed by Ardia et al. (2023) as an additional measure of climate change uncer-

[3]Since the CEI and CEVI indices are typically released to the public in June of the following year, we apply a six-month lag to both indices. The indices, originally presented in annual values, are converted to quarterly values through linear interpolation and align with each firm's fiscal quarter-end months, assuming a constant quarter-to-quarter change within each year (Allen et al., 2012). Subsequently, the indices are normalized to have a mean of 100, log-transformed, and are measured on a quarterly basis, similar to the CCN index.

tainty. Although the series begins in 2003Q1, the results indicate that the index has a significant negative effect on CAPX and INVEST, but not on RDINT. Hence, our baseline findings remain robust when employing alternative measures that capture real environmental impacts and utilizing other methods of textual analysis of newspapers, thereby complementing our primary measure based on the specific intensity of newspaper discussions. Furthermore, given that CCN data terminates in June 2017, while alternative measures extend up to June 2023, we also perform robustness tests over this longer period. The outcomes, detailed in Table A7, confirm that our conclusions remain consistent also over a longer sample period.

Finally, since our baseline analysis employs the raw CCN index to ensure comparability with EPU and to facilitate interpretation, we follow Engle et al. (2020) and Huynh and Xia (2021) in using the innovations in CCN, which are residuals derived from a first-order autoregressive model, to re-estimate Equation (2). The results, presented in Table A8, are largely consistent with our baseline findings.

Table A5. Corporate investment analysis using alternative measures of climate change risk

This table presents the results of corporate investment analysis using CEI (CEVI, GMST, CPU), separately for the dependent variables CAPX (Panel A), RDINT (Panel B), and INVEST (Panel C). Columns 1 to 4 (5 to 8, 9 to 12, 13 to 16) correspond to one to four quarters ahead for the dependent variables, respectively. CEI (CEVI, GMST, CPU) is the U.S. monthly Carbon Emissions index (the volatility of the country-level CEI, the global mean surface temperature, the Climate Policy Uncertainty index created by Gavriilidis (2021)). All other variables are consistent with those outlined in Table 2, and are defined in Section A of the Online Appendix. The controls, which are omitted for brevity, include EPU, Q, CF, SG, and GDP. Quarter dummies refer to a set of calendar and fiscal quarter dummy variables. Parentheses contain t-statistics, computed using standard errors clustered at the firm and calendar quarter levels. The sample period is from 1985Q1 to 2017Q2 (1988Q3 to 2017Q2) for Panel A (Panels B and C), with the exception that CPU data begins from 1987Q3. Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively.

Panel A: CAPX

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
CEI	-5.175***	-5.140***	-5.333***	-5.349***												
	(-5.76)	(-6.05)	(-6.71)	(-6.82)												
CEVI					-2.818***	-2.728***	-2.629***	-2.594***								
					(-14.45)	(-14.05)	(-13.83)	(-13.70)								
GMST									-2.151***	-2.187***	-2.229***	-2.143***				
									(-8.51)	(-10.11)	(-11.92)	(-8.24)				
CPU													-0.358**	-0.454**	-0.394**	-0.419***
													(-2.37)	(-2.60)	(-2.15)	(-2.96)
Investment ahead by	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.54	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.54	0.55	0.55	0.55	0.55	0.55	0.55	0.56
N	418,158	409,070	401,898	395,340	418,158	409,070	401,898	395,340	418,158	409,070	401,898	395,340	400,659	392,100	385,266	379,030

Panel B: RDINT

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
CEI	-0.229	-0.271	-0.337	-0.313												
	(-0.88)	(-1.07)	(-1.34)	(-1.11)												
CEVI					-0.199***	-0.242***	-0.248***	-0.248***								
					(-3.05)	(-3.59)	(-3.60)	(-3.59)								
GMST									-0.121**	-0.160***	-0.208***	-0.222***				
									(-2.61)	(-3.37)	(-4.29)	(-4.23)				
CPU													0.019	0.016	0.037	0.006
													(0.64)	(0.43)	(0.87)	(0.21)
Investment ahead by	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.78	0.77	0.77	0.77	0.78	0.77	0.77	0.77	0.78	0.77	0.77	0.77	0.78	0.77	0.77	0.77
N	392,330	386,201	381,629	377,494	392,330	386,201	381,629	377,494	392,330	386,201	381,629	377,494	392,330	386,201	381,628	377,490

Panel C: INVEST

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
CEI	-4.220***	-4.533***	-5.086***	-5.348***												
	(-3.72)	(-4.13)	(-4.83)	(-5.17)												
CEVI					-2.855***	-2.886***	-2.817***	-2.804***								
					(-12.47)	(-12.40)	(-12.34)	(-12.19)								
GMST									-2.103***	-2.219***	-2.367***	-2.331***				
									(-7.59)	(-8.91)	(-10.66)	(-7.61)				
CPU													-0.254	-0.384*	-0.344	-0.396**
													(-1.52)	(-1.98)	(-1.62)	(-2.49)
Investment ahead by	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.57	0.57	0.57	0.57	0.58	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57
N	392,330	386,201	381,629	377,494	392,330	386,201	381,629	377,494	392,330	386,201	381,629	377,494	392,330	386,201	381,628	377,490

Table A6. Corporate investment analysis using the climate change concern index

This table presents the results from estimating Equation (2), separately for the dependent variables CAPX (Panel A), RDINT (Panel B), and INVEST (Panel C). Columns 1 to 4 (5 to 8, 9 to 12) correspond to one to four quarters ahead for the dependent variables, respectively. CCC is the media-based climate change concern index developed by Ardia et al. (2023). Definitions for the remaining variables are provided in Section A of the Online Appendix. Quarter dummies refer to a set of calendar and fiscal quarter dummy variables. Parentheses contain t-statistics, computed using standard errors clustered at the firm and calendar quarter levels. The sample period is from 2003Q1 to 2017Q2. Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively.

	Panel A: CAPX				*Panel B: RDINT*				*Panel C: INVEST*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CCC	-0.298***	-0.310***	-0.379***	-0.441***	-0.012	-0.019	-0.006	-0.014	-0.299***	-0.326***	-0.387***	-0.467***
	(-2.93)	(-2.84)	(-3.63)	(-4.31)	(-0.49)	(-0.77)	(-0.28)	(-0.60)	(-2.73)	(-2.69)	(-3.28)	(-3.99)
EPU	-0.420***	-0.427***	-0.394***	-0.337***	0.075***	0.047**	0.029	0.012	-0.302**	-0.358***	-0.357***	-0.322***
	(-3.70)	(-3.81)	(-3.63)	(-3.19)	(3.45)	(2.08)	(1.35)	(0.56)	(-2.49)	(-2.87)	(-2.92)	(-2.70)
Q	0.326***	0.325***	0.309***	0.302***	0.197***	0.121***	0.082***	0.061***	0.631***	0.513***	0.433***	0.393***
	(15.21)	(15.63)	(14.10)	(14.11)	(13.60)	(8.35)	(5.83)	(4.25)	(20.03)	(17.19)	(14.13)	(12.84)
CF	2.791***	3.433***	3.420***	3.283***	-5.571***	-4.207***	-3.325***	-2.816***	-5.401***	-2.488***	-1.134*	-0.374
	(6.11)	(7.12)	(8.08)	(9.09)	(-12.37)	(-10.65)	(-9.53)	(-8.30)	(-7.29)	(-3.47)	(-1.73)	(-0.61)
SG	0.037	0.014	0.161***	0.082*	0.052***	0.057***	0.039***	0.041**	0.139***	0.111**	0.255***	0.162***
	(0.97)	(0.38)	(4.17)	(1.89)	(3.34)	(3.48)	(2.83)	(2.65)	(3.31)	(2.33)	(5.74)	(3.45)
GDP	-0.007	0.005	0.010	0.014	-0.010***	-0.008**	-0.005	-0.004	-0.022	-0.008	0.001	0.007
	(-0.26)	(0.26)	(0.74)	(0.99)	(-2.85)	(-2.32)	(-1.66)	(-1.16)	(-0.75)	(-0.33)	(0.09)	(0.45)
Investment ahead by	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.61	0.62	0.62	0.62	0.85	0.84	0.84	0.84	0.65	0.64	0.64	0.64
N	215,332	211,482	208,385	205,330	215,332	211,482	208,385	205,330	215,332	211,482	208,385	205,330

Table A7. Corporate investment analysis using alternative measures of climate change risk over an extended sample period

This table presents the results of corporate investment analysis using CEI (CEVI, GMST, CPU) with an extended sample period, separately for the dependent variables CAPX (Panel A), RDINT (Panel B), and INVEST (Panel C). Columns 1 to 4 (5 to 8, 9 to 12, 13 to 16) correspond to one to four quarters ahead for the dependent variables, respectively. CEI (CEVI, GMST, CPU) is the U.S. monthly Carbon Emissions index (the volatility of the country-level CEI, the global mean surface temperature, the Climate Policy Uncertainty index created by Gavriilidis (2021)). All other variables are consistent with those outlined in Table 2, and are defined in Section A of the Online Appendix. The controls, which are omitted for brevity, include EPU, Q, CF, SG, and GDP. Quarter dummies refer to a set of calendar and fiscal quarter dummy variables. Parentheses contain t-statistics, computed using standard errors clustered at the firm and calendar quarter levels. The sample period is from 1985Q1 to 2023Q2 (1988Q3 to 2023Q2) for Panel A (Panels B and C), with the exception that CPU data begins from 1987Q3. Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively.

Panel A: CAPX

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
CEI	-2.420***	-2.550***	-2.668***	-2.837***												
	(-2.82)	(-3.29)	(-3.31)	(-3.71)												
CEVI					-2.919***	-2.860***	-2.826***	-2.807***								
					(-15.80)	(-15.73)	(-16.06)	(-15.61)								
GMST									-2.229***	-2.260***	-2.331***	-2.277***				
									(-10.89)	(-12.26)	(-14.02)	(-10.43)				
CPU													-0.641***	-0.662***	-0.752***	-0.765***
													(-5.93)	(-5.94)	(-6.20)	(-6.73)
Investment ahead by	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.53	0.54	0.54	0.54	0.54	0.55	0.55	0.55	0.54	0.55	0.55	0.55	0.54	0.55	0.55	0.55
N	508,491	496,228	484,242	472,809	508,491	496,228	484,242	472,809	508,491	496,228	484,242	472,809	490,992	479,258	467,610	456,499

Panel B: RDINT

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
CEI	0.348*	0.281	0.202	0.196												
	(1.67)	(1.42)	(1.01)	(0.88)												
CEVI					-0.251***	-0.282***	-0.285***	-0.285***								
					(-3.95)	(-4.26)	(-4.22)	(-4.22)								
GMST									-0.188***	-0.219***	-0.256***	-0.272***				
									(-3.93)	(-4.57)	(-5.34)	(-5.15)				
CPU													-0.078***	-0.075**	-0.068**	-0.088***
													(-2.72)	(-2.32)	(-2.05)	(-3.02)
Investment ahead by	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.78	0.77	0.77	0.77	0.78	0.77	0.77	0.77	0.78	0.77	0.77	0.77	0.78	0.77	0.77	0.77
N	482,663	473,359	463,973	454,963	482,663	473,359	463,973	454,963	482,663	473,359	463,973	454,963	482,663	473,359	463,972	454,959

Panel C: INVEST

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
CEI	-0.384	-0.880	-1.322	-1.768*												
	(-0.39)	(-0.97)	(-1.34)	(-1.88)												
CEVI					-3.010***	-3.045***	-3.057***	-3.066***								
					(-13.74)	(-14.07)	(-14.45)	(-13.93)								
GMST									-2.247***	-2.347***	-2.525***	-2.524***				
									(-9.71)	(-10.84)	(-12.45)	(-9.53)				
CPU													-0.682***	-0.715***	-0.841***	-0.870***
													(-5.48)	(-5.86)	(-6.13)	(-6.62)
Investment ahead by	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.57	0.56	0.56	0.56	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.56
N	482,663	473,359	463,973	454,963	482,663	473,359	463,973	454,963	482,663	473,359	463,973	454,963	482,663	473,359	463,972	454,959

Table A8. Climate change risk and corporate investment: baseline results using CCN innovation

This table presents the results from estimating Equation (2), separately for the dependent variables CAPX (Panel A), RDINT (Panel B), and INVEST (Panel C). Columns 1 to 4 (5 to 8, 9 to 12) correspond to one to four quarters ahead for the dependent variables, respectively. The climate change risk is measured by the innovation of CCN. Definitions for the remaining variables are provided in Section A of the Online Appendix. Quarter dummies refer to a set of calendar and fiscal quarter dummy variables. Parentheses contain t-statistics, computed using standard errors clustered at the firm and calendar quarter levels. The sample period is from 1985Q1 to 2017Q2 (1988Q3 to 2017Q2) for Panel A (Panels B and C). Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively.

	Panel A: CAPX				*Panel B: RDINT*				*Panel C: INVEST*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CCN	-1.797***	-1.549***	-1.670***	-2.001***	-0.192*	-0.116	-0.121	-0.267***	-1.834***	-1.451***	-1.735***	-2.166***
	(-3.03)	(-3.33)	(-3.62)	(-3.97)	(-1.87)	(-1.20)	(-1.41)	(-3.00)	(-2.92)	(-2.80)	(-3.32)	(-3.80)
EPU	-0.360**	-0.309*	-0.345**	-0.361**	0.008	-0.011	-0.037	-0.046	-0.570***	-0.523***	-0.545***	-0.530***
	(-2.07)	(-1.97)	(-2.32)	(-2.61)	(0.26)	(-0.29)	(-0.97)	(-1.23)	(-3.16)	(-3.01)	(-3.37)	(-3.32)
Q	0.421***	0.405***	0.381***	0.364***	0.179***	0.121***	0.090***	0.064***	0.659***	0.563***	0.494***	0.446***
	(19.84)	(19.58)	(18.93)	(17.64)	(15.28)	(10.40)	(7.83)	(5.69)	(23.13)	(20.09)	(18.01)	(15.64)
CF	3.469***	4.919***	5.389***	5.725***	-6.177***	-5.235***	-4.408***	-4.083***	-5.404***	-2.438***	-0.808	0.123
	(9.14)	(12.66)	(13.93)	(14.26)	(-17.50)	(-15.93)	(-13.98)	(-13.00)	(-9.03)	(-4.19)	(-1.41)	(0.21)
SG	0.085**	0.103***	0.279***	0.172***	0.084***	0.090***	0.057***	0.087***	0.195***	0.223***	0.379***	0.276***
	(2.58)	(3.14)	(8.41)	(5.17)	(6.23)	(6.68)	(4.37)	(5.93)	(5.22)	(5.46)	(10.04)	(7.55)
GDP	0.092***	0.108***	0.106***	0.098***	-0.004	-0.000	0.001	0.001	0.055*	0.081***	0.085***	0.085***
	(3.08)	(3.93)	(3.59)	(3.37)	(-0.67)	(-0.01)	(0.14)	(0.11)	(1.76)	(2.64)	(2.72)	(2.63)
Investment ahead by	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.54	0.54	0.55	0.55	0.78	0.77	0.77	0.77	0.57	0.57	0.57	0.57
N	418,158	409,070	401,898	395,340	392,330	386,201	381,629	377,494	392,330	386,201	381,629	377,494

D Investment irreversibility

As emphasized in real-options theory, irreversibility may offer an additional explanation for the negative relationship between CCN and investment (Bernanke, 1983; Bloom, 2009; Panousi and Papanikolaou, 2012). While capital investment is directly exposed to irreversibility, R&D expenditure is already widely regarded as highly irreversible. However, no common proxy adequately captures irreversibility across both types of investment (Brown et al., 2009; Pindyck, 1993). To explore this channel empirically, we follow prior literature and construct industry-level measures of irreversibility (Himmelberg et al., 1999; Minton and Schrand, 1999; Opler et al., 1999), defined as total industry CAPX, RDINT, or INVEST scaled by total industry assets. As shown in Table A9, we find that the negative effect of climate risk on investment is more pronounced in industries with greater irreversibility, consistent with theoretical predictions.

Table A9. Climate change risk and corporate investment: the effect of investment irreversibility

This table presents the results from estimating Equation (2), incorporating interaction terms between CCN and IR, separately for the two-quarter-ahead dependent variables: CAPX, RDINT, and INVEST. IR denotes industry-level investment irreversibility, measured as the ratio of the total industry investment (CAPX, RDINT, or INVEST) to the total industry assets, where industries are defined at the three-digit SIC level. All other variables are consistent with those outlined in Table 2, and are defined in Section A of the Online Appendix. The controls, which are omitted for brevity, include EPU, Q, CF, SG, and GDP. Quarter dummies refer to a set of calendar and fiscal quarter dummy variables. Parentheses contain t-statistics, computed using standard errors clustered at the firm and calendar quarter levels. The sample period is from 1985Q1 to 2017Q2 (1988Q3 to 2017Q2) for CAPX (RDINT and INVEST). Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively.

	CAPX	RDINT	INVEST
	(1)	(2)	(3)
CCN	-0.957***	-0.011	-0.882***
	(-5.68)	(-0.23)	(-4.82)
CCN×IR	-0.016**	-0.074**	-0.019**
	(-2.57)	(-2.12)	(-2.10)
IR	0.079***	0.375**	0.091**
	(2.62)	(2.12)	(2.13)
Investments ahead by	Two quarters	Two quarters	Two quarters
Controls	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes
Adj. R-squared	0.55	0.77	0.57
N	407,494	386,048	386,048

E CCN decomposition into physical and transition risks

Another concern is that the CCN index captures the extent of media coverage on climate-related topics, which, while informative, may also reflect a broader set of economic factors. To refine our analysis, we use alternative measures that more directly capture economic outcomes. These include the CEI measure, which proxies for transition risk, and global mean surface temperatures, which proxy for physical risk (see Section 6.3). We also considered Hurricane Katrina as an exogenous shock due to its representation of physical risk (see Section B.2). However, it remains crucial to distinguish between the two climate risk components as they are both embedded in the CCN index. In order to shed further light on whether corporations care about both physical and transition risk, we utilize the Actuaries Climate Index (ACI), which captures the frequency of abnormal climate events and changes in extreme weather and sea levels in the United States.[4] This includes phenomena such as droughts, heavy rainfall, and extreme temperatures. By regressing CCN on ACI, we derive the predicted component as a measure of climate news related to physical risk (PHYS), and use the residual component as a measure of public attention related to transition risk (TRAN). We then re-estimate our baseline model, Equation (2), by substituting CCN with PHYS and TRAN, respectively, to examine the impact of these risks.

Table A10 presents the results, with investment measured by CAPX (Panel A), RDINT (Panel B), and INVEST (Panel C). Across these measures, the coefficients for PHYS and TRAN are consistently negative and significant across various forecast quarters (up to four). Notably, the significance of TRAN diminishes after one quarter when RDINT is the dependent variable. While some discrepancies appear in the results between the two types of risks (i.e., for RDINT), the findings are largely consistent, particularly for CAPX and INVEST.

Finally, our conclusion remains robust when using alternative measures of physical and transition risks derived from decomposing the CCN index using indices developed by Faccini et al. (2023). The corresponding results are presented in Table A11. This consistency indicates significant corporate concern over both realized physical risks and attention to transition risks, leading to delayed investment decisions.

[4] See additional information about the ACI at actuariesclimateindex.org.

Table A10. Climate change risk and corporate investment: physical vs. transition risk

This table presents the results of the corporate investment analysis, which considers factors associated with physical and transition risks from CCN. The results are displayed separately for the dependent variables: CAPX (Panel A), RDINT (Panel B), and INVEST (Panel C). Columns 1 to 4 (5 to 8) correspond to predictions for one to four quarters ahead for the dependent variables, respectively. PHYS (TRAN) represents measures of climate news related to physical risk (transition risk), derived as the predicted (residual) components from regressing CCN on the Actuaries Climate Index (ACI). All other variables are consistent with those outlined in Table 2, and are defined in Section A of the Online Appendix. The controls, which are omitted for brevity, include EPU, Q, CF, SG, and GDP. Quarter dummies refer to a set of calendar and fiscal quarter dummy variables. Parentheses contain t-statistics, computed using standard errors clustered at the firm and calendar quarter levels. The sample period is from 1985Q1 to 2017Q2 (1988Q3 to 2017Q2) for Panel A (Panels B and C). Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively.

				Panel A: CAPX				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PHYS	-3.898***	-4.095***	-4.062***	-4.098***				
	(-7.69)	(-8.34)	(-8.18)	(-8.16)				
TRAN					-0.717***	-0.685***	-0.669***	-0.568***
					(-4.38)	(-4.18)	(-4.33)	(-3.34)
Investment ahead by	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.54	0.55	0.55	0.55	0.54	0.54	0.55	0.55
N	418,158	409,070	401,898	395,340	418,158	409,070	401,898	395,340
				Panel B: RDINT				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PHYS	-0.389***	-0.514***	-0.566***	-0.612***				
	(-3.18)	(-4.08)	(-4.28)	(-4.44)				
TRAN					-0.062*	-0.030	-0.040	-0.045
					(-1.71)	(-0.71)	(-1.05)	(-1.13)
Investment ahead by	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.78	0.77	0.77	0.77	0.78	0.77	0.77	0.77
N	392,330	386,201	381,629	377,494	392,330	386,201	381,629	377,494
				Panel C: INVEST				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PHYS	-4.532***	-4.844***	-4.815***	-4.875***				
	(-8.16)	(-8.92)	(-8.52)	(-8.44)				
TRAN					-0.622***	-0.573***	-0.628***	-0.535***
					(-3.42)	(-2.99)	(-3.44)	(-2.76)
Investment ahead by	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57
N	392,330	386,201	381,629	377,494	392,330	386,201	381,629	377,494

Table A11. Climate change risk and corporate investment: alternative measures of physical and transition risk

This table presents the results of the corporate investment analysis, which considers factors associated with physical and transition risks from CCN. The results are displayed separately for the dependent variables: CAPX (Panel A), RDINT (Panel B), and INVEST (Panel C). Columns 1 to 4 (5 to 8) correspond to predictions for one to four quarters ahead for the dependent variables, respectively. PHYS (TRAN) represents measures of climate news related to physical risk (transition risk), derived as the residual components from regressing CCN on the natural disasters index (international summits index) developed by Faccini et al. (2023). All other variables are consistent with those outlined in Table 2, and are defined in Section A of the Online Appendix. The controls, which are omitted for brevity, include EPU, Q, CF, SG, and GDP. Quarter dummies refer to a set of calendar and fiscal quarter dummy variables. Parentheses contain t-statistics, computed using standard errors clustered at the firm and calendar quarter levels. The sample period is from 2001Q1 to 2017Q2. Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively.

				Panel A: CAPX				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PHYS	-0.559***	-0.459***	-0.427***	-0.358***				
	(-3.41)	(-2.84)	(-3.09)	(-2.68)				
TRAN					-0.593***	-0.452***	-0.453***	-0.381**
					(-4.06)	(-3.11)	(-3.33)	(-2.49)
Investment ahead by	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.59	0.60	0.60	0.60	0.59	0.60	0.60	0.60
N	256,067	251,322	247,601	243,957	256,067	251,322	247,601	243,957
				Panel B: RDINT				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PHYS	0.005	-0.009	-0.036	-0.052				
	(0.15)	(-0.28)	(-1.13)	(-1.59)				
TRAN					0.016	0.005	-0.007	-0.046*
					(0.54)	(0.20)	(-0.30)	(-1.76)
Investment ahead by	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
N	256,067	251,322	247,601	243,957	256,067	251,322	247,601	243,957
				Panel C: INVEST				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PHYS	-0.513***	-0.441**	-0.451***	-0.412***				
	(-2.91)	(-2.59)	(-3.09)	(-2.80)				
TRAN					-0.547***	-0.429***	-0.458***	-0.444**
					(-3.55)	(-2.75)	(-3.20)	(-2.63)
Investment ahead by	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
N	256,067	251,322	247,601	243,957	256,067	251,322	247,601	243,957

F Additional tables and figures

Table A12. Climate change risk and corporate investment: baseline results using orthogonalized CCN

This table presents the results from estimating Equation (2), separately for the dependent variables CAPX (Panel A), RDINT (Panel B), and INVEST (Panel C). Columns 1 to 4 (5 to 8, 9 to 12) correspond to one to four quarters ahead for the dependent variables, respectively. The climate change risk is measured by CCN orthogonalized to EPU. Definitions for the remaining variables are provided in Section A of the Online Appendix. Quarter dummies refer to a set of calendar and fiscal quarter dummy variables. Parentheses contain t-statistics, computed using standard errors clustered at the firm and calendar quarter levels. The sample period is from 1985Q1 to 2017Q2 (1988Q3 to 2017Q2) for Panel A (Panels B and C). Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively.

	Panel A: CAPX				*Panel B: RDINT*				*Panel C: INVEST*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CCN	-1.797***	-1.549***	-1.670***	-2.001***	-0.192*	-0.116	-0.121	-0.267***	-1.834***	-1.451***	-1.735***	-2.166***
	(-3.03)	(-3.33)	(-3.62)	(-3.97)	(-1.87)	(-1.20)	(-1.41)	(-3.00)	(-2.92)	(-2.80)	(-3.32)	(-3.80)
EPU	-0.360**	-0.309*	-0.345**	-0.361**	0.008	-0.011	-0.037	-0.046	-0.570***	-0.523***	-0.545***	-0.530***
	(-2.07)	(-1.97)	(-2.32)	(-2.61)	(0.26)	(-0.29)	(-0.97)	(-1.23)	(-3.16)	(-3.01)	(-3.37)	(-3.32)
Q	0.421***	0.405***	0.381***	0.364***	0.179***	0.121***	0.090***	0.064***	0.659***	0.563***	0.494***	0.446***
	(19.84)	(19.58)	(18.93)	(17.64)	(15.28)	(10.40)	(7.83)	(5.69)	(23.13)	(20.09)	(18.01)	(15.64)
CF	3.469***	4.919***	5.389***	5.725***	-6.177***	-5.235***	-4.408***	-4.083***	-5.404***	-2.438***	-0.808	0.123
	(9.14)	(12.66)	(13.93)	(14.26)	(-17.50)	(-15.93)	(-13.98)	(-13.00)	(-9.03)	(-4.19)	(-1.41)	(0.21)
SG	0.085**	0.103***	0.279***	0.172***	0.084***	0.090***	0.057***	0.087***	0.195***	0.223***	0.379***	0.276***
	(2.58)	(3.14)	(8.41)	(5.17)	(6.23)	(6.68)	(4.37)	(5.93)	(5.22)	(5.46)	(10.04)	(7.55)
GDP	0.092***	0.108***	0.106***	0.098***	-0.004	-0.000	0.001	0.001	0.055*	0.081***	0.085***	0.085***
	(3.08)	(3.93)	(3.59)	(3.37)	(-0.67)	(-0.01)	(0.14)	(0.11)	(1.76)	(2.64)	(2.72)	(2.63)
Investment ahead by	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.54	0.54	0.55	0.55	0.78	0.77	0.77	0.77	0.57	0.57	0.57	0.57
N	418,158	409,070	401,898	395,340	392,330	386,201	381,629	377,494	392,330	386,201	381,629	377,494

Table A13. Climate change risk and corporate investment: baseline results using VIX as a measure of economic uncertainty

This table presents the results from estimating Equation (2), separately for the dependent variables CAPX (Panel A), RDINT (Panel B), and INVEST (Panel C). Columns 1 to 4 (5 to 8, 9 to 12) correspond to one to four quarters ahead for the dependent variables, respectively. The climate change risk is measured by CCN, and the economic uncertainty is measured by VIX index from the CBOE. Definitions for the remaining variables are provided in Section A of the Online Appendix. Quarter dummies refer to a set of calendar and fiscal quarter dummy variables. Parentheses contain t-statistics, computed using standard errors clustered at the firm and calendar quarter levels. The sample period is from 1985Q1 to 2017Q2 (1988Q3 to 2017Q2) for Panel A (Panels B and C). Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively.

	Panel A: CAPX				*Panel B: RDINT*				*Panel C: INVEST*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CCN	-0.866***	-0.861***	-0.916***	-0.822***	-0.090**	-0.091**	-0.117***	-0.135***	-0.954***	-0.956***	-1.046***	-0.975***
	(-4.49)	(-4.44)	(-4.76)	(-3.93)	(-2.61)	(-2.50)	(-3.50)	(-3.80)	(-4.36)	(-4.29)	(-4.68)	(-4.00)
VIX	0.073	-0.039	-0.134	-0.215	0.024	0.035	0.025	0.002	0.106	0.002	-0.109	-0.217
	(0.43)	(-0.26)	(-0.88)	(-1.26)	(0.87)	(1.45)	(0.99)	(0.05)	(0.57)	(0.01)	(-0.62)	(-1.09)
Q	0.415***	0.398***	0.378***	0.361***	0.179***	0.120***	0.087***	0.064***	0.669***	0.570***	0.501***	0.451***
	(19.68)	(19.67)	(19.04)	(17.39)	(14.82)	(9.96)	(7.41)	(5.48)	(22.49)	(19.66)	(17.85)	(15.39)
CF	2.912***	4.230***	4.592***	4.759***	-6.301***	-5.300***	-4.452***	-4.157***	-5.717***	-2.791***	-1.247**	-0.489
	(8.10)	(11.75)	(13.14)	(13.82)	(-17.63)	(-15.85)	(-13.85)	(-12.98)	(-9.65)	(-4.88)	(-2.22)	(-0.87)
SG	0.081**	0.094***	0.265***	0.153***	0.083***	0.091***	0.056***	0.092***	0.210***	0.228***	0.374***	0.283***
	(2.35)	(2.77)	(7.80)	(4.61)	(6.04)	(6.77)	(4.39)	(6.21)	(5.62)	(5.55)	(9.67)	(7.71)
GDP	0.082***	0.085***	0.078**	0.078**	0.000	0.005	0.006	0.005	0.079**	0.088***	0.083**	0.082**
	(2.66)	(2.93)	(2.43)	(2.33)	(0.06)	(1.11)	(1.19)	(0.86)	(2.31)	(2.65)	(2.24)	(2.12)
Investment ahead by	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters	One quarter	Two quarters	Three quarters	Four quarters
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.56	0.56	0.56	0.56	0.78	0.78	0.78	0.78	0.58	0.58	0.58	0.58
N	375,647	367,789	361,466	355,636	375,647	367,789	361,466	355,636	375,647	367,789	361,466	355,636

Table A14. Climate change risk and corporate investment: Annual data

This table presents the results from analyzing annual data, arranged separately for the dependent variables CAPX (Panel A), RDINT (Panel B), and INVEST (Panel C). The dependent variables are measured concurrently with, or one year subsequent to, the CCN. CCN and EPU refer to the Climate Change News and Economic Policy Uncertainty indices, respectively. Both indices are measured annually and calculated as the natural logarithm of the monthly arithmetic average within each firm's fiscal year that ends in the corresponding calendar year. All control variables are measured in the year preceding the dependent variables. Definitions for all variables are available in Section A of the Online Appendix. Parentheses contain t-statistics, calculated using standard errors that are clustered at the firm and calendar year levels. The sample period extends from 1985 to 2017. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	Panel A: CAPX		*Panel B: RDINT*		*Panel C: INVEST*	
	(1)	(2)	(3)	(4)	(5)	(6)
CCN	-0.029***	-4.397***	-0.007**	-1.069***	-0.037***	-5.587***
	(-4.65)	(-4.62)	(-2.44)	(-2.78)	(-4.08)	(-4.50)
EPU	-0.005	-0.000	-0.002	0.000	-0.007	-0.000
	(-0.92)	(-0.73)	(-0.90)	(0.44)	(-1.15)	(-0.53)
Q	0.010***	0.010***	0.009***	0.009***	0.021***	0.021***
	(16.47)	(16.35)	(17.20)	(17.34)	(20.95)	(21.00)
CF	0.039***	0.038***	-0.070***	-0.071***	-0.039***	-0.041***
	(8.92)	(8.85)	(-13.46)	(-13.26)	(-5.13)	(-5.43)
SG	0.007***	0.007***	-0.001**	-0.001**	0.007***	0.006***
	(10.52)	(9.74)	(-2.04)	(-2.14)	(5.85)	(5.17)
GDP	0.001	0.002***	-0.000	0.000	0.001	0.002**
	(1.10)	(3.04)	(-0.08)	(1.02)	(0.77)	(2.49)
Investment Year	Same year	One year ahead	Same year	One year ahead	Same year	One year ahead
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.53	0.53	0.82	0.82	0.64	0.64
N	111,343	108,805	111,343	108,805	111,343	108,805

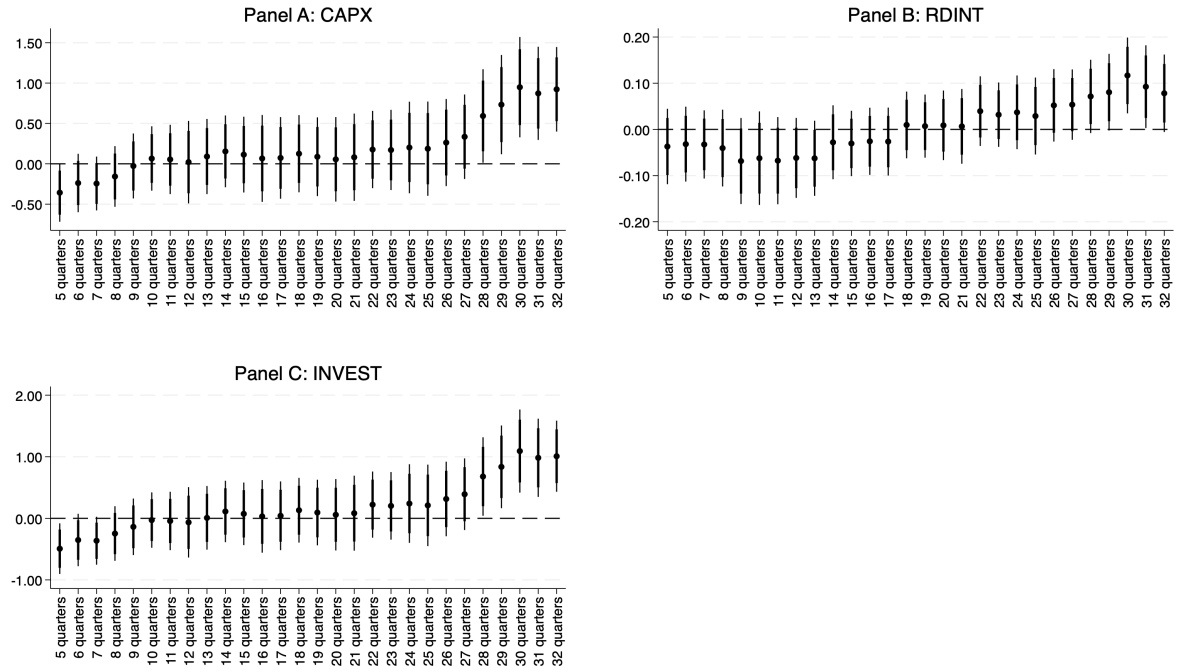


Figure A1. Investment responses to EPU at extended horizons

This figure reports coefficient estimates from regressions of future investment on EPU at alternative horizons. Panels A, B, and C present results for CAPX, RDINT, and INVEST, respectively. The horizontal axis indicates the number of quarters ahead for the dependent variable, extending up to 32 quarters. All regressions follow the specification in Equation (2), with investment measured at different future horizons. The dots represent point estimates, and the vertical bars denote 95% and 99% confidence intervals, respectively, based on standard errors double clustered by firm and calendar quarter.