Responsible ClimateTech: Value or Values

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Abstract

There is a growing trend of firms applying emerging technologies, such as AI and alternative energy, to address climate challenges. This paper provides a systematic analysis of this new economic phenomenon, referred to as ClimateTech. We use large language model (LLM) contextual functions (e.g., dependency parsing) to analyze firm press releases and identify ClimateTech projects. Our findings indicate that early adopters of ClimateTech tend to have strong technological expertise in their leadership teams. ClimateTech investment concentrates in two distinct categories: multipurpose infrastructure and specialized environmental technologies. When examining financial value and environmental impact, we find that infrastructure technologies generate higher financial returns but have no measurable environmental impact—satisfying shareholders but not stakeholders. In contrast, specialized environmental technologies tend to produce neither significant financial returns nor environmental impact. We identify a solution for specialized environmental technology investments to achieve both financial value and environmental benefits: firms integrating emerging environmental technologies into their core business operations—rather than limiting them to side projects or image management—are more likely to balance the trade-off between shareholder value and environmental responsibility.

Keywords: Climate Solution; Climate Finance; Machine Learning; ESG; Socially Responsible Investing; Materiality

1. Introduction

Technology has increasingly penetrated diverse sectors. In finance, for instance, FinTech—the integration of technology and financial services (e.g., Call et al., 2024a; Call et al., 2024b; Cao et al., 2023; Caskurlu, Hoberg, and Phillips, 2024; deHann et al., 2025; Du et al., 2021; Zhu, 2019)—and large language models and generative AI (e.g., Bertomeu et al., 2025; Blankespoor, deHaan, and Li, 2024; Böke et al., 2024; Cao et al., 2024; Huang, Wang, and Yang, 2023; Kim, Muhn, and Nikolaev, 2023), along with other innovations (Brown et al., 2021; Cetin, 2023; Coleman, Fronk, and Valentine, 2024; Rossi and Utkus, 2024) have been extensively studied for over a decade. By contrast, in the domain of climate solutions, the adoption of technology—commonly referred to in industry as ClimateTech—has received far less academic attention, despite its growing economic and societal relevance. In this paper, we provide a systematic analysis of technology-based climate solutions, or ClimateTech. We define ClimateTech as climate solutions that incorporate advanced technological investments, such as AI and alternative energy, distinguishing them from more general climate initiatives that lack such features. We explore three research questions:

1) Description of emerging ClimateTech: Who is adopting it, what types of technologies are being adopted, and for what purposes ClimateTech is being used.
2) We further define responsible ClimateTech as initiatives that meet two criteria: (1) responsiveness to shareholders through financial value creation, and (2) responsiveness to stakeholders through measurable environmental impact.
3) We explore whether there are instrumental ways in which ClimateTech adoption can deliver both value and values to shareholders and stakeholders.

Companies—particularly those with high carbon emissions—frequently communicate their ClimateTech initiatives to shareholders and stakeholders through press releases. For example, in

May 2018, Microsoft announced a carbon emissions reduction plan that highlighted its extensive investments in IT efficiency (ranging from chips to data center infrastructure) as well as in renewable energy. Likewise, in January 2021, Linde announced plans to build, own, and operate the world's largest Proton Exchange Membrane (PEM) electrolyzer plant at the Leuna Chemical Complex in Germany. The new 24-megawatt electrolyzer is expected to produce green hydrogen to supply Linde's industrial customers through the company's existing pipeline network.

We employ an interpretable large language model (LLM) approach to examine press releases and identify companies engaged in ClimateTech. This method enables us to capture word relationships with precision, ensuring that the initiatives we identify correspond to tangible, concrete investments. We then further distinguish technological investments within climate solutions. Our analysis differs from the existing literature by explicitly focusing on technology-driven climate investments and by comparing ClimateTech initiatives with other climate-related activities, which are often documented as forms of greenwashing.

We begin by identifying ClimateTech within general climate-related press releases. Among 8,194 general climate-related press releases from 2010 to 2021, 23% (1,885) are classified as ClimateTech. Our findings show that early adopters of ClimateTech tend to have leadership teams with strong technological expertise. We further find that larger firms—with greater cash holdings and higher levels of R&D investment—are more likely to pursue ClimateTech initiatives, as opposed to general climate activities that are not technology-related. In addition, we find that companies with a higher proportion of AI talent and climate-focused talent are more likely to engage in ClimateTech initiatives compared with non-technology-oriented activities.

Using LLMs to further classify ClimateTech-related initiatives, we find that ClimateTech investments concentrate in two distinct categories: multipurpose infrastructure and specialized

environmental technologies. Multipurpose infrastructure includes multipurpose environmental infrastructure technologies related to machine learning and artificial intelligence, information technology infrastructure, supply chain management infrastructure, and other general-purpose infrastructure. Specialized environmental technologies include EV-related technologies, energy-related innovations, and other advanced specialized environmental solutions.

We observe a higher proportion of firms investing in multipurpose infrastructure (69%) compared with those investing in specialized environmental technology (31%). Within multipurpose infrastructure ClimateTech investments, we observe that the majority of firms (70%) invest in general information technology infrastructure. Additionally, 7% of these investments are related to AI/ML, 6% to supply chain management (SCM), and 16% to other types of infrastructure. Within specialized environmental technology investments, we find that the largest share (69%) is directed toward alternative energy. A further 16% of investments are related to EV technologies, while 15% target other specialized environmental solutions.

Among these ClimateTech technologies, we find that larger firms and those with a CIO position are more likely to invest in multipurpose infrastructure compared with specialized environmental technologies. We also find that larger firms and those with a CIO position tend to allocate more investment toward AI/ML-related infrastructure within multipurpose infrastructure. By contrast, smaller firms, firms with higher cash holdings, and those with a CIO position are more likely to invest in EV-related ClimateTech initiatives.

In addition to providing a systematic analysis of this emerging economic phenomenon and presenting the first large-scale evidence on how firms use technology to address climate issues, we also examine the extent to which ClimateTech initiatives can be considered responsible. This step is motivated by growing concerns about greenwashing and debates over whether firms pursue

such activities for financial motives or for non-financial purposes—such as the "value versus values" consideration discussed in Starks (2023) and by growing interests in finding solutions for achieving environmental performances without sacrificing financial performance (Cheng, Lin, and Yang, 2025). We define responsible ClimateTech as initiatives that meet two criteria: (1) responsiveness to shareholders through financial value creation and (2) responsiveness to stakeholders through measurable environmental impact.

We first examine how capital markets respond to ClimateTech initiatives by analyzing the cumulative abnormal returns (CARs) associated with ClimateTech and ClimateNonTech press announcements. The three-day abnormal return, measured from one day before to two days after the announcement, is 92 basis points and statistically significant. When decomposing ClimateTech into multipurpose infrastructure and specialized environmental technologies, we find that the financial impact is stronger for multipurpose infrastructure investments, with CARs of 98 basis points compared with 79 basis points for specialized environmental technologies.

Comparing ClimateTech with ClimateNonTech press releases, we find that ClimateTech announcements generate CARs that are 56 basis points higher, a difference that is statistically significant. On average, ClimateTech initiatives meet shareholder expectations by delivering positive financial returns. Importantly, we find that this effect is primarily driven by multipurpose infrastructure ClimateTech rather than specialized environmental technologies. There is no significant difference between specialized environmental technology announcements and non-technology-oriented climate announcements. Finally, in assessing how financial markets incorporate ClimateTech information, we find no evidence of drift; the positive abnormal returns are concentrated within the first two days following the press release.

The explanation for this striking difference between the financial impact of multipurpose infrastructure investments and specialized environmental technologies differs from the standard greenwashing interpretation. Our evidence from ClimateTech press releases indicates substantial real investment rather than mere image management. Given that multipurpose infrastructure ClimateTech drives the significant difference in market reaction compared with specialized environmental technologies, one interpretation is that capital markets perceive infrastructure as risk-mitigating. Such infrastructure can be applied to both environmental and non-environmental uses, whereas specialized environmental technologies serve exclusively environmental purposes. While specialized environmental technologies appear to have marginal financial impact, market reactions to them are more heterogeneous. This interpretation is supported by the evidence that, although the magnitude of cumulative abnormal returns is higher for specialized environmental technologies, the effect is not statistically significant.

Climate issues represent a significant externality. Shareholders may favor climate technologies because they can generate financial value by mitigating regulatory risk or by reducing the cost of capital through attracting sustainable investments. In such cases, being responsive to shareholders in terms of financial value does not necessarily benefit stakeholders, who are more concerned with tangible outcomes such as pollution reduction. Thus, it is important to evaluate whether climate technologies have a meaningful impact on real environmental outcomes, rather than merely serving shareholder interests. We ask the question: Is ClimateTech responsible to stakeholders? To address this, we examine the actual environmental outcomes of firms that pursue these climate technologies.

To measure real environmental outcomes, we use both MSCI environmental ratings and RepRisk ClimateTech incident data. MSCI environmental ratings primarily evaluate the risks and

opportunities related to environmental issues; however, they are an imperfect measure of real impact, as they combine financial incentives with non-pecuniary considerations. We find no evidence of improvement in real environmental outcomes—measured by MSCI environmental ratings and RepRisk climate incidents—following either multipurpose infrastructure ClimateTech or specialized environmental technology initiatives. These results suggest that neither category of ClimateTech generates, on average, measurable improvements in environmental outcomes.

Given that specialized environmental technology does not elicit a strong market reaction, one incentive for firms to engage in these activities is that such technologies may potentially lead to better environmental outcomes. But why do we not observe positive environmental impact? More importantly, can we identify a ClimateTech solution that satisfies both shareholders and stakeholders? An important observation is that many ClimateTech investments by firms are unrelated to their core operations—for example, investments in side businesses or philanthropic ClimateTech initiatives. Motivated by this, we distinguish between press releases related to core business activities and those related to non-core activities.

We find that, among press releases tied to firms' core operations, specialized environmental technology announcements are associated with a 98 basis point higher abnormal return compared with ClimateNonTech announcements. We do not observe such a difference in the non-core sample. Moreover, we document significant real environmental improvements when specialized environmental technologies are applied to core business activities. Specifically, for core-related announcements, specialized environmental technology investments are followed by higher MSCI environmental ratings beginning one year after the press release, as well as fewer environmental incidents starting six months after the press release. When examining the impact of multipurpose

infrastructure ClimateTech on core business activities, we do not find evidence that it generates environmental impact.

Overall, when examining financial value and environmental impact, we find that infrastructure technologies generate higher financial returns but produce no measurable environmental impact—satisfying shareholders but not stakeholders. In contrast, specialized environmental technologies typically generate neither significant financial returns nor environmental benefits. However, we identify a pathway for specialized environmental technology investments to achieve both financial value and environmental outcomes: firms that integrate emerging environmental technologies into their core business operations—rather than confining them to side projects or image management—are more likely to balance the trade-off between shareholder value and environmental responsibility.

Because firms differ significantly in whether they leverage state-of-the-art technology to address climate issues, one identification challenge is that firms may endogenously choose whether to adopt technology in this context. Our empirical specification is less vulnerable to this concern because we use an event study framework focusing on short-term event windows, which are less likely to be influenced by broader environmental developments. In addition, we exploit state-year variation in AI talent supply as an exogenous determinant of firms' likelihood of adopting advanced technologies to address the endogeneity issues. Using an instrumental variable specification, our first-stage results show that a greater state-year supply of AI talent increases the probability that firms use technology to address climate concerns. Leveraging this instrumented variable, we further document that the positive cumulative abnormal return remains robust when instrumenting with exogenous variation in the probability of technology adoption.

Our research contributes to several strands of the literature. First, our paper relates to the literature on climate solutions (e.g., Larcker and Watts, 2020; Klausmann, Krueger, and Matos, 2024; Lu, Serafeim, and Xu, 2024; Sautner et al., 2023; Serafeim, 2024). A growing body of work seeks to evaluate and measure climate solutions. We provide a measure that focuses specifically on the technologies employed. Our measure is distinct in that it emphasizes the underlying technologies of climate solutions and develops a taxonomy of these technologies. Our paper contributes to the literature applying textual analysis to measure climate solutions. Distinct from prior work, we contribute to the emerging literature—such as Cao, Yang, and Zhang (2025) —by employing interpretable language models to analyze firm disclosures.

Second, we provide systematic evidence on emerging ClimateTech by analyzing who adopts it, what types of technologies are adopted, and the purposes for which ClimateTech is used.

Third, our paper contributes to the debate on non-pecuniary motives in ESG. Starks (2023) highlights the "value versus values" debate in sustainable investment. We add to this discussion by showing that there is no simple answer; it depends on context. In our setting, infrastructure adoption delivers value but not values. For environmental adoption, when applied appropriately to core products, it can deliver both value and values. We further emphasize that the answer depends on context, and it is scholars' responsibility to identify such contexts and provide implications for managers—for example, distinguishing between core and non-core applications.

The remainder of the paper is structured as follows. Section 2 reviews the related literature. Section 3 presents the data. Section 4 describes the empirical framework. Section 5 reports the results. Section 6 concludes.

2. Related Literature

This paper contributes to three strands of literature. First, we extend the literature on climate solutions by developing a technology-focused measure and taxonomy, distinct from prior work. Second, we add to the debate on non-pecuniary ESG motives by showing how climate solutions can generate real environmental impact through investment channels. Finally, we contribute to textual analysis in finance and accounting research by employing interpretable language models to study firm disclosures.

A growing body of work seeks to evaluate and measure climate solutions. For example, Lu, Serafeim, and Xu (2024) identify climate solutions that foster the transition to a low-carbon economy. Sautner et al. (2023) analyzes the attention paid by earning call participants to firms' climate change exposures and capture exposures related to climate change. Cheng et al. (2025) use patents to measure green innovation. This differs from our approach, as we also capture activities that are not patented, recognizing that firms can engage in advanced climate technologies without necessarily holding patents. Our measure is distinct in that it emphasizes the underlying technologies of climate solutions and develops a taxonomy of these technologies.

Our paper adds to the debate on non-pecuniary ESG motives by showing how climate solutions can generate real environmental impact through investment channels. Starks (2023) highlights the "value versus values" debate in sustainable investment. From the shareholders' perspective, Barber, Morse, and Yasuda (2021) document that investors derive nonpecuniary utility from investing in dual-objective funds, thereby sacrificing returns. Yang and Yasuda (2025) find that the majority of U.S. mutual funds pursue financial motives in sustainable investment. From stakeholders' perspective, Duchin, Gao, and Xu (2025) document that firms divest pollutive plants in response to environmental pressures, usually to buyers with weaker pressures and existing ties, yet overall

pollution levels remain unchanged. Hartzmark and Shue (2023) find that lowering green firms' financing costs has little effect, whereas raising brown firms' costs produces substantial negative impacts. We add to this discussion by showing that climate solutions can operate through real investment channels that generate measurable environmental impact. In particular, we demonstrate that specialized environmental technology solutions, when applied to a firm's core business, can fulfill the responsibility to both shareholders and stakeholders.

Lastly, this research contributes to the literature on using machine learning and AI to measure sustainability. Existing literature has exploited textual analysis to measure firm sustainability. Lu, Serafeim, and Xu (2024) focus on 10-K filings using LLM. Sautner et al. (2023) analyzes the attention paid by earning call participants. A distinct and emerging literature employs interpretable language models to analyze firm disclosures. For example, Cao, Yang, and Zhang (2025) use a deep learning model to extract fund managers' forward-looking risk assessments from narrative discussions. Following the methodology proposed by Cao et al. (2020), we contribute to this literature by leveraging interpretable language models to analyze firm disclosures and measure sustainability-related issues. A distinct and emerging literature employs interpretable language models to analyze firm disclosures. For example, Cao, Yang, and Zhang (2025) use a deep learning model to extract fund managers' forward-looking risk assessments from narrative discussions. Following the methodology proposed by Cao et al. (2020), we contribute to this literature by leveraging interpretable language models to analyze firm disclosures and measure sustainability-related issues.

3. Data

Data on Climate Press Releases

We retrieve firm press releases (PRs) from Capital IQ's the Key Developments database, which compiles structured summaries of corporate events from over 2,000 sources, including press releases, regulatory filings, earnings call transcripts, and firm websites. Each news or event item is categorized into one of more than 100 key development types, such as executive changes, M&As, and product launches. We focus on PRs classified as business expansions/reorganizations, product launches, strategic alliances, and M&As during 2010-2021.

To identify climate-related PRs within these categories, we employ a climate keyword list. The initial list consists of unigrams, bigrams, and trigrams related to climate change, as documented in recent literature (e.g., Sautner et al., 2023). We then expand this list by identifying additional keywords from the full set of PRs using cosine similarity with the initial keywords based on word embeddings each word in the PRs.

Data on Financial Impact

We compute cumulative abnormal returns (CARs) over the window [0,12] surrounding each climate PR, where day 0 is the announcement date (or the next trading day if the PR falls on a weekend or holiday). Abnormal returns are estimated using several benchmark models: the CAPM, the Fama–French three-factor model, the Fama–French three-factor model with momentum, and a market-adjusted model. Expected returns are based on an estimation window of 252 trading days ending one day before the PR announcement.

Data on Environmental Impact

We assess the environmental impact of each climate PR using data from MSCI and RepRisk. MSCI derives annual firm-level ratings on key ESG issues from annual reports, investor presentations, and financial and regulatory filings (Kim and Yoon, 2022). We focus on the climate change theme

and measure the change in its strength rating over the two years following each PR as the MSCI impact score.

RepRisk compiles ESG-related negative incidents from media, regulatory filings, and commercial documents (Li and Wu, 2020). We measure the environmental impact using the total number of such incidents within 6 months and within 1, 2, and 3 years after each PR as the RepRisk impact score.

Data on AI and Environmental Talent

Following Cao et al. (2023) and Cao, Liang, and Moon (2023) , we measure the supply of talent in AI, climate, and ClimateTech fields using data from the Integrated Public Use Microdata Series (IPUMS). We obtain the number of individuals aged 18–64 with undergraduate or graduate degrees in each U.S. state from 2010 to 2021. Each individual is classified as AI, climate, or ClimateTech talent based on their reported degree field. Specifically, AI fields include *Computer and Information Systems*, *Computer Science*, and *Statistics and Decision Science*; climate fields include *Environmental Science* and *Ecology*; and ClimateTech fields include *Transportation Sciences and Technologies* and *Environmental Engineering*. Degree codes were manually reviewed to ensure accurate classification.

We construct state-year talent supply as the share of AI (*Talent_AI*), climate (*Talent_Climate*), or ClimateTech (*Talent_ClimateTech*) graduates relative to the total pool of degree holders. Finally, we match these measures with firms based on the headquarters state of each PR-announcing firm from Compustat.

Other Variables

We use the BoardEx database to identify CEOs' IT backgrounds and CIO positions. CEOs are identified in the individual role dataset using keywords such as "CEO" and "Chief Executive," while CIOs are identified using keywords such as "Chief Information" and "Chief IT." Interim and acting roles are included, but division-, field-, regional-, group-, and deputy-level roles are excluded. *CEO_IT* is an indicator of whether the CEO of the firm has IT background, indicated by their prior role description, educational history, or achievement records containing IT-related keywords such as "IT", "information technology", "AI", or "data". *CIO* is an indicator of whether the firm has a CIO position.

To measure investors' sustainable practices, we use the Morningstar Sustainability Rating, which evaluates funds' ESG exposures monthly based on Sustainalytics' ESG Risk Ratings. We construct a firm-level measure, *Rate_Sustain*, by aggregating fund-level ratings using the market-value weight of the firm in each fund. For each PR, we assign the firm's aggregated rating in the announcement month.

Firms' patent activities are obtained from the United States Patent and Trademark Office (USPTO) and matched to Compustat using pre-processed firm names. *Patents* is the number of patents granted in the announcement year.

Firms' Financial characteristics are obtained from Compustat. *Top3* is an indicator equal to one if the firm's market capitalization ranks in the top three within its two-digit SIC industry in the announcement year. *Size* is the market capitalization in the announcement year. *Cash* is the ratio of cash to total assets in the announcement year. *R&D* is the ratio of R&D expenditure to total assets in the announcement year. *Market-To-Book* is the ratio of market value (total assets plus market value of equity minus book equity) to total assets in the announcement quarter. *Tangibility* is calculated as fixed assets divided by total assets of the firm in the announcement quarter.

Profitability is calculated as operation income before depreciation divided by total assets. *Book_Leverage* is book debt divided by book value. *lnSales* is the natural logarithm of sales.

4. Empirical Design

4.1 Identifying ClimateTech PRs

We classify each climate PR as ClimateTech if it describes a firm's investment in emerging technologies related to climate solutions. To identify such cases, we use a dependency-parsing approach (Chen and Manning, 2014) that links investment and technology keywords based on their grammatical relations within the text. The dependency parsing approach enables us to accurately capture the relationships between words, ensuring that the PRs we identify as ClimateTech correspond to a firm's concrete investments in emerging technologies related to climate solutions. We employ the dependency parsing feature of LLM contextual functions because it allows us to directly observe text structures, improving on bag-of-words approaches by capturing context-specific references to concrete technological investments while providing greater transparency and explainability than blackbox nature of other LLM models (Cao et al., 2020). For example, in the sentence "The firm reached a critical milestone in developing a carbon-free generator," the parser connects the investment term "develop" with the technology term "carbon-free generator," allowing us to classify the PR as ClimateTech. Our analysis differs from the existing literature by focusing specifically on technological investments related to climate solutions and by comparing ClimateTech with other climate-related activities.

Specifically, the dependency parser takes vector representations of the words in a text, part-of speech tags, and labels of relations between words from a basic parser as inputs. It then returns the tree representation of the grammatical structure of each sentence through a deep neural network

algorithm. The resulting tree representation consists of word pairs with grammatical relations. The dependency parser is pre-trained on the English Penn Treebank database, which contains more than three million manually tagged and parsed words from sources, including Wall Street Journal articles, and achieves nearly 90% out-of-sample parsing accuracy.

To label the PRs, we use two keyword lists: 1) an emerging technology keyword list, based on prior literature (e.g., Babina et al., 2022) and expanded using word embeddings, 2) an investment keyword list, drawn from related work on corporate investment (e.g., Hoberg and Maksimovic, 2015). A climate PR is labeled as ClimateTech if at least one investment keyword is syntactically linked to one emerging technology keyword. We considered connections up to three levels deep, meaning that if an emerging technology word was linked to an investment word through intermediate words within three parsing levels, we classified the PR as ClimateTech PR.

4.2 Identifying ClimateTech Categories (Infra vs. Env) and Subcategories

We further divide ClimateTech PRs into two technology subcategories. Using OpenAI's GPT model (*gpt-4o-mini-2024-07-18*), we classify each emerging technology keyword into one of two groups: 1) High-Tech Infrastructure (Infra), which includes technologies such as, AI, cloud computing, internet of things, robotics, 2) High-Tech in Environmental and Energy (Env), which includes renewables, alternative fuels, and other energy-related technologies.

Each ClimateTech PR is then labeled according to the presence of category-specific keywords. PRs containing only infrastructure-related terms are classified as **Infra**, while those containing environmental or energy-related terms are classified as **Env**. When both types of keywords appear in the same PR, we assign it to the **Env** category, reflecting the direct relevance of these technologies to climate initiatives.

The GPT prompt used to classify each emerging technology keyword is as follows:

> *You are a research assistant who strictly follows instructions and provides only valid answers.*
>
> *The following are a keyword related to an emerging technology and two categories of emerging technologies. Choose the relevant categories for the keyword and mark as 1. You need to choose at most one category for each keyword.*
>
> *Keyword: "{keyword}"*
>
> *Emerging Technology Categories:*
>
> *1. High Tech Infrastructure (e.g., LLM, AI, quantum computing, cloud computing, edge computing, internet of things (IoT), robotics, augmented reality (AR), virtual reality (VR), cybersecurity, 3D printing)*
>
> *2. High Tech in Environmental and Energy (e.g., Renewables, Nuclear Energy, Hydrogen, Sustainable Fuels)*
>
> *Please respond in the format: {"High Tech Infrastructure": 1/0, "High Tech in Environmental and Energy": 1/0}.*

To provided more nuanced differences in firms investing in different emerging technologies, we classify each ClimateTech Infra and Env PR into their subcategories. Specifically, we use the GPT model to classify a ClimateTech Infra announcement into one of the following categories: 1) Artificial Intelligence (AL) / Machine Learning (ML) / Analytics, 2) IT Infrastructure, 3) Supply Chain Management (SCM) & Logistics, and 4) Others. We also classify a ClimateTech Env announcement into one of the following categories: 1) Electric Vehicles, 2) Alternative Energy & Chemicals, and 3) others.

The GPT prompt used to classify each ClimateTech Infra PR is as follows:

You are given a firm announcement about a climate change initiative where the firm uses high-tech infrastructure technologies to address a climate issue.

Your tasks are:

1. Classify the announcement into exactly one of the following subcategories, based on the main type of technology used:

1) AI/ML

2) IT Infrastructure (e.g., cloud)

3) Supply Chain Management & Logistics

4) Other General Infra Technology

2. Provide a one-sentence summary explaining how the identified technology is being used for the climate initiative.

Rules:

- Choose only one subcategory (1, 2, 3, or 4).

- The summary must be concise (one sentence only).

Announcement: ""

Please respond in the format:

{{"Subcategory": 1/2/3/4, "Summary": "<one-sentence explanation>"}}

The GPT prompt used to classify each ClimateTech Env PR is as follows:

You are given a firm announcement about a climate change initiative where the firm uses high-tech environmental technologies to address a climate issue.

Your tasks are:

1. Classify the announcement into exactly one of the following subcategories, based on the main type of technology used:

1) electric vehicles

2) alternative energy & chemicals

3) Other General environmental technology

2. Provide a one-sentence summary explaining how the identified technology is being used for the climate initiative.

Rules:

- Choose only one subcategory (1, 2, 3, or 4).

- The summary must be concise (one sentence only).

Announcement: ""

Please respond in the format:

{{"Subcategory": 1/2/3/4, "Summary": "<one-sentence explanation>"}}

4.3 Identifying Core vs. Non-Core Application of ClimateTech

We use OpenAI's GPT model (*gpt-4o-mini-2024-07-18*) to assess the extent to which each climate PR is related to the firm's core business. For each PR, the GPT model produces a core score

measuring its relevance to the firm's primary operations. We then define d_core as an indicator variable equal to one if the core score is above the sample mean and zero otherwise.

The prompt we provided for a given climate PR is as follows:

> *You are an academic researcher in corporate disclosure. Evaluate the extent to which a firm announcement pertains to the firm's core or non-core business. Core business means activities, products, or services directly related to a company's primary revenue-generating operations or strategic focus. Non-core business means activities, products, or services outside the company's primary revenue-generating operations or strategies. Respond strictly in JSON format:*
>
> *{*
>
> *"core_score": <core_score>, # Degree to which the announcement pertains to firm's core business (0-1)*
>
> *}*

5. Empirical Result

5.1 Taxonomy of ClimateTech

Table 1 Panel A presents the mean values of firm characteristics and state-level talent supplies for ClimateTech adopting firms (Column 1) and ClimateTech non-adopting sfirms (Column 2). Notably, firms adopting ClimateTech are more likely to be a top 3 firm in the industry (15% versus 12%), larger in terms of total assets ($39.77B versus $25.27B), more likely to have CIO position (66% versus 58%), allocate higher proportion of R&D expenditure against total asset (8% versus 7%), and have more patents granted (1.75 versus 1.66) compared to firm not adopting ClimateTech.

They also tend to have more AI-related talent supply (0.01153% versus 0.01119%) and more climate-focused talent supply (0.00794% versus 0.00761%) in their headquarter state.

To find whether the differences in firm characteristics and state-level talent supplies between ClimateTech and ClimateNonTech firms are statistically significant, we regress each firm characteristics and state-level talent on *ClimateTech*, an indicator representing whether a climate PR contains ClimateTech investment. Table 1 Panel B presents the regression results for firm characteristics. We find that the coefficients of *ClimateTech* for *Top3* (0.03, $p < 0.01$), *Size* (14500.61, $p < 0.01$), *Cash* (0.01, $p < 0.01$), *CIO* (0.08, $p < 0.01$), *R&D* (0.01, $p < 0.01$), and *Patents* (0.08, $p < 0.05$) are positive and statistically significant, suggesting that firms investing in ClimateTech are indeed larger and have strong IT expertise and innovative pursuits. Table 1 Panel C presents the regression results for talent supplies. We find that the coefficients of *ClimateTech* for AI talent (0.34, $p < 0.01$) and Climate talent (0.13, $p < 0.05$) are positive and statistically significant, suggesting that firms investing in ClimateTech are more likely to be in higher proportion of these talent pools.

[Insert Table 1 Here]

To dig deeper into the types of emerging technologies used for climate initiatives, we classify each ClimateTech PR into Infra and Env, depending on whether the ClimateTech investment focuses on multipurpose infrastructure (Infra) or specialized environmental technologies (Env). Table 2 Panel A compares the two categories of ClimateTech, along with ClimateNonTech, in terms of the firm characteristics. We find that firms investing in Infra for ClimateTech initiatives tend to have higher chance of having a CIO position (68% versus 57%) and larger proportion of R&D expenditure (9% versus 7%) compared to firms investing in Env, which showed similar levels of CIO position and R&D expenditure with ClimateNonTech firms.

We further divide Infra technologies into four categories: 1) AI / ML / Analytics, 2) IT Infrastructure, 3) SCM & Logistics, and 4) Other, and divide Env technologies into three categories: 1) Electric Vehicles, 2) Alternative Energy, and 3) Other. Table 2 Panel B compares the subcategories of Infra and Env firms along with ClimateNonTech. We observe that the majority of firms investing in multipurpose infrastructure technologies (Infra) invest in general IT infrastructure (70%), while 7% of these investments are related to AI/ML/Analytics and 6% SCM. Within specialized environmental technology investments, the largest share (69%) is related to alternative energy, while 16% of investments are related to EV technologies.

Notably, firms investing in AI/ML/Analytics within ClimateTech infrastructure technologies tend to have larger size ($68.47B in total assets) and higher IT expertise in terms of CIO positions (80%) and CEOs having IT background (35%). By contrast, firms investing in EV within ClimateTech environment technologies are smaller in assets, higher in cash holdings, have higher chance of CIO positions on average.

Table 2 Panel C presents the regression results of firm characteristics on *ClimateTech_Infra*, an indicator of whether a ClimateTech PR pertains to investing in Infra technologies (versus Env technologies). We find the coefficients for *CIO* ($0.08, p < 0.01$) and *R&D* ($0.01, p < 0.1$)are positive and statistically significant.

[Insert Table 2 Here]

We also analyze the time-series trend of ClimateTech. Figure 1 plots the annual number of ClimateTech press releases, where ClimateTech is defined as climate-related press releases involving emerging technology investments. We find that the number of specialized environmental ClimateTech announcements remained relatively stable prior to 2019 but shows a sharp upward

trend after 2020. For multipurpose infrastructure technologies, we observe a surge in investment in the early 2010s, followed by a decline, and then an increase again after 2018. The early 2010s surge likely reflects the rapid expansion of general information technology.

[Insert Figure 1 Here]

5.2 Financial Impact of ClimateTech

We first examine the financial outcome of a firm's climate PR using CAR around the announcement of each PR, comparing ClimateTech investments (and Infra and Env categories of technologies) versus ClimateNonTech. Table 3 Panel A provides a comparison between ClimateTech and ClimateNonTech. We find that three-day abnormal return of Fama-French three factor model with momentum with the event window of [-1, 2] around each climate PR using ClimateTech is 92 basis points and statistically significant. It is also significantly larger than ClimateNonTech, suggesting that adopting emerging technologies for climate initiatives is positively viewed by investors. This result remains consistent when other models (the CAPM, the market-adjusted, and the Fama-French three factors) are used to construct CARs.

Table 3 Panel B compares Infra versus Env within ClimateTech investments. We find that the average three-day abnormal return of ClimateTech PR with Infra technologies is 98 basis point, which is statistically significant and larger than a ClimateTech PR with Env technologies (79 basis point). This result remains consistent when the other models are used to construct CARs.

[Insert Table 3 Here]

We further test the difference between ClimteTech and ClimateNonTech initiatives in their financial outcomes. Table 4 Panel A reports the regression results for CARs. Across all specifications for CAR with different models, the coefficients of *ClimateTech* are positive and statistically significant. For example, column (1) suggests that, when controlled for various firm

characteristics and year-quarter and industry fixed effects, a climate PR with ClimateTech investment leads to 56 basis point higher CAR compared to a climate PR without ClimateTech investment. Panel B reports the regression results for CARs on the two categories of ClimateTech: Infra and Env. Across all CAR models, the coefficients of *ClimateTech_Infra are* positive and statistically significant, while the coefficients of *ClimateTech_Env* are not significant. For example, column (1) suggests that, controlling for firm characteristics and year-quarter and industry fixed effects, a climate PR with ClimateTech Infra investment leads to 66 basis point higher CAR compared to a climate PR without ClimateTech investment ($p < 0.01$), while the difference between a climate PR with ClimateTech Env investment and without ClimateTech investment is not significant. The results suggest that investments in multipurpose infrastructure technologies, rather than specialized environment technologies, is the main driver for positive financial outcomes of technology investment in climate initiatives.

[Insert Table 4 Here]

We further assess how financial markets incorporate ClimateTech information by testing return drift. Specifically, we use farther event windows of [3, 5] days, [6, 10] days, [11, 21] days, [22, 63] days, and [64, 126] days after the announcement date to test whether further movement in CAR occurs. Table 5 reports the regression results of CAR with different windows on ClimateTech investment in Infra and Env. In columns (2) – (6) testing farther windows, we find that coefficients for neither Infra nor Env are statistically significant, suggesting that there is no drift and the positive abnormal returns to investment in Infra is absorbed within the three-days window around the announcement date.

[Insert Table 5 Here]

5.3 Environmental Impact of ClimateTech

In this section, we evaluate the actual environmental impact of ClimateTech. To measure real outcomes, we rely on both MSCI environmental ratings and RepRisk ClimateTech incident data. While MSCI environmental ratings primarily assess risks and opportunities related to environmental issues, they are an imperfect proxy for true impact, as they conflate financial incentives with non-pecuniary considerations.

Table 6, Panel A, reports regressions of the change in MSCI ratings from one year after the press release to the current rating. Column 1 presents the results for one year after the press release, while Column 2 shows the effects two years after.

[Insert Table 6 Here]

We find no significant change in MSCI ratings one or two years after the press release of multipurpose infrastructure ClimateTech. This result is consistent with the argument that such infrastructure can be applied to both environmental and non-environmental uses, serving primarily as a risk-mitigation tool. By contrast, we observe an increase in MSCI ratings two years after the press release of specialized environmental technology ClimateTech. This suggests a meaningful difference between multipurpose infrastructure and specialized environmental technologies. However, as noted earlier, MSCI ratings are an imperfect measure of real outcomes: an improvement in ratings does not necessarily indicate genuine environmental progress, but may instead reflect an increase in perceived environmental opportunities. To address this limitation, in Panel B we evaluate environmental outcomes using RepRisk incident data.

We estimate the change in RepRisk incidents following ClimateTech press releases. Our empirical specification differs from the one used to estimate changes in MSCI ratings. Cohn et al. (2022)

evaluate various econometric approaches for count-based outcome variables—in our case, the number of incidents within a given time window—and find that a simple fixed-effects Poisson model produces satisfactory results. Accordingly, we estimate the following Poisson model:

$$\log\left(E(y_{i,t+k}|X_t)\right) = ClimateTech\ Infra_{i,t} + ClimateTech\ Env_{i,t} + y_{i,t-1} + \eta_j + \tau_t + \varepsilon_{i,t}$$

The sample includes all documented press releases. $ClimateTech\ Infra_{i,t}$ equals one if the press release concerns multipurpose infrastructure ClimateTech, and, $ClimateTech\ Env_{i,t}$ equals one if it concerns specialized environmental ClimateTech. The dependent variable, $y_{i,t+k}$, is the number of incidents occurring kkk periods after the press release. We also include the number of incidents during the year prior to the press release to account for the baseline probability of incidents. Finally, we control for industry fixed effects and year–quarter fixed effects.

Table 6, Panel B, reports the Poisson regression results. We find that neither multipurpose infrastructure ClimateTech nor specialized environmental ClimateTech leads to a real decrease in environment-related incidents. Overall, our results show that multipurpose infrastructure ClimateTech consistently fails to improve actual environmental outcomes, while specialized environmental ClimateTech is associated with improvements in MSCI environmental ratings but not with a reduction in incidents.

5.4 Applying to Core Business

Given that specialized environmental technologies do not generate strong market reactions, one possible incentive for firms to pursue these activities is the potential for improved environmental outcomes. Yet why do we not observe such positive impacts? More importantly, can we identify ClimateTech solutions that create value for both shareholders and stakeholders? A key observation is that many corporate ClimateTech investments are unrelated to core operations—for example,

side businesses or philanthropic initiatives. Motivated by this, we distinguish between press releases tied to core business activities and those related to non-core activities.

To do so, we focus on the subsample of press releases related to firms' core businesses. In Table 7 Panel A, Columns (1)–(4) report results for this subsample. Columns (5)–(8) present results for the complementary set of press releases unrelated to core business activities, serving as a robustness check. To evaluate whether specialized environmental technologies can generate value for both shareholders and stakeholders, we first analyze the cumulative abnormal returns (CARs) following ClimateTech press releases within the core business subsample.

[Insert Table 7 Here]

We find that, among press releases tied to firms' core operations, specialized environmental technology announcements are associated with a 98-basis-point higher abnormal return compared with ClimateNonTech announcements. No such difference is observed in the non-core sample. We further analyze the impact of ClimateTech press releases within the core business subsample on firms' MSCI ratings and RepRisk incidents.

Moreover, we document significant real environmental improvements when specialized environmental technologies are applied to core business activities. Specifically, in Table 7 Panel B, specialized environmental technology investments are followed by higher MSCI environmental ratings beginning one year after the press release for core-related announcements (Columns (1)-(2)). Ratings increase by 0.17 points one year after the press release and by 0.34 points two years after. Given that the average MSCI ratings one and two years after the press release are 7.03 and 7.31, respectively, these changes represent increases of 2.4% (=0.17/7.03) and 4.7% (=0.34/7.31).

We find consistent and robust results when evaluating the impact on RepRisk incidents, which are presented in Table 7 Panel C. Specifically, Columns (1)–(4) include only core business press releases, while Columns (5)–(8) focus on non-core business press releases. Using Poisson regression, we find that specialized environmental ClimateTech investments lead to a 22% decrease in the number of environmental incidents six months after the announcement, which remains consistent for three years after the announcement. No significant differences are observed for non-core business press releases.

We also examine whether multipurpose infrastructure ClimateTech could generate positive environmental outcome. We also focus on the subsample of press releases related to firms' core businesses. In Table 8, we examine MSCI environmental rating in Panel A and Reprisk environmental incidents in Panel B. We also include the dummy variable for specialized environmental ClimateTech so that the omitted comparison group is ClimateNonTech.

[Insert Table 8 Here]

Panel A Columns (1)–(2) report results for the subsample of press releases related to firms' core businesses. We find that infrastructure ClimateTech does not lead to an increase in environmental ratings, whereas environmental ClimateTech consistently leads to better environmental ratings. We do not find any significant difference in the non-core sample, reported in Columns (3)–(4). Panel B Columns (1)–(4) report results for the subsample of press releases related to firms' core businesses. We find that infrastructure ClimateTech does not lead to an increase in environmental incidents, whereas environmental ClimateTech consistently leads to a reduction in environmental incidents. For the non-core sample, reported in Columns (5)–(8), we find weak and inconsistent significant results. These results are not robust when clustering is not applied at the industry level.

Our conclusion is that we do not identify multipurpose infrastructure ClimateTech as a responsible solution for both shareholders and stakeholders.

5.5 Identification Using AI Talents

Because firms differ significantly in whether they leverage advanced technologies to address climate issues, a key identification challenge is the potential endogeneity of firms' adoption decisions. Our empirical specification is less vulnerable to this concern because we employ an event-study framework focusing on short-term event windows. In addition, we exploit state-year variation in AI talent supply as an exogenous determinant of firms' likelihood of adopting advanced technologies. Specifically, we implement an instrumental variable approach, using state-level AI talent supply as an instrument for firms' choice between ClimateTech and ClimateNonTech. The results are presented in Table 9.

[Insert Table 9 Here]

Table 9, Panel 1, reports the first-stage regression. The results suggest that state-level AI talent supply increases the probability that firms adopt ClimateTech. Using the coefficients from the first stage, we compute the predicted probability of ClimateTech adoption and create a dummy variable equal to one for firms in the top decile of this predicted probability.

In Table 9, Panel 2, we regress CAR on the instrumented ClimateTech dummy. We find that the positive cumulative abnormal return remains robust when instrumenting with exogenous variation in the probability of technology adoption. Specifically, the release of an instrumented ClimateTech press release is associated with a 98-basis-point higher CAR, a magnitude comparable to the results in Table 3. These IV results suggest that the positive CAR we document is not driven by endogeneity concerns.

6. Conclusion

This paper provides the first systematic evidence on how firms deploy advanced technologies to address climate challenges. By distinguishing ClimateTech from more general climate initiatives, we highlight a critical dimension of corporate climate strategy that has been largely overlooked in academic research. Our findings show that while multipurpose infrastructure investments generate significant financial returns, they fail to deliver measurable environmental benefits, thereby primarily serving shareholders. In contrast, specialized environmental technologies often yield neither financial rewards nor environmental impact—unless integrated into firms' core operations, where they can create dual value for both shareholders and stakeholders.

Taken together, our study advances the literature on climate solutions, sustainable finance, and textual analysis by introducing a taxonomy of ClimateTech and demonstrating how interpretable language models can uncover the real effects of corporate climate disclosures. Looking ahead, our evidence calls for closer scrutiny of the conditions under which ClimateTech can genuinely align financial incentives with environmental responsibility, as well as for policies that encourage firms to deploy advanced technologies not only to mitigate shareholder risk but also to generate meaningful environmental impact.

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Tables and Figures

Table 1 Taxonomy of ClimateTech

Panel A presents the mean values of firm characteristics for ClimateTech announcing firms and ClimateNonTech announcing firms. The sample PRs are selected from Capital IQ's Key Development database, spanning 2010 – 2021. ClimateTech sample is PRs about firms applying emerging technologies to address climate challenges. ClimateNonTech sample is PRs about firms addressing climate challenges without applying emerging technologies. Firms' financial characteristics are derived from Compustat. *Top3* is an indicator equal to one if the firm's market capitalization ranks in the top three within its two-digit SIC industry in the announcement year. *Size* is the market capitalization in the announcement year. *Cash* is the ratio of cash to total assets in the announcement year. *R&D* is the ratio of R&D expenditure to total assets in the announcement year. Top management characteristics are constructed using BoardEx database. *CEO_IT* is 1 if the CEO of the firm has IT background and 0 otherwise. *CIO* is 1 if the firm has a CIO position and 0 otherwise. Patent information is derived from USPTO. *Patents* is the number of patents granted in the announcement year. The supply of talent is constructed using IPUMS database. *Talent_AI*, *Talent_Climate*, *Talent_ClimateTech* represent state-year level share of talent supply in AI, climate, and ClimateTech, respectively. Investor's sustainable practices are derived from Morningstar Sustainability Rating. *Rate_Sustain* is the value-weighted sustainability ratings of the funds investing in the announcing firm in the announcing month.

Panel B and C reports regression results of the firm characteristics (defined in Panel A) on ClimateTech. *ClimateTech* equals to 1 if a PR is a ClimateTech announcement and 0 if the PR is a ClimateNonTech announcement. *t*-statistics in parentheses are based on standard errors clustered by firm. Asterisks denote significance levels (***=1%, **=5%, *=10%).

Panel A: ClimateTech versus ClimateNonTech

	(1)	(2)
Sample	ClimateTech	ClimateNonTech
Top3	0.15	0.12
Size	39772.25	25271.64
Cash	0.15	0.14
CIO	0.66	0.58
CEO_IT	0.20	0.18
R&D	0.08	0.07
Patents	1.75	1.66
Talent_AI	11.53	11.19
Talent_Climate	7.94	7.81
Talent_ClimateTech	5.29	5.23
Rate_Sustain	2.57	2.55
Observations	1885	6309

Panel B: Regression of Firm Characteristics on ClimateTech

Dep. Var.	(1) *Top3*	(2) *Size*	(3) *Cash*	(4) *CIO*	(5) *CEO_IT*	(6) *R&D*	(7) *Patents*	(8) *Rate_Sustain*
ClimateTech	0.03***	14500.61***	0.01***	0.08***	0.01	0.01***	0.08**	0.02
	(3.55)	(5.09)	(2.93)	(5.05)	(1.20)	(2.87)	(2.11)	(1.14)
Constant	0.12***	25271.64***	0.14***	0.58***	0.18***	0.07***	1.66***	2.55***
	(28.10)	(18.47)	(74.02)	(82.65)	(32.70)	(43.42)	(82.97)	(239.37)
Year-Qtr FE	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	8089	8083	7919	6119	6119	5723	4319	2348
Adjusted R^2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Panel C: Regressions of Talent Supplies on ClimateTech

Dep. Var.	(1) *Talent_AI*	(2) *Talent_Climate*	(3) *Talent_ClimateTech*
ClimateTech	0.34***	0.13**	0.06
	(3.86)	(2.31)	(1.47)
Constant	11.19***	7.81***	5.23***
	(262.53)	(287.06)	(283.31)
Year-Qtr FE	YES	YES	YES
Industry FE	YES	YES	YES
Observations	7738	7738	7738
Adjusted R^2	0.00	0.00	0.00

Table 2 Taxonomy of Infrastructure and Environmental ClimateTech

Panel A presents the mean values of firm characteristics for ClimateTech announcing firms – divided into Infra and Env, depending on whether the ClimateTech investment focuses on multipurpose infrastructure (Infra) or specialized environmental technologies (Env) – and ClimateNonTech announcing firms. *Top3* is an indicator equal to one if the firm's market capitalization ranks in the top three within its two-digit SIC industry in the announcement year. *Size* is the market capitalization in the announcement year. *Cash assets* is the ratio of cash to total assets in the announcement year. *R&D* is the ratio of R&D expenditure to total assets in the announcement year. Top management characteristics are constructed using BoardEx database. *CEO_IT* is 1 if the CEO of the firm has IT background and 0 otherwise. *CIO* is 1 if the firm has a CIO position and 0 otherwise. Patent information is derived from USPTO. *Patents* is the number of patents granted in the announcement year. Investor's sustainable practices are derived from Morningstar Sustainability Rating. *Rate_Sustain* is the value-weighted sustainability ratings of the funds investing in the announcing firm in the announcing month.

Panel B further divides the two ClimateTech categories into subcategories. Specifically, we use GPT model to classify a ClimateTech – Infra announcement into one of the following categories: 1) AL/ML/Analytics, 2) IT Infrastructure, 3) SCM & Logistics, and 4) Others. We also classify a ClimateTech – Env announcement into one of the following categories: 1) Electric Vehicles, 2) Alternative Energy & Chemicals, and 3) others.

Panel C reports regression results of the firm characteristics (defined in Panel A) on ClimateTech - Infra. The sample is ClimateTech PRs. *Infra* equals to 1 if a PR is a ClimateTech investment announcement focusing on infrastructure technologies and 0 if focusing on environmental technologies. *t*-statistics in parentheses are based on standard errors clustered by firm. Asterisks denote significance levels (***=1%, **=5%, *=10%).

Panel A: ClimateTech Infra and Env versus ClimateNonTech

Sample	(1) ClimateTech Infra	(2) ClimateTech Env	(3) ClimateNonTech
Top3	0.15	0.15	0.12
Size	39790.99	36602.06	25271.64
Cash	0.15	0.15	0.14
CIO	0.68	0.57	0.58
CEO_IT	0.20	0.20	0.18
R&D	0.09	0.07	0.07
Patents	1.75	1.66	1.66
Rate_Sustain	2.59	2.51	2.55
Observations	1298	470	6315

Panel B: Subcategories of ClimateTech Infra and Env

Sample	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ClimateTech - Infra				ClimateTech - Env			Climate NonTech
Sub-category	AI/ML	IT	SCM	Other	EV	Alt. Energy	Other	
Top3	0.16	0.15	0.18	0.14	0.14	0.15	0.16	0.12
Size	68474.13	41670.35	33545.46	21818.38	25140.80	37595.11	44178.60	25271.64
Cash	0.16	0.16	0.10	0.16	0.20	0.13	0.16	0.14
CIO	0.80	0.70	0.67	0.56	0.73	0.53	0.57	0.58
CEO_IT	0.35	0.21	0.17	0.10	0.12	0.21	0.24	0.18
R&D	0.09	0.09	0.06	0.07	0.09	0.06	0.08	0.07
Patents	1.72	1.79	1.55	1.70	1.54	1.69	1.63	1.66
Rate_Sustain	2.66	2.57	2.68	2.58	2.45	2.48	2.72	2.55
Obs.	89 (6.9%)	914 (70.4%)	84 (6.5%)	211 (16.3%)	74 (15.7%)	326 (69.3%)	70 (14.9%)	6315

Panel C: Regressions of Firm Characteristics on ClimateTech Infra

Dep. Var.	(1) *Top3*	(2) *Size*	(3) *Cash*	(4) *CIO*	(5) *CEO_IT*	(6) *R&D*	(7) *Patents*	(8) *Rate_Sustain*
ClimateTech_Infra	-0.00	60.44	0.01	0.08***	-0.00	0.01*	0.03	0.06
	(-0.00)	(0.01)	(0.88)	(2.74)	(-0.10)	(1.95)	(0.44)	(1.53)
Constant	0.15***	39730.55***	0.15***	0.61***	0.20***	0.08***	1.72***	2.53***
	(10.04)	(6.53)	(23.11)	(26.14)	(10.21)	(14.18)	(25.50)	(79.19)
Year-Qtr FE	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1865	1864	1827	1344	1344	1411	1129	568
Adjusted R^2	-0.00	-0.00	-0.00	0.00	-0.00	0.00	-0.00	0.00

Table 3 ClimateTech Announcement Return

Panel A presents the mean cumulative abnormal returns (CAR) for ClimateTech and ClimateNonTech PRs. CARs are computed over the window [-1, 2] surrounding each PR with expected returns based on an estimation window of 252 trading days ending one day before the PR announcement. Abnormal returns are estimated using the Fama–French three-factor model with momentum (*CAR_ffm_2*), the market-adjusted model (*CAR_madj_2*), the CAPM (*CAR_capm_2*), and the Fama–French three-factor model (*CAR_ff_2*). Panel B presents the mean CAR for the separate PR samples of the two ClimateTech categories: Infra and Env.

Panel A: ClimateTech versus ClimateNonTech

	(1)	(2)
Sample	ClimateTech	ClimateNonTech
CAR_ffm_2	0.92	0.45
CAR_madj_2	0.93	0.45
CAR_capm_2	0.89	0.40
CAR_ff_2	0.95	0.45
Observations	2960	9456

Panel B: ClimateTech Infra versus Env

	(1)	(2)
Sample	ClimateTech Infra	ClimateTech Env
CAR_ffm_2	0.98	0.79
CAR_madj_2	0.99	0.79
CAR_capm_2	0.96	0.71
CAR_ff_2	1.01	0.79
Observations	2103	857

Table 4 ClimateTech Announcement Return Regressions

This table reports regression results of CAR on ClimateTech (Panel A) and ClimateTech – Infra and ClimateTech – Env (Panel B). The sample includes all Climate PRs. The dependent variables are CAR calculated using the CAPM (Column 1), the Fama–French three-factor model (Column 2), the Fama–French three-factor model with momentum (Column 3), and a market-adjusted model (Column 4). In all specifications, CARs are computed over the window [-1, 2] surrounding each PR with expected returns based on an estimation window of 252 trading days ending one day before the PR announcement. In Panel A, the main independent variable is *ClimateTech*, which is 1 if a PR is a ClimateTech announcement and 0 if the PR is a ClimateNonTech announcement. In Panel B, the main independent variables are *ClimateTech_Infra* and *ClimateTech_Env*. *ClimateTech_Infra* is 1 if a climate PR is a ClimateTech investment announcement focusing on infrastructure technologies and 0 otherwise. *ClimateTech_Env* is 1 if a climate PR is a ClimateTech investment announcement focusing on environmental technologies and 0 otherwise. All control variables are lagged by one quarter. *MTB* is the ratio of market value to total assets. *Tangibility* is calculated as fixed assets divided by total assets. *Profitability* is calculated as operation income before depreciation divided by total assets. *Leverage* is book debt divided by book value. *lnSales* is the natural logarithm of sales. *t*-statistics in parentheses are based on standard errors clustered by firm. Asterisks denote significance levels (***=1%, **=5%, *=10%).

Panel A: Regressions of CAR on ClimateTech

	(1)	(2)	(3)	(4)
Dep. Var.	*CAR_ffm_2*	*CAR_madj_2*	*CAR_capm_2*	*CAR_ff_2*
ClimateTech	0.56***	0.57***	0.56***	0.58***
	(3.95)	(3.86)	(3.77)	(4.12)
MTB_lag	-0.16*	-0.17*	-0.17**	-0.17*
	(-1.90)	(-1.97)	(-2.06)	(-1.91)
Tangibility_lag	0.18	0.29	0.36	0.35
	(0.43)	(0.65)	(0.82)	(0.79)
Profitability_lag	-11.25*	-11.31*	-11.26*	-11.38*
	(-1.89)	(-1.99)	(-1.91)	(-1.88)
Leverage_lag	-0.27	-0.27	-0.37	-0.36
	(-0.79)	(-0.77)	(-1.01)	(-1.05)
lnSales_lag	-0.28***	-0.27***	-0.26***	-0.28***
	(-3.87)	(-3.85)	(-3.65)	(-3.87)
Year-Qtr FE	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Observations	11935	11935	11935	11935
Adjusted R^2	0.01	0.02	0.01	0.02

Panel B: Regressions of CAR on ClimateTech Infra and Env

	(1)	(2)	(3)	(4)
	CAR_ffm_2	*CAR_madj_2*	*CAR_capm_2*	*CAR_ff_2*
ClimateTech_Infra	0.66***	0.68***	0.69***	0.70***
	(2.74)	(2.73)	(2.84)	(2.92)
ClimateTech_Env	0.31	0.29	0.24	0.30
	(1.48)	(1.33)	(1.05)	(1.36)
MTB_lag	-0.16*	-0.17*	-0.17**	-0.17*
	(-1.91)	(-1.98)	(-2.08)	(-1.93)
Tangibility_lag	0.21	0.32	0.39	0.38
	(0.49)	(0.72)	(0.90)	(0.86)
Profitability_lag	-11.33*	-11.41*	-11.36*	-11.47*
	(-1.88)	(-1.98)	(-1.91)	(-1.88)
Leverage_lag	-0.27	-0.27	-0.37	-0.36
	(-0.79)	(-0.77)	(-1.01)	(-1.05)
lnSales_lag	-0.28***	-0.27***	-0.26***	-0.28***
	(-3.86)	(-3.84)	(-3.63)	(-3.86)
Year-Qtr FE	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Observations	11935	11935	11935	11935
Adjusted R^2	0.01	0.02	0.01	0.02

Table 5 ClimateTech Announcement Return Drift Regressions

This table reports regression results of CAR drift. The sample includes all Climate PRs. The dependent variables are CAR calculated using the Fama–French three-factor model with momentum. CARs are computed over the window of [-1, 2] days (*CAR_ffm_2*), [3, 5] days (*CAR_ffm_5*), [6, 10] days (*CAR_ffm_10*), [11, 21] days (*CAR_ffm_21*), [22, 63] days (*CAR_ffm_63*), and [64, 126] days (*CAR_ffm_126*) with expected returns based on an estimation window of 252 trading days ending one day before the PR announcement. The main independent variables are *ClimateTech_Infra*, which is 1 if a climate PR is a ClimateTech investment announcement focusing on infrastructure technologies and 0 otherwise, and *ClimateTech_Env*, which is 1 if a climate PR is a ClimateTech investment announcement focusing on environmental technologies and 0 otherwise. All control variables are lagged by one quarter. *MTB* is the ratio of market value to total assets. *Tangibility* is calculated as fixed assets divided by total assets. *Profitability* is calculated as operation income before depreciation divided by total assets. *Leverage* is book debt divided by book value. *lnSales* is the natural logarithm of sales. *t*-statistics in parentheses are based on standard errors clustered by firm. Asterisks denote significance levels (***=1%, **=5%, *=10%).

	(1)	(2)	(3)	(4)	(5)	(6)
Dev. Var.	*CAR_ffm_2*	*CAR_ffm_5*	*car_ffm_10*	*car_ffm_21*	*car_ffm_63*	*car_ffm_126*
ClimateTech_Infra	0.66***	-0.00	0.10	0.00	-0.12	0.04
	(2.74)	(-0.02)	(0.45)	(0.03)	(-0.27)	(0.06)
ClimateTech_Env	0.31	-0.17	0.09	-0.33	0.50	-0.06
	(1.48)	(-1.06)	(0.55)	(-0.80)	(0.65)	(-0.06)
MTB_lag	-0.16*	-0.02	-0.10**	-0.00	0.01	0.12
	(-1.91)	(-1.17)	(-2.44)	(-0.04)	(0.03)	(0.37)
Tangibility_lag	0.21	-0.16	-0.88	0.61	1.58	-0.88
	(0.49)	(-0.27)	(-1.51)	(0.86)	(0.52)	(-0.18)
Profitability_lag	-11.33*	5.26*	8.42	9.92***	10.56	28.89***
	(-1.88)	(1.99)	(1.47)	(2.69)	(0.60)	(2.72)
Leverage_lag	-0.27	0.64**	0.09	0.22	1.60*	3.04**
	(-0.79)	(2.60)	(0.48)	(1.01)	(1.75)	(2.03)
lnSales_lag	-0.28***	-0.08**	-0.10*	-0.03	-0.23	-0.41*
	(-3.86)	(-2.47)	(-1.71)	(-0.45)	(-1.20)	(-1.84)
Year-Qtr FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Observations	11935	11935	11935	11935	11935	11883
Adjusted R^2	0.01	0.01	0.00	0.00	0.02	0.03

Table 6 ClimateTech Environmental Impact

This table reports regression results of environmental impact of ClimateTech. The sample includes all Climate PRs. In Panel A, the dependent variables are MSCI firm strength ratings on climate change theme over the two following years after each climate PR. In Panel B, the dependent variables are the number of RepRisk negative incidents in 6 months, 1 year, 2 years, and 3 years following the climate PR announcement date. The main independent variables are *ClimaeTech_Infra*, which is 1 if a climate PR is a ClimateTech investment announcement focusing on infrastructure technologies and 0 otherwise, and *ClimateTech_Env*, which is 1 if a climate PR is a ClimateTech investment announcement focusing on environmental technologies and 0 otherwise. All control variables are lagged by one quarter. *MTB* is the ratio of market value to total assets. *Tangibility* is calculated as fixed assets divided by total assets. *Profitability* is calculated as operation income before depreciation divided by total assets. *Leverage* is book debt divided by book value. *lnSales* is the natural logarithm of sales. *t*-statistics in parentheses are based on standard errors clustered by firm. Asterisks denote significance levels (***=1%, **=5%, *=10%).

Panel A: Regressions of MSCI Rating on ClimateTech Infra and Env

	(1)	(2)
Dep. Var	*MSCI_lead1*	*MSCI_lead2*
ClimateTech_Infra	-0.08	-0.04
	(-1.68)	(-0.62)
ClimateTech_Env	0.11	0.19**
	(1.61)	(2.41)
MTB_lag	-0.02	0.02
	(-1.15)	(0.66)
Tangibility_lag	0.07	-0.03
	(0.58)	(-0.21)
Profitability_lag	-0.63	-0.34
	(-0.46)	(-0.20)
Leverage_lag	0.10	0.16
	(1.14)	(1.33)
lnSales_lag	0.02	-0.02
	(0.95)	(-0.65)
Year-Qtr FE	YES	YES
Industry FE	YES	YES
Observations	5771	5562
Adjusted R^2	0.02	0.03

Panel B: Regressions of RepRisk Incidents on ClimateTech Infra and Env

Dep. Var.	(1) *RepRisk_6m*	(2) *RepRisk_1y*	(3) *RepRisk_2y*	(4) *RepRisk_3y*
ClimateTech_Infra	-0.02	-0.04	-0.04*	-0.04
	(-0.76)	(-1.41)	(-1.66)	(-1.63)
ClimateTech_Env	0.02	-0.00	0.01	0.00
	(0.37)	(-0.03)	(0.27)	(0.14)
RepRisk_bf1y	0.01***	0.01***	0.01***	0.01***
	(3.84)	(3.89)	(3.86)	(3.84)
MTB_lag	0.12***	0.13***	0.15***	0.16***
	(5.18)	(5.62)	(6.69)	(7.69)
Tangibility_lag	-0.03	0.06	0.24	0.41
	(-0.14)	(0.24)	(0.73)	(0.97)
Profitability_lag	-4.17**	-4.66***	-4.86***	-5.13***
	(-2.44)	(-2.64)	(-2.99)	(-3.33)
Leverage_lag	-0.05	-0.03	-0.10	-0.17
	(-0.19)	(-0.13)	(-0.40)	(-0.61)
lnSales_lag	0.91***	0.91***	0.91***	0.91***
	(13.30)	(14.11)	(14.49)	(14.49)
Year-Qtr FE	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Observations	8862	8862	8864	8870
Pseudo R^2	0.78	0.82	0.85	0.86

Table 7 Further Breakdown of Environmental ClimateTech

This table reports regression results of CAR and environmental impact of ClimateTech, focusing on environmental technologies (Env). Columns (1) to (4) present results for the Core sample, in which a climate initiative is relevant to the announcing firm's primary operations. Columns (5) to (7) present results for the Non-Core sample, in which a climate initiative is for peripheral operations, rather than primary. In Panel A, the dependent variables are CAR calculated using the Fama–French three-factor model with momentum (Columns 1 and 5), the market-adjusted model (Columns 2 and 6), the CAPM (Columns 3 and 7), and the Fama–French three-factor model (Columns 4 and 8). In all specifications, CARs are computed over the window [-1, 2] surrounding each PR. In Panel B, the dependent variables are MSCI firm strength ratings on climate change theme in the next year (Columns 1 and 3) and two-years (Columns 2 and 4) post each climate PR. In Panel C, the dependent variables are the number of RepRisk negative incidents in 6 months (Columns 1 and 5), 1 year (Columns 2 and 6), 2 years (Columns 3 and 7), and 3 years (Columns 4 and 8) following the climate PR announcement.

The main independent variable is *ClimateTech_Env*, which is 1 if a climate PR is a ClimateTech investment announcement focusing on environmental technologies and 0 otherwise. All control variables are lagged by one quarter. *MTB* is the ratio of market value to total assets. *Tangibility* is calculated as fixed assets divided by total assets. *Profitability* is calculated as operation income before depreciation divided by total assets. *Leverage* is book debt divided by book value. *lnSales* is the natural logarithm of sales. *t*-statistics in parentheses are based on standard errors clustered by firm. Asterisks denote significance levels (***=1%, **=5%, *=10%).

Panel A: Regressions of CAR on ClimateTech Env by Core vs. Non-Core Sampless

Sample	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Core				Non-Core			
Dep. Var.	*CAR_ffm_2*	*CAR_madj_2*	*CAR_capm_2*	*CAR_ff_2*	*CAR_ffm_2*	*CAR_madj_2*	*CAR_capm_2*	*CAR_ff_2*
ClimateTech_Env	0.98**	0.94**	0.92*	0.96**	-0.27	-0.28	-0.37	-0.30
	(2.62)	(2.08)	(1.93)	(2.40)	(-0.87)	(-0.92)	(-1.20)	(-0.97)
MTB_lag	-0.11	-0.11	-0.11	-0.11	-0.26**	-0.27**	-0.28***	-0.27**
	(-1.34)	(-1.31)	(-1.42)	(-1.33)	(-2.56)	(-2.66)	(-2.67)	(-2.58)
Profitability_lag	1.94	2.39	2.27	1.78	-21.03*	-21.59*	-21.33*	-21.14*
	(0.60)	(0.61)	(0.60)	(0.53)	(-1.88)	(-1.97)	(-1.90)	(-1.88)
Tangibility_lag	-0.63	-0.47	-0.34	-0.45	1.17	1.23	1.23	1.29
	(-0.87)	(-0.72)	(-0.51)	(-0.63)	(1.05)	(1.08)	(1.08)	(1.16)
Leverage_lag	-0.04	-0.02	-0.20	-0.15	-0.47	-0.47	-0.50	-0.52
	(-0.21)	(-0.11)	(-0.98)	(-0.83)	(-0.86)	(-0.90)	(-0.93)	(-0.98)
lnSales_lag	-0.40***	-0.39***	-0.37***	-0.40***	-0.17	-0.16	-0.15	-0.17
	(-3.99)	(-3.88)	(-3.82)	(-4.08)	(-1.51)	(-1.34)	(-1.27)	(-1.46)
Year-Qtr FE	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	5783	5783	5783	5783	6148	6148	6148	6148
Adjusted R^2	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02

Panel B: Regressions of MSCI Rating on ClimateTech Env by Core. Non-Core Samples

Sample	(1)	(2)	(3)	(4)
	Core		Non-Core	
Dep. Var.	*MSCI_lead1*	*MSCI_lead2*	*MSCI_lead1*	*MSCI_lead2*
ClimateTech_Env	0.17*	0.34**	0.08	0.10
	(1.89)	(2.63)	(0.86)	(0.87)
MTB_lag	-0.03**	0.00	-0.01	0.03
	(-2.27)	(0.15)	(-0.37)	(0.99)
Profitability_lag	-0.50	0.31	-0.50	-0.51
	(-0.35)	(0.21)	(-0.27)	(-0.23)
Tangibility_lag	0.11	0.12	0.06	-0.15
	(0.74)	(0.68)	(0.32)	(-0.84)
Leverage_lag	0.19	0.12	-0.01	0.17
	(1.67)	(0.84)	(-0.13)	(1.00)
lnSales_lag	0.00	-0.03	0.03	-0.01
	(0.08)	(-1.15)	(0.79)	(-0.34)
Year-Qtr FE	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Observations	2792	2681	2979	2881
Adjusted R^2	0.04	0.04	0.01	0.01

Panel C Regressions of Reprisk Incidents on ClimateTech Env by Core. Non-Core Samples

Sample	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Core				Non-Core			
Dep. Var.	*RepRisk_6m*	*RepRisk_1y*	*RepRisk_2y*	*RepRisk_3y*	*RepRisk_6m*	*RepRisk_1y*	*RepRisk_2y*	*RepRisk_3y*
ClimateTech_Env	-0.22**	-0.22***	-0.22***	-0.21***	0.07	0.04	0.06*	0.05*
	(-2.00)	(-3.13)	(-3.18)	(-2.68)	(1.47)	(1.24)	(1.76)	(1.89)
RepRisk_bf1y	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***
	(7.11)	(7.22)	(6.77)	(6.81)	(4.21)	(4.28)	(4.31)	(4.29)
MTB_lag	0.06*	0.05*	0.07***	0.09***	0.12***	0.13***	0.15***	0.17***
	(1.83)	(1.70)	(2.89)	(3.65)	(6.78)	(7.36)	(9.25)	(10.70)
Profitability_lag	-6.98***	-6.76***	-7.29***	-7.63***	-3.34**	-3.92**	-4.05***	-4.36***
	(-3.29)	(-3.27)	(-4.37)	(-5.05)	(-2.11)	(-2.42)	(-2.63)	(-2.77)
Tangibility_lag	-0.06	-0.20	-0.01	0.14	0.12	0.25	0.44	0.61
	(-0.35)	(-1.23)	(-0.07)	(0.56)	(0.43)	(0.74)	(0.99)	(1.12)
Leverage_lag	0.18	0.22**	0.20**	0.18*	-0.23	-0.21	-0.31	-0.40
	(1.57)	(2.05)	(1.97)	(1.80)	(-0.74)	(-0.67)	(-0.93)	(-1.12)
lnSales_lag	0.93***	0.91***	0.92***	0.94***	0.85***	0.85***	0.85***	0.85***
	(16.08)	(16.15)	(16.60)	(17.02)	(13.36)	(14.45)	(15.50)	(15.62)
Year-Qtr FE	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	4194	4203	4203	4203	4620	4631	4657	4662
Pseudo R^2	0.76	0.80	0.84	0.87	0.78	0.83	0.85	0.86

Table 8 Environmental Impact of Infrastructure ClimateTech

This table reports regression results of the environmental impact of ClimateTech, focusing on infrastructure technologies (Infra). In Panel A, the dependent variables are MSCI firm strength ratings on climate change theme in the next year (Columns 1 and 3) and two-years (Columns 2 and 4) post each climate PR. Columns (1) to (2) present results for the Core sample, in which a climate initiative is relevant to the announcing firm's primary operations. Columns (3) to (4) present results for the Non-Core sample, in which a climate initiative is for peripheral operations, rather than primary. In Panel B, the dependent variables are the number of RepRisk negative incidents in 6 months (Columns 1 and 5), 1 year (Columns 2 and 6), 2 years (Columns 3 and 7), and 3 years (Columns 4 and 8) following the climate PR announcement. Columns (1) to (4) present results for the Core sample, in which a climate initiative is relevant to the announcing firm's primary operations. Columns (5) to (7) present results for the Non-Core sample, in which a climate initiative is for peripheral operations, rather than primary. The main independent variable is *ClimateTech_Infra*, which is 1 if a climate PR is a ClimateTech investment announcement focusing on multipurpose infrastructure technology and 0 otherwise. *ClimateTech_Env*, which is 1 if a climate PR is a ClimateTech investment announcement focusing on environmental technologies and 0 otherwise, is included as control variable. All other control variables are lagged by one quarter. *MTB* is the ratio of market value to total assets. *Tangibility* is calculated as fixed assets divided by total assets. *Profitability* is calculated as operation income before depreciation divided by total assets. *Leverage* is book debt divided by book value. *lnSales* is the natural logarithm of sales. *t*-statistics in parentheses are based on standard errors clustered by firm. Asterisks denote significance levels (***=1%, **=5%, *=10%).

Panel A: Regressions of MSCI Rating on ClimateTech Infra by Core. Non-Core Samples

	(1)	(2)	(3)	(4)
Sample	Core		Non-Core	
Dep. Var.	*MSCI_lead1*	*MSCI_lead2*	*MSCI_lead1*	*MSCI_lead2*
ClimateTech_Infra	-0.05	0.03	-0.10	-0.08
	(-0.84)	(0.40)	(-1.10)	(-0.87)
ClimateTech_Env	0.16*	0.34**	0.06	0.09
	(1.78)	(2.59)	(0.64)	(0.78)
MTB_lag	-0.03**	0.00	-0.01	0.03
	(-2.26)	(0.13)	(-0.34)	(1.00)
Profitability_lag	-0.56	0.35	-0.50	-0.51
	(-0.39)	(0.24)	(-0.27)	(-0.23)
Tangibility_lag	0.10	0.12	0.05	-0.17
	(0.67)	(0.71)	(0.25)	(-0.93)
Leverage_lag	0.19	0.12	-0.01	0.17
	(1.67)	(0.85)	(-0.14)	(0.99)
lnSales_lag	0.00	-0.03	0.03	-0.01
	(0.12)	(-1.16)	(0.82)	(-0.31)
Year-Qtr FE	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Observations	2792	2681	2979	2881
Adjusted R^2	0.04	0.04	0.01	0.01

Panel B Regressions of Reprisk Incidents on ClimateTech Env by Core. Non-Core Samples

Sample	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Core				Non-Core			
Dep. Var.	*RepRisk 6m*	*RepRisk 1y*	*RepRisk 2y*	*RepRisk 3y*	*RepRisk 6m*	*RepRisk 1y*	*RepRisk 2y*	*RepRisk 3y*
ClimateTech_Infra	-0.03	-0.05	-0.03	-0.03	-0.03	-0.04	-0.05*	-0.05*
	(-0.78)	(-1.03)	(-0.73)	(-0.61)	(-0.95)	(-1.18)	(-1.71)	(-1.74)
ClimateTech_Env	-0.22**	-0.23***	-0.22***	-0.22***	0.06	0.04	0.05	0.04
	(-2.05)	(-3.22)	(-3.16)	(-2.71)	(1.22)	(0.90)	(1.20)	(1.23)
RepRisk_bf1y	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***
	(7.12)	(7.23)	(6.81)	(6.86)	(4.21)	(4.28)	(4.32)	(4.29)
MTB_lag	0.06*	0.05*	0.08***	0.09***	0.12***	0.13***	0.15***	0.17***
	(1.84)	(1.73)	(2.90)	(3.68)	(6.79)	(7.37)	(9.25)	(10.69)
Profitability_lag	-6.98***	-6.76***	-7.28***	-7.62***	-3.34**	-3.92**	-4.04***	-4.35***
	(-3.30)	(-3.28)	(-4.39)	(-5.06)	(-2.12)	(-2.43)	(-2.64)	(-2.79)
Tangibility_lag	-0.06	-0.20	-0.01	0.14	0.13	0.26	0.44	0.62
	(-0.36)	(-1.24)	(-0.08)	(0.56)	(0.44)	(0.76)	(1.01)	(1.15)
Leverage_lag	0.18	0.22**	0.20**	0.18*	-0.23	-0.21	-0.31	-0.40
	(1.57)	(2.07)	(1.99)	(1.82)	(-0.75)	(-0.68)	(-0.94)	(-1.13)
lnSales_lag	0.93***	0.91***	0.93***	0.94***	0.85***	0.85***	0.85***	0.85***
	(16.38)	(16.58)	(17.12)	(17.58)	(13.47)	(14.52)	(15.60)	(15.70)
Year-Qtr FE	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	4194	4203	4203	4203	4620	4631	4657	4662
Pseudo R^2	0.76	0.80	0.84	0.87	0.78	0.83	0.86	0.86

Table 9 Causal Inference for ClimateTech

This table reports the two-stage least-squares regression results for CAR using an instrumental variable for ClimateTech. The sample includes all climate PRs. Panel A presents the first-stage regression results for *ClimateTech*, an indicator of whether climate PR announcing firm applies emerging technology investments, on state-year level AI talent supplies. The main independent variable is *Talent_AI*, representing state-year level share of talent supply in AI. Panel B presents the results for CAR on the instrumented ClimateTech (*ClimateTech_IV*), with four models for calculating CAR. All panels include firm characteristics as control variables. *MTB* is the ratio of market value to total assets. *Tangibility* is calculated as fixed assets divided by total assets. *Profitability* is calculated as operation income before depreciation divided by total assets. *Leverage* is book debt divided by book value. *lnSales* is the natural logarithm of sales. *t*-statistics in parentheses are based on standard errors clustered by firm. Asterisks denote significance levels (***=1%, **=5%, *=10%).

Panel A: First-Stage Model for ClimateTech

Dep. Var.	(1) *ClimateTech*
Talent_AI	0.01**
	(2.36)
MTB_lag	-0.00
	(-1.19)
Tangibility_lag	-0.07
	(-1.29)
Profitability_lag	-0.50***
	(-4.55)
Leverage_lag	0.00
	(0.08)
lnSales_lag	0.02***
	(4.43)
Year-Qtr FE	YES
Industry FE	YES
Observations	11504
Adjusted R^2	0.04

Panel B: Second-Stage Model for CAR on Instrumented ClimateTech

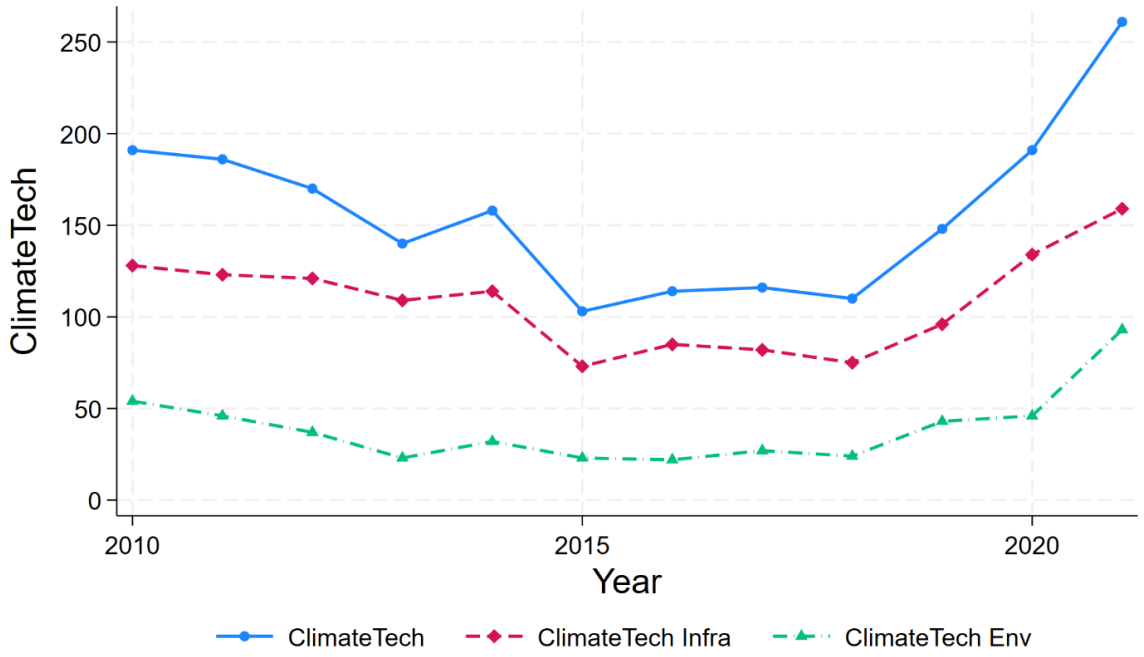
Dep. Var.	(1) *CAR_ffm_2*	(2) *CAR_madj_2*	(3) *CAR_capm_2*	(4) *CAR_ff_2*
ClimateTech_IV	0.98**	1.01***	1.04**	1.01**
	(2.58)	(2.75)	(2.66)	(2.56)
MTB_lag	-0.16*	-0.17*	-0.17**	-0.17*
	(-1.90)	(-1.96)	(-2.06)	(-1.91)
Tangibility_lag	0.27	0.38	0.45	0.44
	(0.60)	(0.84)	(0.99)	(0.94)
Profitability_lag	-10.64*	-10.68**	-10.59*	-10.75*
	(-1.90)	(-2.01)	(-1.92)	(-1.89)
Leverage_lag	-0.30	-0.30	-0.40	-0.39
	(-0.89)	(-0.87)	(-1.12)	(-1.16)
lnSales_lag	-0.32***	-0.30***	-0.29***	-0.32***
	(-5.29)	(-5.42)	(-5.16)	(-5.35)
Year-Qtr FE	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Observations	11935	11935	11935	11935
Adjusted R^2	0.01	0.02	0.01	0.02

Figure 1 Trends

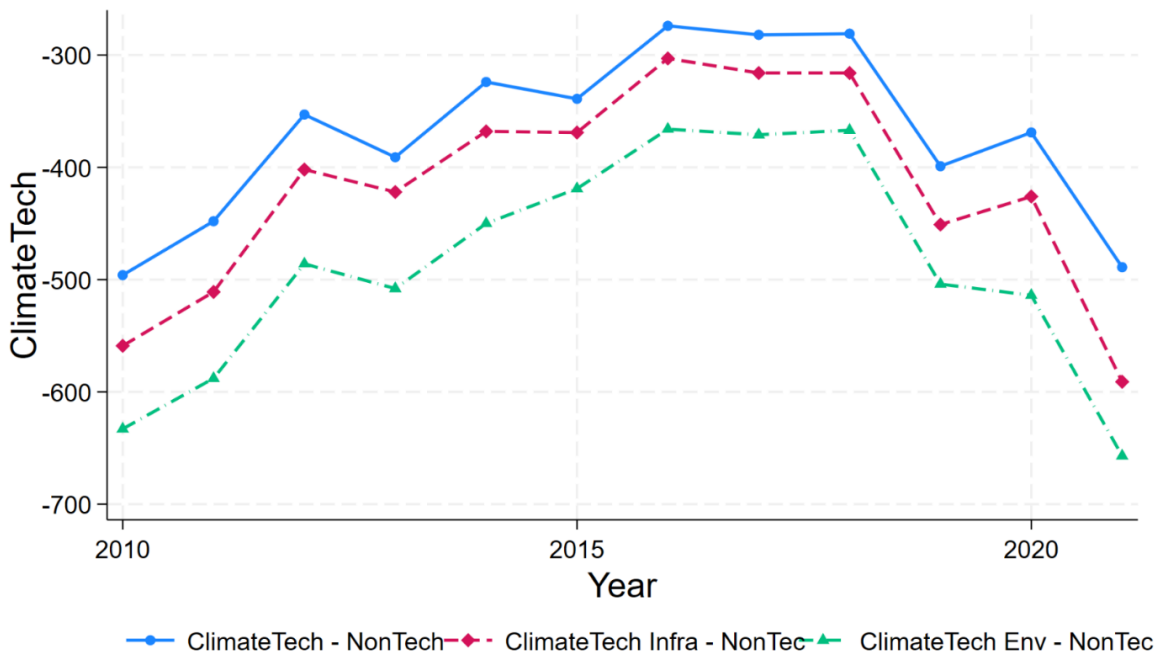
This figure plots the annual trend of number of ClimateTech PRs. ClimateTech is defined as climate PRs with emerging technology investments, indicated by at least one investment keyword syntactically linked to one emerging technology keyword. ClimateTech Infra is defined as PRs with emerging technology investments, where the focal emerging technology is classified as multipurpose infrastructure technology. ClimateTech Env is defined as PRs with emerging technology investments, where the focal emerging technology is classified as environmental technology.

Panel A presents the number of PRs in each category. Panel B presents the number of PRs in each category minus the number of ClimateNonTech PRs, where a climate PR does not utilize emerging technologies. Panel C focuses on climate PRs in each category from firms in environmental industries, defined as SIC industry classifications of 13, 49, and 87.

Panel A: Number of ClimateTech PRs



Panel B: Number of ClimateTech PRs minus ClimateNonTech PRs



Panel C: Number of ClimateTech PRs in Environnemental Industries

