The Salience of Climate Change and Green Patents Review[†]

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Abstract

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Abstract

This paper investigates how climate change shapes patent examiners' beliefs and patent review outcomes. Using a large sample of U.S. patent examiners from 2012 to 2020, we exploit geographical variations of examiner locations and rely on climatic natural disasters as shocks to beliefs about climate change. We find that examiners who experience climatic natural disasters grant more green patents in the future. Furthermore, green patents granted by examiners with experience of climatic disasters are of higher quality. The effects of climatic disaster experience are muted on non-green patent reviews. Moreover, disaster-affected examiners are more likely to donate more to the Democratic Party and exert greater effort in reviewing green patent applications. Finally, these green patents granted by disaster-affected examiners significantly reduce firms' greenhouse gas emissions.

Keywords: patent examiner, climate change, climatic disaster, green patents, belief change

JEL Classifications: G30, G41, O30, Q54, Q55

1. Introduction

Climatic natural disasters, such as drought, hurricanes, and wildfires, are extreme consequences of climate change. Since 1980, the U.S. has experienced 377 billion-dollar climatic natural disasters, amounting to a total cost of more than $2.67 trillion.[1] Besides the non-negligible economic costs, climatic natural disasters cause yearly mortality of more than 300 in the U.S. Technological advances, such as carbon capture (mitigation tech) and biodiversity protection (adaptation tech), are broadly viewed as promising solutions to climate change. However, the literature offers little about what determines the success of these innovations. We attempt to fill the gap by investigating the role of patent examiners in the review process for green patents.

Patent examiners are gatekeepers of the innovation system and significantly influence which inventions ultimately receive legal protection and market access. A recent study by Shu, Tian, and Zhan (2022) documents that the sharp time constraints faced by patent examiners adversely impact the quality of patents granted and the value of innovating firms, highlighting the substantial impacts of examiners on patent quality. Moreover, patent examiners differ in a variety of dimensions, such as experience (Lemley and Sampat, 2012), career concerns (Frakes and Wasserman, 2017), and leniency (Farre-Mensa, Hegde, and Ljungqvist, 2020). It is less known whether examiners have any non-pecuniary preferences or beliefs and how these characteristics eventually affect their behaviors during the patent review process and outcomes.[2]

Measuring an examiner's preferences or beliefs is empirically challenging, as they are often correlated or confounded by other characteristics of patent examiners. To obtain a clean measure, we exploit the geographical variations of examiners and climatic disasters that hit different regions at different times. The occurrence of climatic disasters, which serve as a proxy for climate change, provides a quasi-exogenous setting. Such events are

[1] https://www.ncei.noaa.gov/access/billions/

[2] We refer preferences to non-pecuniary and green preferences, and beliefs to beliefs about climate changes in the paper. Preferences and beliefs are used interchangeably.

unlikely to be related to examiners' characteristics but are likely to shape their beliefs or preferences. We then hypothesize that experiences of climatic disasters lead to a higher approval rate of green patents.

Using data from the Spatial Hazard and Loss Database for the United States (SHELDUS), we first identify major climatic natural disasters. Patent examiners and patent information are obtained from the United States Patent and Trademark Office (USPTO) and other U.S. official websites. Our examiner sample starts in 2012 when the USPTO officially launched a work-from-anywhere (WFA) program, creating geographical variations for examiners. Examiner location (county-level) as well as their compensation information are provided by FederalPay.org. We are interested in the effect of climatic disasters on examiner behavior, thus we aggregate the patent information to examiner-year level. We exclude an examiner-year observation if the examiner does not grant any patent in a given year. With this simple filtering process, our sample contains 58,161 examiner-year observations from 8,408 unique examiners.

We begin our investigation by examining whether the experience of a climatic natural disaster affects the portion of green patents granted by an examiner. We find a strong and positive relation between the examiner's climatic disaster experience and the share of green patents in their granted patent portfolio. Compared with an examiner without experiencing a climatic disaster, an examiner with climatic disaster experience grants approximately 10% more of green patents in the year after the disaster. Our empirical design can rule out the possibility that a growing interest in green technologies drives our results as we compare the examiners with and without experiencing a climatic disaster in the same year. Our results are also immune to changes in corporate innovation strategies, for example, firms see more growth opportunities in green technology or invest more in green technology, because of the random assignment of patent applications to examiners.

In addition to the baseline finding, our study aims to investigate the quality of green patents granted by examiners after experiencing climatic disasters. One hypothesis

suggests that climatic disasters may alter examiners' beliefs about climate change, prompting them to voluntarily dedicate more effort to thoroughly evaluating green patent applications. This heightened scrutiny could lead to improved quality in the green patents they grant. Conversely, if examiners' preference for green patents is driven by their personal attention after experiencing disasters, there should be a decline in the quality of these patents, as examiners might grant green patents more easily without necessarily conducting thorough evaluations. Our findings reveal that examiners who encounter climatic disasters in the preceding year tend to grant higher-quality green patents compared to those who do not experience such events. This finding indicates that the influence of climatic disasters on examiners goes beyond the quantity of green patents granted, extending to their selection of high-quality green patents.

Furthermore, we aim to demonstrate that examiners reshape their beliefs about climate change after experiencing climatic disasters. Our research shows that examiners who have encountered such disasters tend to increase their donations to the Democratic Party and dedicate greater effort to the examination process of green patents. This evidence suggests that experiencing climatic disasters acts as a catalyst for belief change, prompting examiners to invest more effort in reviewing green patent applications and, consequently, improving the quality of these patents.

To further explore the heterogeneity, we conduct several cross-sectional tests. We find that the impact of climatic disasters on examiners' preferences is more pronounced among senior and male examiners, stronger for those with heightened climate change awareness, amplified for examiners who have experienced more severe disasters, and most notable in the case of hurricanes and wildfires.

Having established the causal effect of climate change and examiners' belief change, we turn to exploring the tangible impact of the finding at the firm level. Specifically, we examine whether high-quality green patents granted by disaster-affected examiners translate into meaningful environmental benefits for the companies that own them. Our

analysis reveals that these high-quality green patents significantly contribute to reducing firms' greenhouse gas emissions. This indicates that the experience of climatic disasters not only influences examiners' decision-making but also facilitates the approval of impactful green innovations that enhance firms' environmental performance.

In addition, we include a subsection demonstrating that extreme heat similarly affects examiners' preferences for green patents. Our analysis shows that exposure to extreme heat increases the likelihood of approving green patents, with the approved patents also being of higher quality. These findings support our finding that specific climate events can reshape examiners' beliefs and promote greater support for green innovation.

Finally, we conduct several robustness tests to enhance our findings. We firstly address two concerns that the baseline finding may be driven by a higher volume of green patent applications or influenced by geographic proximity bias, where firms located near examiners could gain informational advantages or hire former examiners to facilitate their patent processes. Then, we conduct several tests, including matching affected examiners and unaffected examiners, using an alternative classification for green patents, dividing green patents into two categories, and doing a placebo test. Together, these robustness tests strengthen the validity of our findings, providing additional evidence for the effects of climate change on examiners' beliefs and subsequent granting of green patents.

Our paper provides new evidence on the salience of climate change and the review of green patents, which, in turn, influences firms' greenhouse gas emissions. This represents an important yet underexplored area within innovation studies, particularly in green innovation, where existing research remains limited in understanding how various factors shape its development. Cohen, Gurun, and Nguyen (2024) find that oil, gas, and energy-producing firms produce more, significantly higher quality, green innovation. Similarly, Chu, Liu, and Tian (2021) show that firms increase both environmental innovation input and output in response to nearby environmental spills. However, different from prior studies which suggest that green patents do not necessarily reduce the carbon emissions

of innovating firms (Bolton, Kacperczyk, and Wiedemann, 2023; Hege, Pouget, and Zhang, 2024), our findings reveal that selected high-quality green patents can significantly reduce firms' greenhouse gas emissions. This result is partially consistent with Cheng, Lin, and Yang (2024) and Hege, Li, and Zhang (2025), further highlighting the importance of quality in green innovation.

Secondly, existing literature documents that patent granting can be affected by the characteristics of patent examiners, such as examiner experience (Lemley and Sampat, 2012), promotion (Frakes and Wasserman, 2017), leniency (Farre-Mensa, Hegde, and Ljungqvist, 2020), and busyness (Shu, Tian, and Zhan, 2022), and external factors or policies on examiners' behaviors, including external weather variations (Kovács, 2017), telecommuting and work-from-anywhere policies from the USPTO (Choudhury, Foroughi, and Larson, 2021; Baek, 2023), and the distance between USPTO and patent firms (Jia and Tian, 2018). We contribute to the growing body of research on examiners by first demonstrating how changes in examiners' beliefs can influence the review of green patents.

Thirdly, our study contributes to the emerging literature "Climate Finance" proposed by Hong, Karolyi, and Scheinkman (2020) and Giglio, Kelly, and Stroebel (2021). While some studies suggest that early-life disasters can have long-term effects on individuals, such as CEOs (Bernile, Bhagwat, and Rau, 2017; O'Sullivan, Zolotoy, and Fan, 2021) and households (Gao, Liu, and Shi, 2020), our research focuses on climate change in adulthood and aligns with findings that the impact is often temporary on personal beliefs and behaviors, as observed in firm managers (Dessaint and Matray, 2017), fund managers (Alok, Kumar, and Wermers, 2020), investors (Krueger, Sautner, and Starks, 2020; Choi, Gao, and Jiang, 2020; Bolton and Kacperczyk, 2021; Huynh and Xia, 2023), lenders (Ouazad and Kahn, 2022), households (Baldauf, Garlappi, and Yannelis, 2020; Bharath and Cho, 2023; Del Valle, Scharlemann, and Shore, 2024), directors (Huang, Jiang, Xuan, and Zhou, 2022), analysts (Bourveau and Law, 2021; Han, Mao, Tan, and Zhang, 2024),

and survey-based findings on individuals' attitudes toward CO2 emissions (Bernard, Tzamourani, and Weber, 2023).

The remainder of this paper is organized as follows. Section 2 describes the data and summary statistics. Section 3 presents our baseline results about the effect of climate change on green patents review. Section 4 analyzes mechanisms and several cross-sectional tests. Section 5 shows the real impact of firm greenhouse gas emissions. Section 6 delves into the influence of extreme temperature. Section 7 shows robustness tests. Section 8 summarizes the conclusions.

2. Data

In this section, we introduce the datasets used in our study, including climatic natural disaster data, patent data, and patent examiner data.

2.1 Climatic natural disaster data

We collect county-level information on natural disaster events in the U.S. from the Spatial Hazard and Loss Database for the United States (SHELDUS database) maintained by Arizona State University.[3] The SHELDUS database defines the disaster area by countries directly impacted by natural disasters, providing information on the type of natural disaster events (18 types), the name of affected counties, county-level dollar damages caused by each type of event, the number of injuries or fatalities caused by each type of event, the duration of each type of event, and the date of the event. Based on existing literature (e.g., Alok, Kumar, and Wermers, 2020) and analysis with ChatGPT, we classify disasters into two categories: those strongly linked to climate change, referred to as climatic natural disasters, and those that are not. Supporting evidence explaining the

[3] https://cemhs.asu.edu/sheldus The SHELDUS database shows that the data about natural disasters (e.g., drought, flooding, fog, hail, avalanche, coastal, heat, hurricane/tropical storm, landslide, lightning, severe thunderstorm, tornado, wildfire, wind, and winter weather) is from National Climatic Data Center, and other disasters (such as earthquake, tsunami/seiche, and volcano) is from National Geophysical Data Center. This also demonstrates that the selected disasters are climatic disasters, which are more closely associated with climate change.

classification of these events as climatic natural disasters and their connection to climate change is provided in Appendix B.

Following previous studies (Barrot and Sauvagnat, 2016; Huynh and Xia, 2023), we select disasters with total estimated damages exceeding $10 million per county (in 2020 constant dollars) and durations of less than 30 days. We also require that the total number of injuries and fatalities caused by the disaster be greater than zero so that the examiner can sense the disaster damage more directly. Panel A of Table 1 reports summary statistics for climatic natural disasters that occurred between 2011 and 2019 in our sample.[4] There are six types, including flooding, hurricane, tornado, wildfire, wind, and hail.

[Insert Table 1 Panel A about here]

2.2 Examiner and patent data

We obtain data on all issued utility patents and patent examiners from the U.S. Patent & Trademark Office (USPTO) and PatentsView.[5] Each patent has a patent ID, an examiner's full name, and an issue date. All patents are randomly assigned to an examiner, and the detailed examination process for patent applications is outlined in Shu, Tian, and Zhan (2022). We then use the examiners' names from the USPTO database to link the examiner to their location and pay information from FederalPay.org, a public resource for U.S. government employee data.[6] In December 2010, President Obama signed the Telework Enhancement Act, which set standard rules and regulations for remote work at federal government agencies. In response, the USPTO officially launched a work-from-anywhere (WFA) program, the Telework Enhancement Act Pilot Program (TEAPP) in early 2012. This program allows employees to live and work anywhere in the contiguous U.S. (greater than 50 miles from the USPTO headquarters), thus awarding eligible patent

[4] To align our timeline with examiner location data, we do not consider disasters before 2011.

[5] https://www.uspto.gov/ip-policy/economic-research/research-datasets/patent-examination-research-dataset-public-pair; https://patentsview.org/

[6] https://www.federalpay.org/employees/patent-and-trademark-office

examiners geographic flexibility. This is the first program that allows examiners to work far enough away from the headquarters, and the USPTO does not adjust wages for employees opting to participate in the WFA program. Therefore, to fully examine the effect of climate change on examiners' beliefs, our sample period starts in 2012 to ensure that the sample has extensive location coverage. Figure 1 shows the geographic distribution of examiners in 2020. As shown in Figure 1, patent examiners are dispersed across multiple counties rather than concentrated only near the USPTO headquarters, highlighting the considerable variation in their locations. This widespread geographic coverage allows us to thoroughly investigate the impact of climate change on examiners' beliefs and decisions.

[Insert Figure1 about here]

To classify patents as green or non-green, we rely on Cooperative Patent Classification (CPC) codes for all issued patents from the USPTO. Specifically, the CPC Y02 category, defined by the USPTO and EPO, is designed to identify climate-related technologies, which include technologies or applications for mitigation or adaptation against climate change.[7] Building on the Organization for Economic Co-operation and Development new method (hereafter OECD 2023) proposed by Dussaux, Agnelli, and Es-Sadki (2023), as well as insights from previous studies (e.g., Calel, 2020), we classify patents under the CPC Y02 category as green patents, focusing on those most relevant to climate change in our main analysis.

[7] CPC YO2 includes technologies for adaptation to climate change (Y02A); climate change mitigation technologies related to buildings (Y02B); capture, storage, sequestration, or disposal of greenhouse gases (Y02C); climate change mitigation technologies in information and communication technologies (Y02D); reduction of greenhouse gas emissions related to energy generation, transmission, or distribution (Y02E); climate change mitigation technologies in the production or processing of goods (Y02P); climate change mitigation technologies related to transportation (Y02T); and climate change mitigation technologies related to wastewater treatment or waste management (Y02W).

2.3 Summary statistics

Our final sample consists of 8,408 unique examiners from 2012 to 2020. To establish the link between examiner location and climatic natural disasters, we use county-level location data. We construct an examiner-level preference measure for green patents, referred to as the Green Patent Ratio, which is defined as the proportion of green patents relative to all patents granted by each examiner in a given year. Meanwhile, we construct an examiner-level disaster measure, labeled Disaster, which is a dummy variable equal to one if an examiner experienced a climatic disaster in the previous year, and zero otherwise. Summary statistics for the main variables are presented in Table 1 Panel B. There are 58,161 examiner-year observations. The mean values of the Disaster and Green Patent Ratio are 0.01 and 0.08, respectively, while their standard deviations are 0.08 and 0.16. All continuous variables that are not constrained between 0 and 1 are winsorized at 1% and 99% level. Detailed variable definitions are provided in Appendix A.

[Insert Table 1 Panel B about here]

3. Climate Change and Green Patent Review

In this section, we examine the relation between climatic disasters and examiners' beliefs regarding climate change, as reflected in the green patent review process.

3.1 Baseline results

In the baseline analysis, we analyze whether an examiner's experience of climatic disasters influences the proportion of green patents they grant. The basic OLS regression we estimate is as follows:

$$Green\ Patent\ Ratio_{i,t} = \beta_0 + \beta_1 Disaster_{i,t-1} + FEs + \varepsilon_{it} \quad (1)$$

where the dependent variable, $Green\ Patent\ Ratio_{i,t}$ is defined as the percentage of green patents granted in all granted patents for examiner i during year t, representing examiners' preference for green patents. The independent variable, $Disaster_{i,t-1}$, is a dummy variable,

which equals one if the examiner experiences climatic disasters in year *t-1* and zero otherwise. To account for unobserved heterogeneity, we include examiner and year fixed effects in our model, and standard errors are double-clustered at the county and year levels. If climate change can influence examiners' beliefs to grant more green patents, we expect significantly positive coefficient estimates of the examiner disaster measure.

Table 2 confirms our conjecture and shows that climatic disasters positively affect examiners' preference for granting green patents across different specifications by altering the fixed effects and cluster methods. Specifically, the coefficient is 0.0079 in column (1), suggesting that after examiners experienced climatic natural disasters, the magnitude of the Green Patent Ratio will increase by 9.9% relative to the mean (0.0079/0.08). Figure 2 illustrates the dynamic effects of climatic disasters on examiner decisions. Our analysis reveals a significant coefficient only in the year *t+1* following the occurrence of climatic disasters. The coefficients for the years preceding the disasters and all years following two years after the disasters are not statistically significant. This finding confirms our hypothesis that the impact of climatic disasters on examiners' beliefs is temporary.

[Insert Table 2 and Figure 2 about here]

To address a potential concern that certain types of climatic disasters may not be directly related to climate change, we exclude two less frequent types, wind and hail, which occurred only a few times in our sample. The results, presented in Table C1, remain consistent even after these exclusions, reinforcing the robustness of our main finding.[8] Additionally, when dealing with censored data, some scholars argue that the Tobit model is more appropriate, as it allows for the inclusion of observations with values at the limit (in this case, a proportion of 0 for values exceeding 50%). Therefore, we use the Tobit

[8] Besides, we delete the examiners who located in the headquarters of the USPTO office, and the results hold. We also rule out the potential effect of disasters occurring in nearby counties on examiners' preferences in our analysis. We further confirm that the impact on examiners' preference is solely influenced by experiencing disasters within their own county, rather than other counties within the same state.

model to conduct a robustness test, and the results are shown in Table C2. The findings indicate that the influence of climatic disasters on the granting of green patents remains robust, even when considering the censoring issue.

Taken together, our findings suggest that climatic natural disasters play a crucial role in shaping examiners' beliefs about climate change, particularly regarding granting green patents. This selective granting behavior appears to be temporary but significant, affecting the decision-making process and promoting the development of green innovation. These results underscore the importance of understanding external environmental factors in the patent examination process and their potential to drive sustainable technological advancements.

3.2 The impact of climate change on green patent quality

Building on the baseline finding that examiners grant more green patents after experiencing climatic disasters, we turn to examining the quality of these patents. One possibility is that such experiences heighten examiners' personal attention to green innovation, leading them to approve green patents more easily without thorough evaluation. If this is the case, we would expect the quality of green patents to either decline or show no significant change. However, if climatic disasters reshape examiners' beliefs about climate change and inspire them to take a more active role in promoting green innovation, they may increase the effort invested in reviewing green patent applications. This shift in belief could lead to more rigorous evaluations, ultimately improving the quality of granted green patents.

We construct three measures to prove our hypothesis. Green Patent Quality measures the quality of green patents, which is defined as the logarithm of one plus the average number of citations received by green patents each examiner each year, adjusted for truncation following Hall, Jaffe, and Trajtenberg (2001). Non-green Patent Quality is defined as the logarithm of one plus the average number of citations received by non-

green patents each examiner each year, adjusted for truncation following Hall, Jaffe, and Trajtenberg (2001). All Patent Quality is defined as the logarithm of one plus the average number of citations received by all patents each examiner each year, adjusted for truncation following Hall, Jaffe, and Trajtenberg (2001).

In Table 3, the coefficient on the Disaster variable in column (1) is positive and significant at the 1% level, showing that the quality of green patents granted by examiners who have experienced climatic disasters increases.[9] Specifically, if the disasters happened in the examiners' location, the coefficient of Disaster for Green Patent Quality will increase by 0.0157, which is approximately 3.5% relative to the mean of the variable (0.0157/0.45). Additionally, the effects of climatic disaster experience are diminished for non-green patent quality, as the coefficient in column (2) is statistically insignificant. Overall, examiners change their beliefs toward green patents after encountering climatic disasters and dedicate themselves to selecting high-quality green patents that have the potential to contribute to addressing the challenges posed by climate change.

[Insert Table 3 about here]

4. Mechanism and Cross-sectional Evidence

In the previous section, we posit that examiners' experiences with climatic disasters influence their beliefs about climate change, prompting them to grant more green patents, which are also of higher quality. To further investigate the underlying mechanisms and channels through which climatic disasters shape examiners' beliefs, we provide additional evidence to conduct a series of heterogeneity analyses in this section.

[9] We also use the median citation received by green patents for each examiner in a given year, adjusted for truncation following Hall, Jaffe, and Trajtenberg (2001), to run the OLS regression. The results are largely similar. We also run the Poisson regression using the untruncation-adjusted quality measures to test the effect. The results are consistent and are shown in Table C3.

4.1 The effect of climate change on examiners' beliefs

We examine the relationship between climate change and shifts in examiners' beliefs, using their political affiliation as a proxy. By analyzing donation data, we aim to capture changes in their behavior and provide evidence of belief shifts in response to climatic disasters. If exposure to climatic disasters influences examiners' views on climate change, we expect an increased tendency to donate to the Democratic Party, which cares more about climate change-related issues and advocates for ESG (Environmental, Social, and Governance) initiatives, such as environmental protection. (Di Giuli and Kostovetsky, 2014; Bernstein, Billings, Gustafson, and Lewis, 2022).

We collect examiners' donation data from two sources. First, we use the Federal Election Commission (FEC) database following prior studies (e.g., Di Giuli and Kostovetsky, 2014; Addoum and Kumar, 2016; Babenko, Fedaseyeu, and Zhang, 2020; Bizjak, Kalpathy, Mihov, and Ren, 2022), which provides detailed records of political contributions to federal candidates and political parties since 1979, including the donor's name, address, occupation, and contribution amount. Second, we supplement missing data with the Database on Ideology, Money in Politics, and Elections (DIME) from Harvard University (Bonica, 2024), which includes over 130 million contributions to local, state, and federal elections. We identify political donation records associated with examiners' names and institutions in the FEC database and use the DIME database to fill any gaps, ultimately obtaining 514 observations.

Table 4 reveals a significant increase in examiners' political donations to the Democratic Party over time. This shift suggests a potential change in their underlying beliefs, particularly regarding climate change. As the Democratic Party emphasizes climate action and environmental policies, the rise in donations may reflect a growing alignment between examiners' values and the party's stance on climate-related issues. These findings highlight a possible ideological shift among examiners, influenced by the increased severity of climate change.

[Insert Table 4 about here]

4.2 The effect of climate change on examiners' efforts

Building upon the findings above, we aim to support our hypothesis that the quality of granted green patents increases because examiners change their beliefs and then put more effort into evaluating green patents after experiencing climatic disasters. We attempt to explain this interesting finding from the perspective of examiners' increased efforts in granting green patents. To examine this conjecture, we consider several measures to evaluate the examiners' efforts.

The first measure uses the number of claims to evaluate the examiner's search effort following Harhoff and Wagner (2009). A larger number of claims requires more time for examination, as claims define patents' boundaries and must be reviewed and validated by the examiner. Green Claim is the average number of claims in green patents reviewed by each examiner annually. Similarly, Non-green Claim and All Claim represent the averages for non-green and all patents, respectively. The second measure is the total number of patent references (backward citations) made by examiners, used to evaluate their search effort. Since each reference must be identified and validated, a higher number of references generally increases the examination time. Green Reference is the average number of references to green patents cited by each examiner annually. Similarly, Non-green Reference and All Reference represent the averages for non-green and all patents, respectively. The first two measures are based on the patent data,[10] while the third measure is based on the rejection data. We aim to examine whether examiners become

[10] To ensure the accuracy of our assessment of the examiners' efforts, we focus on samples that include patents granted in year *t* following the occurrence of disasters in year *t-1* without any prior rejections, which allows us to evaluate the examiners' efforts precisely. This filter ensures that the examiner's first action on these patents is taken after the occurrence of the disaster. If the examiner had taken some non-final reject actions before the disaster occurred, we would not be able to accurately measure the increase of the examiner's effects from climatic disasters. We also use this sample to run the baseline regression, and the results shown in Table C4 are consistent.

more meticulous in rejecting green patent applications after a disaster. Green Rejection represents the proportion of green rejections based on 102 or 103 reasons that include at least one prior art citation, relative to the total number of such rejections by each examiner annually. Similarly, Non-green Rejection and All Rejection are defined similarly for non-green and all rejections.

Table 5 presents the results of our analysis, focusing on the relationship between climatic disasters and examiners' efforts in granting green patents. In column (1) of Panels A and B, the coefficients on the Disaster variable are positively signed and statistically significant, while the coefficients in columns (2) and (3) are statistically insignificant. Similarly, from Panel C, we can observe that after experiencing a disaster, examiners become more meticulous in deciding whether to reject green patent applications. Overall, the results suggest that compared to non-green patents, examiners affected by climatic disasters devote greater effort to reviewing green applications, thereby improving the quality of granted green patents.

[Insert Table 5 about here]

4.3 The role of examiners' characteristics

More experienced examiners are often seasoned professionals, likely to be older and, in some cases, parents. This demographic, shaped by life experiences and responsibilities, is more concerned about environmental development and the survival environment for future generations (Lemley and Sampat, 2012; Cronqvist and Yu, 2017; Bernard, Tzamourani, and Weber, 2023). Meanwhile, women tend to show greater concern for climate change-related issues (Bernard, Tzamourani, and Weber, 2023). Males may be more influenced by climatic disasters, as females generally show heightened concern for climate-related issues even before such events occur. Based on these, we hypothesize that the impact of climatic disasters is more pronounced among senior examiners and men compared to their less experienced counterparts and female examiners.

To measure examiners' experience, we use two proxy variables: High Compensation, a dummy variable equal to one if the examiner's General Schedule (GS) pay level in the previous year is no lower than the median, and zero otherwise.[11] Long Tenure is a dummy variable that equals one if the examiner's number of work years in the previous year is no less than the median, and zero otherwise.[12] Female is a dummy variable equal to one if the examiner is female and zero otherwise.[13] Table 6 supports our hypothesis regarding examiners' positions. The coefficients of interaction terms are significantly positive in the first two columns (0.0094 for Disaster × High Compensation and 0.0098 for Disaster × Long Tenure), and significantly negative in the last column (-0.0079 for Disaster × Female). The results imply that senior examiners or male examiners appear more responsive to climatic disasters, which influences their approach to examining and granting patents.

[Insert Table 6 about here]

4.4 The effect of examiners' attention to climate change

The extent of examiners' reaction to climatic disasters depends on the level of their concern towards such events. Prior studies have shown that the Google Search Volume Index (SVI) can proxy for people's attention (Da, Engelberg, and Gao, 2011). The index measures search volumes and ranges from 0 to 100, with a higher score indicating higher search intensity and, consequently, higher public attention. To proxy for the level of examiners' attention towards climate change, we use both year-level and state-year-level

[11] The General Schedule (GS) is the primary pay scale used for United States federal employees. The grade level assigned to a position determines the corresponding pay level for that job.

[12] We identify the examiner's first year of work using the complete patent database provided by the USPTO, rather than limiting it to our sample. The first year an examiner appears in the patent database is regarded as their starting year as a patent examiner.

[13] We identify the examiner's gender using the name-to-gender correspondence provided by SSA.gov, an official United States government website. https://www.ssa.gov/oact/babynames/limits.html Those that cannot be matched are considered missing.

SVI from Google Trends for the "climate change" term.[14] High Attention is a dummy variable that equals one if the SVI in the previous year is higher than the median and zero otherwise. High State Attention is a dummy variable that equals one if the state's SVI in the previous year is higher than the median of all the states this year and zero otherwise. Local public attention to climate change may also influence examiners' concerns. For example, areas governed by the Democratic Party or states that have joined the U.S. Climate Alliance are likely to exhibit higher attention to climate issues, as the Democratic Party prioritizes climate change and environmental policies. To proxy for the local level of examiners' attention towards climate change, we use Dem County, a dummy variable equal to one if the examiner's county in the previous year is governed by the Democratic Party, and Climate Alliance, a dummy variable equal to one if the examiner's state has joined the U.S. Climate Alliance in the previous year. We expect the impact of climatic disasters on green patent granting to be stronger among examiners with heightened attention to climate change.

Table 7 supports our hypothesis about the examiners' attention to climate change. The significant and positive coefficients of the interaction terms suggest that examiners who demonstrate a higher level of attention and concern about climate change are more responsive to climatic disasters. This finding implies that these examiners who are more attentive to potential consequences of climate change are particularly sensitive to the impact of climatic disasters.

[Insert Table 7 about here]

[14] Google search volume can be obtained from Google Trends. (https://trends.google.com/trends/?geo=US). We also consider the search volume of "climate natural disaster" and "natural disaster" and the results are similar.

4.5 The effect of disaster severity

When examiners face more severe degrees of climatic disasters, the impact on their behavior can become more pronounced, because more severe disasters tend to bring direct shocks and heightened awareness of the urgent need to address environmental challenges to patent examiners. Examiners who experience the severe effects of climatic disasters may undergo a significant shift in their beliefs. As a result, examiners may be more inclined to grant green patents that demonstrate substantial contributions to mitigating or adapting to these challenges. To investigate this conjecture, we examine four aspects, the damage caused by the disasters (Huge Damage), the duration of their occurrence (Long Duration), the fatality caused by the disasters (Fatality), and the continuous occurrence (Consecutive Year).

Table 8 confirms our intuition, as the interaction terms show positive and statistically significant coefficients. This indicates that the impact of climatic disasters on examiners is significantly stronger in the face of highly severe disasters. Experiencing severe disasters likely deepens examiners' understanding of the importance of green technologies, fostering a heightened awareness and urgency that translates into a greater likelihood of supporting green patents offering sustainable solutions.

[Insert Table 8 about here]

4.6 The role of disaster types

In this section, we categorize climatic disasters into specific types. We hypothesize that hurricanes, with their widespread destruction, often leave a profound and lasting impact on affected communities, while wildfires not only devastate vast areas of land but also pose significant health risks through smoke and air pollution. The results in Table 8 support this hypothesis, showing that hurricanes and wildfires have the strongest impact on examiners compared to other types of climatic disasters.

[Insert Table 9 about here]

5. Real Effect on Firm Greenhouse Gas Emissions

Our previous research shows that after experiencing climatic disasters, examiners not only adjust their beliefs and approve a higher proportion of green patents but also approve green patents of higher quality. In this section, we are particularly interested in whether these high-quality green patents, selected by disaster-affected examiners, significantly contribute to mitigating climate change. Specifically, we aim to examine whether the companies holding these patents experience a corresponding reduction in greenhouse gas emissions.

The patent data from our main sample are matched to U.S. publicly listed firms using the mappings developed by Kogan, Papanikolaou, Seru, and Stoffman (2017). We require our sample firms to have at least one green patent at least one green patent in the measurement year used to calculate the examiner preference measure. Greenhouse gas emission data is obtained from the Trucost database, which measures environmental impact across key dimensions for over 16,800 companies. For the firm-level regression analysis, the dependent variable is Log(GHG Emission), which represents the logarithm of the total greenhouse gas (GHG) emission intensity, including Scope 1, Scope 2, and Scope 3 emissions, as provided by the Trucost database. This measure captures the firms' greenhouse gas emissions over the three years following the granting of green patents. The key independent variable in this analysis is the Selected Green Ratio, defined as the percentage of green patents granted by examiners who experienced a climatic disaster in the previous year for each firm. We control for firm characteristics, including Book-to-market, Log(Assets), Leverage, Cash Holding, Div/Inc, RD Intensity, and Return. Summary statistics for firm-level variables are shown in Table C5. Our sample includes 491 public firms and 1,974 firm-years from 2012 to 2020. A negative coefficient would

indicate that firms receiving a higher proportion of green patents from these examiners see a reduction in GHG emissions over time.

The results in Table 10 confirm our hypothesis. The negative and statistically significant coefficients for the Selected Green Ratio provide strong evidence that high-quality green patents granted by disaster-affected examiners help reduce the innovating firms' greenhouse gas emissions. Unlike prior studies, which argue that green patents do not necessarily lower firms' carbon emissions (Bolton, Kacperczyk, and Wiedemann, 2023; Hege, Pouget, and Zhang, 2024), our findings focus on firms owning selected high-quality green patents, rather than green patents in general. This highlights that green patents granted by disaster-affected examiners are not only of higher quality but also more effective in addressing climate change, supporting our argument that examiners who experience climatic disasters are more likely to identify and approve impactful green patents that contribute to mitigating climate change.

[Insert Table 10 about here]

6. Extreme temperature and Green Patent Review

In this section, we conduct a parallel section to examine whether other climate-related phenomena, such as extreme heat, have a similar impact on examiners' beliefs. Extreme heat, a growing consequence of climate change, is known to affect human behavior, decision-making, and productivity. By analyzing whether extreme heat influences examiners' decisions—such as increasing the approval rate or quality of green patents—we aim to broaden our understanding of how various climatic factors shape examiner behavior.

Following Addoum, Ng, and Ortiz-Bobea (2020, 2023), we use daily temperature data from the PRISM Climate Group, the official climatological database of the U.S. Department of Agriculture. The PRISM dataset provides daily mean, minimum, and maximum temperatures for grid cells across the continental United States. We construct

three variables. Extreme Heat is a dummy variable that equals 1 if the total number of days in a year when the maximum temperature in the examiner's county exceeds the 90^{th} percentile across all counties is greater than the median of all counties for that year, and zero otherwise. Extreme Temperature is a dummy variable that equals 1 if the total number of days when the maximum temperature in the examiner's county exceeds the 90^{th} percentile plus the total number of days when the minimum temperature falls below the 10^{th} percentile across all counties is greater than the median of all counties for that year, and zero otherwise. Extreme Cold is a dummy variable that equals 1 if the total number of days in a year when the minimum temperature in the examiner's county is below the 10^{th} percentile across all counties is greater than the median of all counties for that year, and zero otherwise.

The results in Table 11 indicate that exposure to extreme heat increases the likelihood of examiners granting more green patents, but this relationship does not hold for extreme cold. We further investigate whether exposure to extreme heat affects the quality of granted green patents. As shown in Table 12, the coefficient in column (1) is positive and significant, suggesting that examiners exposed to extreme weather grant higher-quality green patents. Meanwhile, this effect does not extend to non-green patents. These findings further validate our results and provide a deeper understanding of how climate change shapes decision-making.

[Insert Table 11 and Table 12 about here]

7. Robustness Tests

In this section, we address two alternative explanations and conduct several robustness tests to reinforce our main findings.

7.1 Rule out the possibility of an increase in green patent applications

The baseline result shows that examiners who have experienced climatic disasters tend to grant more green patents than their peers. An increased share of green patents granted

could be driven by either the examiner changing her belief or simply receiving the applications for green patents. To rule out the possibility of the latter explanation, we further decompose the outcome of green patent grants into two components, i.e., the approval rate of green patent applications and the number of green patent applications. Green Approve Rate is defined as the total number of green patents issued by the examiner divided by the total number of green applications reviewed by that examiner in a given year. Non-Green Approve Rate and All Approve Rate are defined similarly. Green Application Ratio is defined as the percentage of green patent applications among all patent applications reviewed by each examiner annually.[15] If our conjecture that climatic disasters change examiners' preferences for green patents is correct, our results should be driven by an increased approval rate rather than the growing number of green patent applications. Furthermore, this positive relationship does not hold for non-green patents.

The coefficient on the Green Approval Rate in Table 13 is positive and significant, while the coefficient on the Green Application Ratio is insignificant. This supports the conclusion that patent examiners are more likely to grant green patents after experiencing climatic disasters, which reshape their beliefs about climate change. We also find insignificant changes in approval rates of non-green and all patents in columns (2) and (3), indicating that climatic disasters only change examiners' preference for green patent applications. All these results imply that the observed increase in green patents is not driven by a surge in the overall number of green patent applications but rather by examiners' selective granting preference specifically towards green patents.

[Insert Table 13 about here]

[15] As introduced by Shu, Tian, and Zhan (2021), it takes an average of 0.7 years for a patent application to be assigned to an examiner, and several additional months for the examiner to issue the first office action. Therefore, we define the effective application year based on the year of the examiner's first action, rather than the application filing year. Additionally, we do not use the year an application is rejected as the application year, as many undecided applications are still under review by examiners.

7.2 Rule out the possibility of location advantage

The proximity of patent applicants to examiners' locations may provide an advantage in obtaining valuable information related to patent applications, potentially increasing their chances of success. This advantage may introduce a selection bias in the patent examination process. Jia and Tian (2018) highlight significant information asymmetry between patent firms and examiners, noting that firms near examiners may gain an edge by accessing valuable information or hiring former examiners to navigate the patenting process more effectively. To address this potential issue, we remove patents where the patent company is located in the same state as the examiners from the main sample.[16]

The results in Table 14 align with our baseline findings, even after implementing this geographic restriction. We observe that examiners prefer to grant more green patents after experiencing climatic disasters, further supporting that examiners' exposure to climatic disasters significantly influences green patent review progress. Overall, these supplementary analyses help us rule out alternative explanations, further reinforcing the conclusion that climatic disasters can reshape examiners' beliefs about climate change, leading them to selectively favor the granting of green patent applications.

[Insert Table 14 about here]

7.3 Matched sample

In this subsection, we match pair examiners with similar characteristics. Specifically, we use two matching methods to match examiners within the same art units each year. For the "1:m" matching method, each affected examiner is paired with any number of unaffected examiners from the same art unit, thereby allowing multiple matches for each

[16] We also do another test that excluding patents owned by companies located in counties that are within a 50-mile distance from the examiner's county. The results are consistent. County distances are great-circle distances calculated using the Haversine formula based on internal points in the geographic area. https://www.nber.org/research/data/county-distance-database

affected examiner. The "1:1" method refines this approach by selecting the most similar examiner from the "1:m" pool, with the selection criteria based on choosing an examiner with the closest GS pay level. Additionally, we match examiners within the same art units while considering a pay level gap of no more than one each year. The "1:m" method refers to each affected examiner being paired with any number of unaffected examiners from the same art unit and a GS level gap of no more than one. The "1:1" method further narrows down the matches by selecting the most similar examiner from the "1:m" pool, with the selection criteria based on choosing an examiner with an equal GS level.

The coefficients in all columns of Table 15 are statistically significant and positive, showing the positive relation between climatic disasters and examiners' preferences toward green patents. Using the matching method can help us mitigate potential biases and ensure that our comparisons are made between examiners with comparable attributes, providing more robust evidence of the impact of climatic disasters on the granting of green patents.

[Insert Table 15 about here]

7.4 Alternative definition of green patent: OECD 2015 definition

In this section, we follow Cohen, Gurun, and Nguyen (2024) to identify green patents using the International Patent Classification (IPC) system, as defined in the 2015 version of the Organization for Economic Co-operation and Development's (OECD) classification (hereafter OECD 2015). Hascic and Migotto (2015) provide a detailed description of OECD's algorithm that identifies patents incorporating environmental technologies related to pollution, water scarcity, and climate change mitigation. Given the partial overlap between the OECD 2015 and the OECD 2023 (CPC Y02) classifications, we first classify green patents based on the OECD 2015 framework. (OECD 15) We then divide these patents into two groups. One includes green patents that fall within the intersection of the OECD 2015 and OECD 2023 classifications. (OECD 15&23) The other includes green patents classified under the OECD 2015 framework but not labeled under OECD

2023. (OECD 15|23) Finally, we identify green patents using the union of the OECD 2015 and OECD 2023 classifications. (OECD 15 or 23)

The effect is most pronounced in Table 16, column (4), where all Y02 tags are included as green patents, while the coefficient in column (3) is insignificant. The results indicate that the increase in green patents is primarily driven by those classified as climate-related rather than other green patents under the OECD 2015 classifications. These results provide further support for the hypothesis that climatic disasters can shape examiners' beliefs regarding climate change, thereby increasing the share of climate-related green patents.

[Insert Table 16 about here]

7.5 Specific categories of green patent

To further analyze the impact of climate disasters on the granting of green patents, we categorize green patents into two segments: technologies for climate change adaptation and technologies for climate change mitigation. Climate change adaptation encompasses technologies that help adapt to the adverse effects of climate change, such as controlling or monitoring floods or hurricanes. On the other hand, climate change mitigation includes technologies for climate change mitigation in many areas, such as the capture and disposal of greenhouse gases and the use of non-fossil fuels in aviation.

We run regressions on these two subsamples, with the results shown in Table 17. The positive and significant coefficients in both columns suggest that green patents related to climate change adaptation and mitigation increase after examiners experience climate disasters. However, the effect is stronger for mitigation patents than adaptation patents. This indicates a greater boost in granting technologies aimed at mitigating climate change. The trend suggests that examiners may prioritize mitigation technologies, which address the root causes of climate change and offer long-term solutions, over adaptation

technologies, which are often seen as reactive measures managing the consequences rather than preventing the problem.

[Insert Table 17 about here]

7.6 Placebo test

In the previous section, we focused on natural disasters strongly linked to climate change, such as hurricanes and wildfires, as examples of climatic disasters. These disasters are chosen due to their strong link to climate change. In this section, we conduct a placebo test by analyzing natural disasters unrelated or weakly related to climate change. The goal is to determine whether such events similarly influence examiners' behavior. We combined insights from an extensive literature review with ChatGPT analysis to differentiate between climate-related and non-climate-related disasters. Details are introduced in Appendix B. This careful categorization ensures the robustness of our analysis.

The placebo test results show that natural disasters unrelated to climate change do not affect examiners' behavior in the same way as climate-related disasters. This highlights the unique impact of climate change-related events on examiner decision-making, further reinforcing the link between climate change and belief change among patent examiners.

[Insert Table 18 about here]

8. Conclusion

This paper explores how patent examiners react to climate change, as manifested in the examination of green patents. Using a large sample of U.S. patent examiners from 2012 to 2020, we use climatic natural disasters as shocks and find that examiners who have experienced climatic disasters tend to grant more green patents in the subsequent year.

Furthermore, examiners who experienced climatic disasters in the previous year tend to grant higher-quality green patents compared to those who have not been affected by such events, as they exert additional effort in reviewing green patents.

Beyond the quantity and quality of green patents granted, our findings reveal that these belief changes are reflected in the fact that examiners affected by climatic disasters are more likely to increase donations to the Democratic Party, further evidencing a shift in their climate-related preferences. Our cross-sectional analysis highlights significant heterogeneity in these effects. The impact of climatic disasters on examiners' preferences is stronger among senior and male examiners, those with heightened climate change awareness, and individuals exposed to more severe disasters.

Finally, we establish the broader implications of these findings at the firm level. High-quality green patents granted by disaster-affected examiners contribute meaningfully to reducing firms' greenhouse gas emissions, underlining the real-world environmental benefits of these decisions. Additionally, we find that extreme heat similarly influences examiners, increasing both the quantity and quality of green patents granted.

Overall, our study underscores the role of personal experiences with climate events in shaping personal beliefs and decision-making, advancing green innovation, and improving environmental performance. These findings highlight a novel pathway through which climate change fosters meaningful progress toward sustainable innovation. Further exploration of these effects in future research will contribute to a deeper understanding of the examination mechanisms employed by patent examiners and the development of green innovations.

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Figure 1. Examiner Distribution in U.S. Counties

This figure presents an overview of patent examiner distribution in 2020. No. of examiners represents the number of examiners in each county.

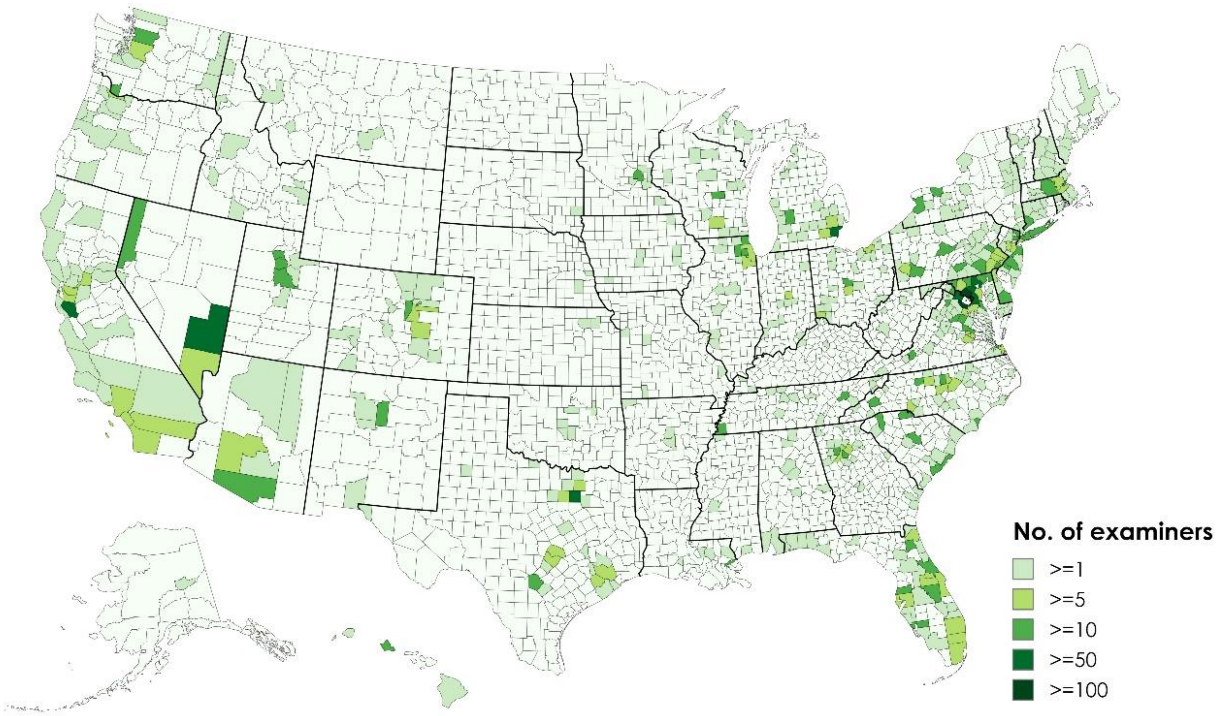


Figure 2. Parallel Trend

This figure shows the dynamic effects of climatic disasters on examiner decisions. Year 0 is the year in which the disasters occurred. Examiner and year fixed effects are included, and standard errors are double-clustered at the county and year levels. The sample period is from 2012 to 2020. Capped spikes indicate statistical significance at the 10% level.

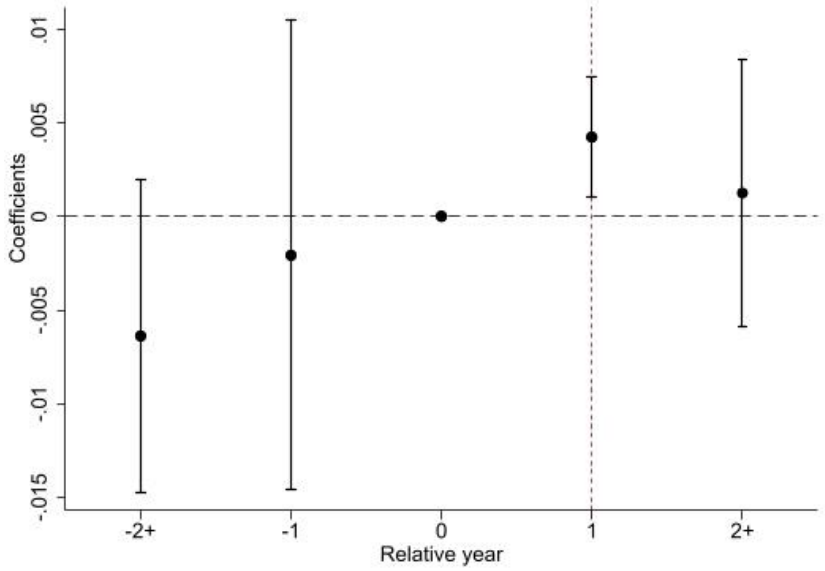


Table 1. Summary Statistics

This table shows summary statistics in our sample. Panel A reports summary statistics for climatic natural disasters in the U.S. that affected patent examiners in our sample. We obtain data from the SHELDUS Database. Reported damages are in $ 10 million adjusted to 2020 dollars. Panel B reports the summary statistics of examiner-year level variables from 2012 to 2020. Disaster is a dummy variable that equals one if the examiner experiences climatic disasters in the previous year and zero otherwise. Green Patent Ratio is defined as the percentage of green patents granted out of all granted patents for each examiner in a given year. Green Patent Quality is defined as the logarithm of one plus the average number of citations received by green patents for each examiner in a given year, adjusted for truncation following Hall, Jaffe, and Trajtenberg (2001). Non-green Patent Quality is defined as the logarithm of one plus the average number of citations received by non-green patents for each examiner in a given year, adjusted for truncation following Hall, Jaffe, and Trajtenberg (2001). All Patent Quality is defined as the logarithm of one plus the average number of citations received by all patents for each examiner in a given year, adjusted for truncation following Hall, Jaffe, and Trajtenberg (2001). Raw Dem Donation is the total annual amount of donations contributed to the Democratic Party by each examiner. Log(Dem Donation) is the logarithm of one plus the total annual amount of donations to the Democratic Party for each examiner. Green Claim is defined as the average number of claims from green patents reviewed by each examiner in a given year. Non-green Claim is defined as the average number of claims from non-green patents reviewed by each examiner in a given year. All Claim is defined as the average number of claims from all patents reviewed by each examiner in a given year. Green Reference is the average number of references to green patents cited by each examiner each year. Non-green Reference is the average number of references to non-green patents cited by each examiner each year. All Reference is the average number of references to green patents cited by each examiner each year. Green Rejection is the proportion of green rejections based on 102 or 103 reasons that include at least one prior art citation, relative to the total number of such rejections by each examiner each year. Non-green Rejection is the proportion of non-green rejections based on 102 or 103 reasons that include at least one prior art citation, relative to the total number of such rejections by each examiner each year. All Rejection is the proportion of all rejections based on 102 or 103 reasons that include at least one prior art citation, relative to the total number of such rejections by each examiner each year. Extreme Heat is a dummy variable that equals 1 if the total number of days in a year when the maximum temperature in the examiner's county exceeds the 90^{th} percentile across all counties is greater than the median of all counties for that year, and zero otherwise. Extreme Temperature is a dummy variable that equals 1 if the total number of days when the maximum temperature in the examiner's county exceeds the 90^{th} percentile plus the total number of days when the minimum temperature falls below the 10^{th} percentile across all counties is greater than the median of all counties for that year, and zero otherwise. Extreme Cold is a dummy variable that equals 1 if the total number of days in a year when the minimum temperature in the examiner's county is below the 10^{th} percentile across all counties is greater than the median of all counties for that year, and zero otherwise. All continuous variables that are not constrained between 0 and 1 are winsorized at 1% and 99% level. Detailed variable definitions are provided in Appendix A.

Panel A: Summary statistics for climatic natural disasters

Disasters	Average Damage ($ 10M)	Average Duration (Days)	Average Injuries & Fatalities	No. of Disasters
Flooding	245.08	2.96	6.87	23
Hurricane/Tropical Storm	264.97	2.87	4.20	15
Tornado	39.02	1.00	109.80	10
Wildfire	160.33	14.33	10.03	6
Wind	105.61	1.50	1.50	2
Hail	130.38	1.00	1.00	1

Panel B: Summary statistics for patent examiners

Variable	Obs	Mean	STD	P1	P25	Med	P75	P99
Examiner-year								
No. of Patents	58,161	43.02	26.17	1.00	23.00	40.00	59.00	114.00
No. of Green Patents	58,161	3.79	7.99	0.00	0.00	1.00	4.00	41.00
Disaster	58,161	0.01	0.08	0.00	0.00	0.00	0.00	0.00
Green Patent Ratio	58,161	0.08	0.16	0.00	0.00	0.03	0.09	0.96
Green Patent Quality	35,450	0.30	0.32	0.00	0.00	0.22	0.48	1.42
Non-green Patent Quality	57,735	0.32	0.21	0.00	0.15	0.32	0.47	0.89
All Patent Quality	58,161	0.33	0.21	0.00	0.16	0.33	0.48	0.88
Raw Dem Donation	514	311.28	598.53	0.00	38.50	120.50	300.00	3000.00
Log(Dem Donation)	458	4.98	1.37	1.61	4.13	5.02	5.77	8.02
Green Claims	22,345	16.16	6.66	3.00	12.00	16.00	20.00	42.00
Non-green Claims	54,701	16.40	4.11	6.00	13.86	16.29	18.73	30.43
All Claims	55,459	16.39	4.03	6.00	13.88	16.25	18.67	30.08
Green Reference	22,345	2.86	4.02	0.00	0.33	1.50	3.67	23.00
Non-green Reference	54,701	3.28	3.86	0.00	0.82	2.00	4.22	21.25
All Reference	55,459	3.25	3.82	0.00	0.80	2.00	4.16	21.20
Green Rejection	44,117	0.88	0.24	0.00	0.86	1.00	1.00	1.00
Non-green Rejection	62,630	0.87	0.16	0.23	0.82	0.92	0.98	1.00
All Rejection	62,955	0.87	0.16	0.25	0.83	0.92	0.97	1.00
Extreme Heat	58,141	0.63	0.48	0.00	0.00	1.00	1.00	1.00
Extreme Temperature	58,141	0.12	0.32	0.00	0.00	0.00	0.00	1.00
Extreme Cold	58,141	0.13	0.34	0.00	0.00	0.00	0.00	1.00

Table 2. The Effect of Climate Change on Green Patent Review

This table presents examiner-level regressions of examiners' preferences for green patents on climatic disaster exposures. Green Patent Ratio is defined as the percentage of green patents granted out of all granted patents for each examiner in a given year. Disaster is a dummy variable that equals one if the examiner experiences climatic disasters in the previous year and zero otherwise. The baseline model includes examiner and year fixed effects. Standard errors are double-clustered at the county and year levels, and reported in parentheses. The sample period is from 2012 to 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent Variable: Green Patent Ratio			
	(1)	(2)	(3)	(4)
Disaster	0.0079^{***}	0.0079^{***}	0.0121^{***}	0.0077^{***}
	(0.0020)	(0.0024)	(0.0035)	(0.0025)
Examiner FE	Yes	Yes	No	Yes
County FE	No	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Cluster	County, Year	County	County, Year	County, Year
# Obs.	58,161	58,161	58,161	58,161
Adj. R^2	0.852	0.852	0.043	0.852

Table 3. The Effect of Climate Change on Green Patent Quality

This table presents examiner-level regressions of green patent quality on climatic disaster exposures. Green Patent Quality is defined as the logarithm of one plus the average number of citations received by green patents for each examiner in a given year, adjusted for truncation following Hall, Jaffe, and Trajtenberg (2001). Non-green Patent Quality is defined as the logarithm of one plus the average number of citations received by non-green patents for each examiner in a given year, adjusted for truncation following Hall, Jaffe, and Trajtenberg (2001). All Patent Quality is defined as the logarithm of one plus the average number of citations received by all patents for each examiner in a given year, adjusted for truncation following Hall, Jaffe, and Trajtenberg (2001). Disaster is a dummy variable that equals one if the examiner experiences climatic disasters in the previous year and zero otherwise. Examiner and year fixed effects are included. Standard errors are double-clustered at the county and year levels, and are reported in parentheses. The sample period is from 2012 to 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Green Patent Quality	Non-green Patent Quality	All Patent Quality
	(1)	(2)	(3)
Disaster	0.0222**	-0.0034	-0.0013
	(0.0111)	(0.0061)	(0.0060)
Examiner FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
# Obs.	35,450	57,735	58,161
Adj. R^2	0.322	0.661	0.677

Table 4. The Effect of Climate Change on Examiners' Beliefs

This table presents examiner-level regressions of examiners' belief change on climatic disaster exposures. Raw Dem Donation is the total annual amount of donations contributed to the Democratic Party by each examiner. Log(Dem Donation) is the logarithm of the total annual amount of donations to the Democratic Party for each examiner. Disaster is a dummy variable that equals one if the examiner experiences climatic disasters in the previous year and zero otherwise. Examiner and year fixed effects are included. Standard errors are double-clustered at the county and year levels, and are reported in parentheses. The sample period is from 2012 to 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Raw Dem Donation	Log(Dem Donation)
	(1)	(2)
Disaster	204.8644***	0.4456***
	(52.1659)	(0.1156)
Control	Yes	Yes
Examiner FE	Yes	Yes
Year FE	Yes	Yes
# Obs.	514	458
Adj. R^2	0.238	0.495

Table 5. The Effect of Climate Change on Examiners' Effort

This table presents examiner-level regressions of examiners' efforts for green patents on climatic disaster exposures. Disaster is a dummy variable that equals one if the examiner experiences climatic disasters in the previous year and zero otherwise. Green Claim is defined as the average number of claims from green patents reviewed by each examiner in a given year. Non-green Claim is defined as the average number of claims from non-green patents reviewed by each examiner in a given year. All Claim is defined as the average number of claims from all patents reviewed by each examiner in a given year. Green Reference is the average number of references to green patents cited by each examiner each year. Non-green Reference is the average number of references to non-green patents cited by each examiner each year. All Reference is the average number of references to green patents cited by each examiner each year. In Panels A and B, we focus on the sample that includes patents granted in year *t* following disasters that occurred in year *t-1*, with no actions taken in year *t-1*, which allows us to more accurately assess the efforts of the examiners. In panel C, we focus on the sample with all the rejection applications. Green Rejection represents the proportion of green rejections based on 102 or 103 reasons that include at least one prior art citation, relative to the total number of such rejections by each examiner each year. Non-green Rejection represents the proportion of non-green rejections based on 102 or 103 reasons that include at least one prior art citation, relative to the total number of such rejections by each examiner each year. All Rejection represents the proportion of all rejections based on 102 or 103 reasons that include at least one prior art citation, relative to the total number of such rejections by each examiner each year. Disaster is a dummy variable that equals one if the examiner experiences climatic disasters in the previous year and zero otherwise. Examiner and year fixed effects are included. Standard errors are double-clustered at the county and year levels, and are reported in parentheses. The sample period is from 2012 to 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Claims reviewed by examiners			
	Green Claim	Non-green Claim	All Claim
	(1)	(2)	(3)
Disaster	1.1476***	0.0292	0.2098
	(0.3576)	(0.1628)	(0.1809)
Examiner FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
# Obs.	22,345	54,701	55,459
Adj. R^2	0.176	0.320	0.330
Panel B: Reference cited by examiners for patents			
	Green Reference	Non-green Reference	All Reference
	(1)	(2)	(3)
Disaster	0.3124**	-0.0990	-0.0294
	(0.1414)	(0.0762)	(0.0400)
Examiner FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
# Obs.	22,345	54,701	55,459
Adj. R^2	0.584	0.744	0.749
Panel C: Reference cited by examiners for rejected applications			
	Green Rejection	Non-green Rejection	All Rejection
	(1)	(2)	(3)
Disaster	0.0296**	0.0033	0.0036
	(0.0142)	(0.0068)	(0.0065)
Examiner FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
# Obs.	44,117	62,630	62,955
Adj. R^2	0.329	0.649	0.659

Table 6. The Role of Examiners' Characteristics

This table presents the results from the regression analysis on the role of examiners' characteristics on green patent review. Green Patent Ratio is defined as the percentage of green patents granted in all granted patents for each examiner in a given year. Disaster is a dummy variable that equals one if the examiner experiences climatic disasters in the previous year and zero otherwise. High Compensation is a dummy variable that equals one if the examiners' pay level in the previous year is no lower than the median pay level, and zero otherwise. Disaster × High Compensation is an interaction term between Disaster and High Compensation. Long Tenure is a dummy variable that equals one if the number of years of the examiner year in the previous year is no less than the median work, and zero otherwise. Disaster × Long Tenure is an interaction term between Disaster and Long Tenure. Female is a dummy variable that equals one if the examiner is female, and zero otherwise. Disaster × Female is an interaction term between Disaster and Female. Examiner and year fixed effects are included. Standard errors are double-clustered at the county and year levels, and are reported in parentheses. The sample period is from 2012 to 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent Variable: Green Patent Ratio		
	(1)	(2)	(3)
Disaster	0.0023	0.0033	0.0096***
	(0.0022)	(0.0028)	(0.0033)
High Compensation	0.0012		
	(0.0014)		
Disaster × High Compensation	0.0092***		
	(0.0027)		
Long Tenure		0.0017***	
		(0.0005)	
Disaster × Long Tenure		0.0098***	
		(0.0035)	
Disaster × Female			-0.0079*
			(0.0044)
Examiner FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
# Obs.	58,161	58,161	48,879
Adj. R^2	0.852	0.852	0.855

Table 7. The Role of Examiners' Attention to Climate Change

This table presents the results from the regression analysis on the role of examiners' attention on green patent review. Green Patent Ratio is defined as the percentage of green patents granted in all granted patents for each examiner in a given year. Disaster is a dummy variable that equals one if the examiner experiences climatic disasters in the previous year and zero otherwise. High Attention is a dummy variable that equals one if the total Google search volume in the previous year is higher than the median and zero otherwise. Disaster × High Attention is an interaction term between Disaster and High Attention. High State Attention is a dummy variable that equals one if the state's Google search volume in the previous year is higher than the median of all states for that year and zero otherwise. Disaster × High State Attention is an interaction term between Disaster and High State Attention. Dem County is a dummy variable that equals one if the county where the examiner is located is governed by the Democratic Party in the previous year, and zero otherwise. Disaster × Dem County is an interaction term between Disaster and Dem County. Climate Alliance is a dummy variable that equals one if the state where the examiner is located has joined the United States Climate Alliance in the previous year, and zero otherwise. Disaster × Climate Alliance is an interaction term between Disaster and Climate Alliance. Examiner and year fixed effects are included. Standard errors are double-clustered at the county and year levels, and are reported in parentheses. The sample period is from 2012 to 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent Variable: Green Patent Ratio			
	(1)	(2)	(3)	(4)
Disaster	0.0015	0.0071***	0.0048**	0.0067***
	(0.0013)	(0.0017)	(0.0022)	(0.0017)
Disaster × High Attention	0.0086***			
	(0.0017)			
High State Attention		-0.0004		
		(0.0009)		
Disaster × High State Attention		0.0048**		
		(0.0021)		
Dem County			0.0001	
			(0.0001)	
Disaster × Dem County			0.0021**	
			(0.0009)	
Climate Alliance				-0.0013
				(0.0009)
Disaster × Climate Alliance				0.0101***
				(0.0028)
Examiner FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
# Obs.	58,161	58,161	58,161	58,161
Adj. R^2	0.852	0.852	0.852	0.852

Table 8. The Role of Disaster Severity

This table presents the results from the regression analysis on the role of disaster severity on green patent review. Green Patent Ratio is defined as the percentage of green patents granted in all granted patents for each examiner in a given year. Disaster is a dummy variable that equals one if the examiner experiences climatic disasters in the previous year and zero otherwise. Huge Damage is a dummy variable that equals one if the total damage of the corresponding disasters is higher than the median and zero otherwise. Disaster × Huge Damage is an interaction term between Disaster and Huge damage. Long Duration is a dummy variable that equals one if the total duration of the corresponding disasters is higher than the median and zero otherwise. Disaster × Long Duration is an interaction term between Disaster and Long Duration. Fatality is a dummy variable that equals one if the corresponding disasters have caused the fatality, and zero otherwise. Disaster × Fatality is an interaction term between Disaster and Fatality. Consecutive Year is a dummy variable that equals one if the examiners experience climatic disasters in the previous two consecutive years and zero otherwise. Disaster × Consecutive Year is an interaction term between Disaster and Consecutive Year. Examiner and year fixed effects are included. Standard errors are double-clustered at the county and year levels, and are reported in parentheses. The sample period is from 2012 to 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent Variable: Green Patent Ratio			
	(1)	(2)	(3)	(4)
Disaster	0.0051***	0.0058***	-0.0015	0.0069***
	(0.0008)	(0.0022)	(0.0044)	(0.0015)
Disaster × Huge Damage	0.0074*			
	(0.0039)			
Disaster × Long Duration		0.0090**		
		(0.0057)		
Disaster × Fatality			0.0115**	
			(0.0052)	
Disaster × Consecutive Year				0.0108**
				(0.0051)
Examiner FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
# Obs.	58,161	58,161	58,161	54,815
Adj. R^2	0.852	0.852	0.852	0.857

Table 9. The Role of Disaster Types

This table presents the results from the regression analysis on the role of disaster types on green patent review. Green Patent Ratio is defined as the percentage of green patents granted in all granted patents for each examiner in a given year. Disaster is a dummy variable that equals one if the examiner experiences climatic disasters in the previous year and zero otherwise. Hurricane is a dummy variable that equals one if the climate disaster is hurricane, and zero otherwise. Wildfire is a dummy variable that equals one if the climate disaster is wildfire, and zero otherwise. Other Type is a dummy variable that equals one if the disasters are not among the climate disasters specifically listed in the column. Examiner and year fixed effects are included. Standard errors are double-clustered at the county and year levels, and are reported in parentheses. The sample period is from 2012 to 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent Variable: Green Patent Ratio		
	(1)	(2)	(3)
Hurricane	0.0118***		0.0116***
	(0.0032)		(0.0031)
Wildfire		0.0145***	0.0144***
		(0.0052)	(0.0054)
Other Type	0.0052***	0.0070***	0.0029***
	(0.0012)	(0.0018)	(0.0008)
Examiner FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
# Obs.	58,161	58,161	58,161
Adj. R^2	0.852	0.852	0.852

Table 10. The Effect of the Salience on Firm Greenhouse Gas Emission

This table presents firm-level regressions of greenhouse gas emissions on selected green patents by event examiners. Log(GHG Emission) is the logarithm of the sum of Scope 1 greenhouse gas intensity, Scope 2 greenhouse gas intensity, and Scope 3 greenhouse gas intensity provided by the Trucost database in the following three years. Selected Green Ratio is the percentage of green patents granted by examiners who experienced the disaster in the previous year for each firm. Firm Disaster is a dummy variable that equals one if the county where the firm's headquarters is located experienced a climatic disaster in the previous year, and zero otherwise. We control firm-level variables, including Book-to-market, Log(Assets), Leverage, Cash Holding, Div/Inc, RD Intensity, and Return. Detailed variable definitions are provided in Appendix A. Firm, county, and year fixed effects are included in columns (1) and (2), while industry, county, and year fixed effects are included in columns (3) and (4). Standard errors are double-clustered at the county and year levels, and are reported in parentheses. The sample period is from 2012 to 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent Variable: Log(GHG Emission)			
	(1)	(2)	(3)	(4)
Selected Green Ratio	-0.4433***	-0.4356***	-0.8656***	-0.8568***
	(0.1425)	(0.1483)	(0.1769)	(0.1781)
Firm Disaster		-0.0192		-0.0217
		(0.0197)		(0.0346)
Control	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	No	No
Industry FE	No	No	Yes	Yes
County FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
# Obs.	1,974	1,974	1,974	1,974
Adj. R^2	0.978	0.978	0.822	0.822

Table 11. The Effect of Extreme Temperature on Green Patent Review

This table presents examiner-level regressions of examiners' preferences for green patents on extreme temperature exposures. Green Patent Ratio is defined as the percentage of green patents granted out of all granted patents for each examiner in a given year. Extreme Hot is a dummy variable that equals 1 if the total number of days in a year when the maximum temperature in the examiner's county exceeds the 90th percentile across all counties is greater than the median of all counties for that year, and zero otherwise. Extreme Temperature is a dummy variable that equals 1 if the total number of days when the maximum temperature in the examiner's county exceeds the 90th percentile plus the total number of days when the minimum temperature falls below the 10th percentile across all counties is greater than the median of all counties for that year, and zero otherwise. Extreme Cold is a dummy variable that equals 1 if the total number of days in a year when the minimum temperature in the examiner's county is below the 10th percentile across all counties is greater than the median of all counties for that year, and zero otherwise. Examiner and year fixed effects are included. Standard errors are double-clustered at the county and year levels, and are reported in parentheses. The sample period is from 2012 to 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent Variable: Green Patent Ratio		
	(1)	(2)	(3)
Extreme Hot	0.0022***		
	(0.0006)		
Extreme Temperature		0.0029***	
		(0.0008)	
Extreme Cold			-0.0011
			(0.0010)
Examiner FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
# Obs.	58,141	58,141	58,141
Adj. R^2	0.852	0.852	0.852

Table 12. The Effect of Extreme Temperature on Green Patent Quality

This table presents examiner-level regressions of green patent quality on climatic disaster exposures. Green Patent Quality is defined as the logarithm of one plus the average number of citations received by green patents for each examiner in a given year, adjusted for truncation following Hall, Jaffe, and Trajtenberg (2001). Non-green Patent Quality is defined as the logarithm of one plus the average number of citations received by non-green patents for each examiner in a given year, adjusted for truncation following Hall, Jaffe, and Trajtenberg (2001). All Patent Quality is defined as the logarithm of one plus the average number of citations received by all patents for each examiner in a given year, adjusted for truncation following Hall, Jaffe, and Trajtenberg (2001). Extreme Heat is a dummy variable that equals 1 if the total number of days in a year when the maximum temperature in the examiner's county exceeds the 90th percentile across all counties is greater than the median of all counties for that year, and zero otherwise. Examiner and year fixed effects are included. Standard errors are double-clustered at the county and year levels, and are reported in parentheses. The sample period is from 2012 to 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Green Patent Quality	Non-green Patent Quality	All Patent Quality
	(1)	(2)	(3)
Extreme Heat	0.0138**	0.0026	0.0024
	(0.0066)	(0.0021)	(0.0020)
Examiner FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
# Obs.	35,436	57,715	58,141
Adj. R^2	0.322	0.660	0.677

Table 13. The Effect of Climate Change on Green Patent Review

(Rule Out the Possibility of An Increase in Green Applications)

This table presents examiner-level regressions of examiners' preferences for green patents on climatic disaster exposures. Green Approve Rate is defined as the total number of green patents issued by the examiner divided by the total number of green applications received by the examiner in a given year. Non-green Approve Rate is defined as the total number of non-green patents issued by the examiner divided by the total number of non-green applications received by the examiner in a given year. All Approve Rate is defined as the total number of all patents issued by the examiner divided by the total number of all applications reviewed by the examiner in a given year. Green Application Ratio is defined as the percentage of green patent applications in all patent applications received by each examiner in a given year. Disaster is a dummy variable that equals one if the examiner experiences climatic disasters in the previous year and zero otherwise. Examiner and year fixed effects are included. Standard errors are double-clustered at the county and year levels, and are reported in parentheses. The sample period is from 2012 to 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Green Approve Rate	Non-green Approve Rate	All Approve Rate	Green Application Ratio
	(1)	(2)	(3)	(4)
Disaster	0.1290**	-0.0079	0.0023	0.0043
	(0.0645)	(0.0129)	(0.0156)	(0.0042)
Examiner FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
# Obs.	39,754	57,700	57,769	57,769
Adj. R^2	0.070	0.270	0.287	0.889

Table 14. The Effect of Climate Change on Green Patent Review

(Rule Out the Possibility of Location Advantage)

This table presents examiner-level regressions of examiners' preferences for green patents on climatic disaster exposures. Green Patent Ratio is defined as the percentage of green patents granted out of all granted patents for each examiner in a given year. Disaster is a dummy variable that equals one if the examiner experiences climatic disasters in the previous year and zero otherwise. We exclude patents owned by companies located in the same state as the examiners. Examiner and year fixed effects are included. Standard errors are double-clustered at the county and year levels, and are reported in parentheses. The sample period is from 2012 to 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent Variable: Green Patent Ratio			
	(1)	(2)	(3)	(4)
Disaster	0.0081^{***}	0.0081^{***}	0.0120^{***}	0.0078^{***}
	(0.0017)	(0.0025)	(0.0033)	(0.0023)
Examiner FE	Yes	Yes	No	Yes
County FE	No	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Cluster	County, Year	County	County, Year	County, Year
# Obs.	58,142	58,142	58,142	58,142
Adj. R^2	0.851	0.851	0.043	0.852

Table 15. The Effect of Climate Change on Green Patent Review

(Matched Sample)

This table presents examiner-level regressions of examiners' preferences for green patents on climatic disaster exposures using matched samples. Green Patent Ratio is defined as the percentage of green patents granted in all granted patents for each examiner in a given year. Disaster is a dummy variable that equals one if the examiner experiences climatic disasters in the previous year and zero otherwise. Columns (1) and (2) use a sample with matched examiners of the same art units. Columns (3) and (4) use a sample with matched examiners of the same art units and a GS level gap of no more than 1. Examiner and year fixed effects are included. Standard errors are double-clustered at the county and year levels, and are reported in parentheses. The sample period is from 2012 to 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent Variable: Green Patent Ratio			
	Art unit matching		Art unit + Pay matching	
	1:m	1:1	1:m	1:1
	(1)	(2)	(3)	(4)
Disaster	0.0076^{***}	0.0077^{***}	0.0096^{***}	0.0100^{***}
	(0.0016)	(0.0015)	(0.0024)	(0.0023)
Examiner FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
# Obs.	9,402	3,128	6,241	2,358
Adj. R^2	0.827	0.865	0.785	0.766

Table 16. The Effect of Climate Change on Green Patent Review

(Alternative Green Patent Classification)

This table presents examiner-level regressions of examiners' preferences for green patents on climatic disaster exposures, based on another green patent classification. OECD 15 is the percentage of green patents identified by the OECD 2015 classification in all granted patents for each examiner each year. Green Patent Ratio is the percentage of granted green patents out of all granted patents for each examiner in a given year. OECD 15|23 is the percentage of green patents that fall within the OECD 2015 classification but do not include the OECD 2023 classification in all granted patents for each examiner each year. OECD 15|23 is the percentage of green patents that fall within the OECD 2015 classification but do not include the OECD 2023 classification in all granted patents for each examiner each year. OECD 15 or 23 is the percentage of green patents identified by the union of OECD 2015 and 2023 classifications in all granted patents for each examiner each year. Disaster is a dummy variable that equals one if the examiner experiences climatic disasters in the previous year and zero otherwise. Examiner and year fixed effects are included. Standard errors are double-clustered at the county and year levels, and are reported in parentheses. The sample period is from 2012 to 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	OECD 15	OECD 15&23	OECD 15|23	OECD 15 or 23
	(1)	(2)	(3)	(4)
Disaster	0.0038***	0.0044**	-0.0006	0.0074***
	(0.0011)	(0.0018)	(0.0010)	(0.0018)
Examiner FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
# Obs.	58,161	58,161	58,161	58,161
Adj. R^2	0.888	0.875	0.819	0.868

Table 17. The Effect of Climate Change on Green Patent Review (Specific Categories)

This table presents examiner-level regressions of examiners' preferences for green patents on climatic disaster exposures based on specific categories. Adaptation Ratio is the percentage of green patents related to technologies for adaptation to climate change in all granted patents for each examiner each year. Mitigation Ratio is the percentage of green patents related to technologies for climate change mitigation in all granted patents for each examiner each year. Disaster is a dummy variable that equals one if the examiner experiences climatic disasters in the previous year and zero otherwise. Examiner and year fixed effects are included. Standard errors are double-clustered at the county and year levels, and are reported in parentheses. The sample period is from 2012 to 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Adaptation Ratio	Mitigation Ratio
	(1)	(2)
Disaster	0.0014^{*}	0.0062^{***}
	(0.0008)	(0.0014)
Examiner FE	Yes	Yes
Year FE	Yes	Yes
# Obs.	58,161	58,161
Adj. R^2	0.547	0.864

Table 18. The Effect of Non-climatic Disasters on Green Patent Review

This table presents examiner-level regressions of examiners' preferences for green patents on non-climatic disaster exposures. Green Patent Ratio is defined as the percentage of green patents granted out of all granted patents for each examiner in a given year. Disaster Other is a dummy variable that equals one if the examiner experiences non-climatic disasters in the previous year and zero otherwise. Examiner and year fixed effects are included. Standard errors are double-clustered at the county and year levels, and are reported in parentheses. The sample period is from 2012 to 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent Variable: Green Patent Ratio			
	(1)	(2)	(3)	(4)
Disaster Other	0.0003	0.0003	-0.0023	0.0003
	(0.0017)	(0.0019)	(0.0049)	(0.0013)
Examiner FE	Yes	Yes	No	Yes
County FE	No	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Cluster	County, Year	County	County, Year	County, Year
# Obs.	58,161	58,161	58,161	58,161
Adj. R^2	0.852	0.852	0.043	0.852

Appendix A: Variable Definitions

Variables	Definitions
Disaster	Disaster is a dummy variable, which equals one if the examiner experiences climatic disasters in year *t-1* and zero otherwise.
Green Patent Ratio	Green Patent Ratio is the percentage of green patents granted in all granted patents for each examiner in a given year.
Green Patent Quality	Green Patent Quality is the logarithm of one plus the average number of citations received by green patents for each examiner in a given year, adjusted for truncation following Hall, Jaffe, and Trajtenberg (2001).
Non-green Patent Quality	Non-green Patent Quality is the logarithm of one plus the average number of citations received by non-green patents for each examiner in a given year, adjusted for truncation following Hall, Jaffe, and Trajtenberg (2001).
All Patent Quality	All Patent Quality is the logarithm of one plus the average number of citations received by all patents for each examiner in a given year, adjusted for truncation following Hall, Jaffe, and Trajtenberg (2001).
Raw Dem Donation	Raw Dem Donation is the total annual amount of donations contributed to the Democratic Party by each examiner.
Log(Dem Donation)	Log(Dem Donation) is the logarithm of the total annual amount of donations to the Democratic Party for each examiner.
Green Claim	Green Claim is the average number of claims from green patents reviewed by each examiner in a given year.
Non-green Claim	Non-green Claim is the average number of claims from non-green patents reviewed by each examiner in a given year.
All Claim	All Claim is the average number of claims from all patents reviewed by each examiner in a given year.
Green Reference	Green Reference is the average number of references to green patents cited by each examiner each year.
Non-green Reference	Non-green Reference is the average number of references to non-green patents cited by each examiner each year.
All Reference	All Reference is the average number of references to green patents cited by each examiner each year.
Green Rejection	Green Rejection is the proportion of green rejections based on 102 or 103 reasons that include at least one prior art citation, relative to the total number of such rejections by each examiner each year.
Non-green Rejection	Non-green Rejection is the proportion of non-green rejections based on 102 or 103 reasons that include at least one prior art citation, relative to the total number of such rejections by each examiner each year.
All Rejection	All Rejection is the proportion of all rejections based on 102 or 103 reasons that include at least one prior art citation, relative to the total number of such rejections by each examiner each year.

High Compensation	High Compensation is a dummy variable that equals one if the examiners' pay level is no lower than the median pay level, and zero otherwise.
Long Tenure	Long Tenure is a dummy variable that equals one if the number of years of the examiner is no less than the median work year, and zero otherwise.
Female	Female is a dummy variable that equals one if the examiner is female, and zero otherwise.
High Attention	High Attention is a dummy variable that equals one if the total Google search volume in one year is higher than the median and zero otherwise.
High State Attention	High State Attention is a dummy variable that equals one if the state's Google search volume in one year is higher than the median of all states this year and zero otherwise.
Dem County	Dem County is a dummy variable that equals one if the county where the examiner is located is governed by the Democratic Party and zero otherwise.
Climate Alliance	Climate Alliance is a dummy variable that equals one if the state where the examiner is located has joined the United States Climate Alliance and zero otherwise.
Huge Damage	Huge Damage is a dummy variable that equals one if the total damage is higher than the median damage of all disasters and zero otherwise.
Long Duration	Long Duration is a dummy variable that equals one if the total duration of the disasters is higher than the median duration of all disasters and zero otherwise.
Fatality	Fatality is a dummy variable that equals one if the disaster has caused the fatality and zero otherwise.
Consecutive Year	Consecutive Year is a dummy variable that equals one if the examiners experience climatic disasters in the two consecutive years and zero otherwise.
Hurricane	Hurricane is a dummy variable that equals one if the climate disaster is hurricane and zero otherwise.
Wildfire	Wildfire is a dummy variable that equals one if the climate disaster is wildfire and zero otherwise.
Other Type	Other Type is a dummy variable that equals one if the disasters are not among the climate disasters specifically listed in the column.
Log(GHG Emission)	Log(GHG Emission) is the logarithm of the sum of Scope 1 greenhouse gas emission intensity, Scope 2 greenhouse gas emission intensity, and Scope 3 greenhouse gas emission intensity in the following three years.
Selected Green Ratio	Selected Green Ratio is the percentage of green patents granted by examiners who experienced the disaster out of all green patents in the previous year for each firm.
Firm Disaster	Firm Disaster is a dummy variable that equals one if the county where the firm's headquarters is located experienced a climatic disaster in the previous year and zero otherwise.

Book-to-market	Book-to-market is the difference between common equity and preferred stock capital at the end of the year divided by the equity market value at the end of the year.
Return	Return is the stock price at the end of the year divided by the stock price at the end of the previous year, minus 1.
Log(Assets)	Log(Assets) is the logarithm of total assets at the end of the year.
Div/Inc	Div/Inc is dividends at the end of the year divided by net income at the end of the year.
Leverage	Leverage is long-term debt plus current liabilities divided by total assets in US dollars (millions).
Cash Holding	Cash Holding is the ratio of current assets over total assets.
RD Intensity	RD Intensity is the R&D expense scaled by total assets.
Extreme Heat	Extreme Heat is a dummy variable that equals 1 if the total number of days in a year when the maximum temperature in the examiner's county exceeds the 90^{th} percentile across all counties is greater than the median of all counties for that year, and zero otherwise.
Extreme Temperature	Extreme Temperature is a dummy variable that equals 1 if the total number of days when the maximum temperature in the examiner's county exceeds the 90^{th} percentile plus the total number of days when the minimum temperature falls below the 10^{th} percentile across all counties is greater than the median of all counties for that year, and zero otherwise.
Extreme Cold	Extreme Cold is a dummy variable that equals 1 if the total number of days in a year when the minimum temperature in the examiner's county is below the 10^{th} percentile across all counties is greater than the median of all counties for that year, and zero otherwise.
Green Approve Rate	Green Approve Rate is defined as the total number of green patents issued by the examiner divided by the total number of green applications received by the examiner in a given year.
Non-green Approve Rate	Non-green Approve Rate is defined as the total number of non-green patents issued by the examiner divided by the total number of non-green applications received in a given year.
All Approve Rate	All Approve Rate is defined as the total number of all patents issued by the examiner divided by the total number of all applications reviewed by the examiner in a given year.
Green Application Ratio	Green Application Ratio is defined as the percentage of green patent applications in all patent applications received by each examiner in a given year.
OECD 15	OECD 15 is the percentage of green patents identified by the OECD 2015 classification in all granted patents for each examiner each year.
OECD 15&23	OECD 15&23 is the percentage of green patents identified by the intersection of both OECD 2015 and OECD 2023 classifications in all granted patents for each examiner each year.
OECD 15|23	OECD 15|23 is the percentage of green patents that fall within the OECD 2015 classification but do not include the OECD 2023 classification in all granted patents for each examiner each year.

OECD 15 or 23	OECD 15 or 23 is the percentage of green patents identified by the union of OECD 2015 and 2023 classifications in all granted patents for each examiner each year.
Adaptation Ratio	Adaptation Ratio is the percentage of green patents related to technologies for adaptation to climate change in all granted patents for each examiner each year.
Mitigation Ratio	Mitigation Ratio is the percentage of green patents related to technologies for climate change mitigation in all granted patents for each examiner each year.
Disaster Other	Disaster Other is a dummy variable that equals one if the examiner experiences non-climatic disasters in the previous year and zero otherwise.

Appendix B: Supporting Evidence

In this appendix, we provide supporting evidence for why the events in our sample can be classified as climatic natural disasters and how these events are related to climate change.

The Spatial Hazard and Loss Database for the United States (SHELDUS) includes 18 types of natural disasters. In our study, we focus on identifying natural disasters more closely linked to climate change, referred to as climatic disasters. The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (2022) highlights extreme climate events like flooding, drought, wind, tornadoes, and storms (including thunderstorms, hail, and hurricanes/tropical storms).[17] Additionally, Alok, Kumar, and Wermers (2020) and Kim, Wang, and Wu (2022) provide broader definitions of climatic disasters based on SHELDUS, though their categorizations differ slightly.

Building on these studies, additional literature, and classifications generated with the assistance of ChatGPT, we identify 10 climate-related disasters: drought, flooding, coastal, heat, hurricane/tropical storm, severe thunderstorm, wildfire, wind, tornado, and hail. We exclude the remaining 8 types: fog, avalanche, landslide, lightning, winter weather, earthquake, tsunamis/seiche, and volcanic. Figure B1 presents ChatGPT's classification process. Table B1 bases on existing scientific research to detail the relationships between the six selected climatic disaster types in our final sample and climate change, providing a solid foundation for our classification and analysis. Overall, these references collectively support our classification of events in the sample as climatic natural disasters and establish their connection to climate change. This ensures that our analysis is grounded in established scientific and empirical research, thereby strengthening the validity of our study's findings.

[17] https://www.ipcc.ch/report/ar6/wg2/

Figure B1. Climatic Disasters Classified by ChatGPT

This figure demonstrates how ChatGPT classifies climatic disasters that are highly related to climate change.

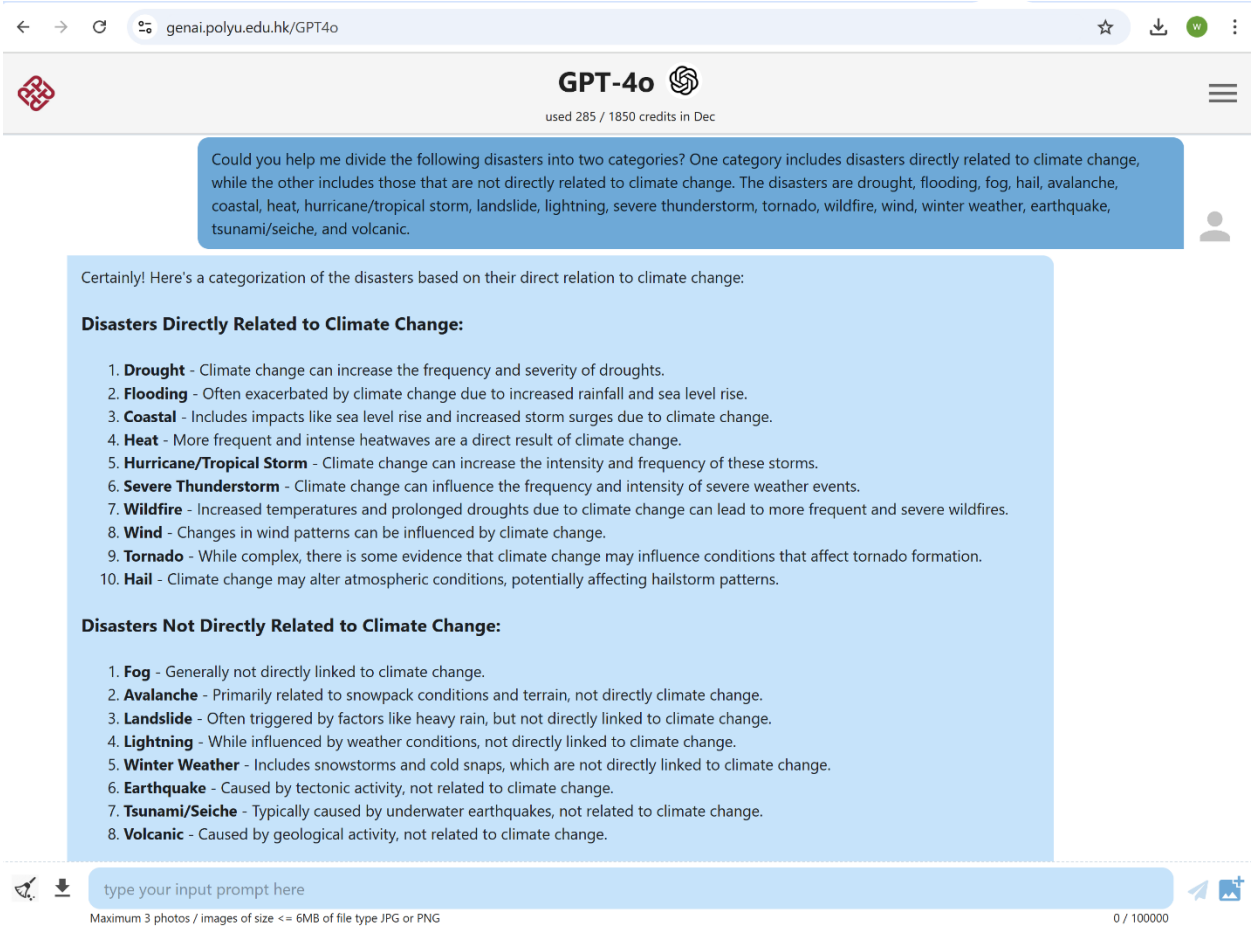


Table B1. Supporting Evidence for Climatic Natural Disasters

Disasters	Relation to Climate Change
Flooding	Climate change increases flooding by raising the frequency and intensity of heavy precipitation and altering temperatures across the region. (Mallakpour and Villarini, 2015; Alifu, Hirabayashi, Imada, and Shiogama, 2022)
Hurricane/ Tropical Storm	Climate changes, such as higher sea-surface temperatures, increased atmospheric moisture, and changes in large-scale circulation, can influence factors like intensity, size, landfall angle, translation speed, and sea level, thereby contributing to hurricanes and tropical storms. (Hassanzadeh et al., 2020; Strauss et al., 2021)
Tornado	Climate change plays a significant role in modulating the annual frequency of tornadoes. In a warming climate, the frequency of environments favorable to tornadoes is expected to increase, particularly in spring, due to a rise in high wind shear values in the lowest 1 km of the atmosphere. (Brooks, Carbin, and Marsh, 2014; Nouri, Devineni, Were, and Khanbilvardi, 2021)
Wildfire	Climate changes, such as increased global temperatures, accelerate the water cycle, leading to more intense rainfall events, more severe and widespread droughts, regional humidity variations, and sea surface temperature fluctuations, which in turn increase wildfire. For example, these changes dry out vegetation, making it more flammable, and create conditions that are more favorable for wildfires, thereby increasing their frequency and severity. (Jolly et al., 2015; Gutierrez et al, 2021.)
Wind	Climate change can influence wind-related natural disasters by altering variables directly linked to wind generation and propagation. For instance, increasing greenhouse gas concentrations can intensify winds that promote upwelling. This intensification is more noticeable at higher latitudes, consistent with the warming patterns associated with climate change, leading to more severe wind events. (Sydeman et al., 2014; Lobeto, Menendez, and Losada, 2021)
Hail	Climate change, such as global warming, affects low-level moisture, convective instability, microphysical processes, and vertical wind shear. These changes create conditions that increase the frequency and severity of hail by enhancing the atmospheric environment necessary for hail formation and growth. (Allen, 2017; Raupach et al., 2021)

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Appendix C

Table C1. The Effect of Climate Change on Green Patent Review (Exclude Certain Disasters)

This table presents examiner-level regressions of examiners' preferences for green patents on climatic disaster exposures. Green Patent Ratio is the percentage of green patents granted out of all granted patents for each examiner in a given year. Disaster is a dummy variable that equals one if the examiner experiences climatic disasters in the previous year and zero otherwise. We exclude certain climate disasters, such as hail and wind events, as they may be less directly associated with climate change compared to other disasters in our sample. The baseline model includes examiner and year fixed effects. Standard errors are double-clustered at the county and year levels, and are reported in parentheses. The sample period is from 2012 to 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent Variable: Green Patent Ratio			
	(1)	(2)	(3)	(4)
Disaster	0.0084^{***}	0.0084^{***}	0.0126^{***}	0.0082^{***}
	(0.0019)	(0.0024)	(0.0034)	(0.0023)
Examiner FE	Yes	Yes	No	Yes
County FE	No	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Cluster	County, Year	County	County, Year	County, Year
# Obs.	58,161	58,161	58,161	58,161
Adj. R^2	0.852	0.852	0.043	0.852

Table C2. The Effect of Climate Change on Green Patent Review (Tobit Model)

This table presents examiner-level regressions of examiners' preferences for green patents on climatic disaster exposures. Green Patent Ratio is the percentage of green patents granted out of all granted patents for each examiner in a given year. Disaster is a dummy variable that equals one if the examiner experiences climatic disasters in the previous year and zero otherwise. The Tobit model includes county and year fixed effects. Standard errors are double-clustered at the county and year levels, and are reported in parentheses. The sample period is from 2012 to 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent Variable: Green Patent Ratio	
	(1)	(2)
Disaster	0.0202^{***}	0.0202^{***}
	(0.0071)	(0.0074)
County FE	Yes	Yes
Year FE	Yes	Yes
Cluster	County, Year	County
# Obs.	58,161	58,161
Pseudo R^2	0.112	0.112

Table C3. The Effect of Climate Change on Green Patent Quality (Poisson Model)

This table presents examiner-level regressions of green patent quality on climatic disaster exposures. Green Patent Raw Quality is the average number of citations received by green patents for each examiner in a given year. Non-green Patent Raw Quality is the average number of citations received by non-green patents for each examiner in a given year. All Patent Raw Quality is the average number of citations received by all patents for each examiner in a given year. Disaster is a dummy variable that equals one if the examiner experiences climatic disasters in the previous year and zero otherwise. Examiner and year fixed effects are included. Standard errors are double-clustered at the county and year levels, and are reported in parentheses. The sample period is from 2012 to 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Green Patent Raw Quality	Non-green Patent Raw Quality	All Patent Raw Quality
	(1)	(2)	(3)
Disaster	0.1961***	0.0032	0.0231
	(0.0723)	(0.0501)	(0.0459)
Examiner FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
# Obs.	35,450	57,735	58,161
Pseudo R^2	0.471	0.499	0.500

Table C4. The Effect of Climate Change on Green Patent Review (Subsample)

This table presents examiner-level regressions of examiners' preferences for green patents on climatic disaster exposures. Green Patent Ratio is the percentage of green patents granted out of all granted patents for each examiner in a given year. Disaster is a dummy variable that equals one if the examiner experiences climatic disasters in the previous year and zero otherwise. Here we use the same sample in Table 5. The baseline model includes examiner and year fixed effects. Examiner and year fixed effects are included. Standard errors are double-clustered at the county and year levels, and are reported in parentheses. The sample period is from 2012 to 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent Variable: Green Patent Ratio			
	(1)	(2)	(3)	(4)
Disaster	0.0091^{***}	0.0091^{***}	0.0141^{***}	0.0088^{***}
	(0.0022)	(0.0029)	(0.0026)	(0.0026)
Examiner FE	Yes	Yes	No	Yes
County FE	No	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Cluster	County, Year	County	County, Year	County, Year
# Obs.	55,682	55,682	55,682	55,682
Adj. R^2	0.874	0.874	0.044	0.874

Table C5. Summary Statistics

This table shows summary statistics for firm-level variables in our sample. Log(GHG Emission) is the logarithm of the sum of Scope 1 greenhouse gas intensity, Scope 2 greenhouse gas intensity, and Scope 3 greenhouse gas intensity provided by the Trucost database in the following three years. Selected Green Ratio is the percentage of green patents granted by examiners who experienced the disaster in the previous year for each firm. Firm Disaster is a dummy variable that equals one if the county where the firm's headquarters is located experienced a climatic disaster in the previous year, and zero otherwise. Book-to-market is the difference between common equity and preferred stock capital at the end of the year divided by the equity market value at the end of the year. Return is the stock price at the end of the year divided by the stock price at the end of the previous year, minus 1. Log(Assets) is the logarithm of total assets at the end of the year. Div/Inc is dividends at the end of the year divided by net income at the end of the year. Leverage is long-term debt plus current liabilities divided by total assets in US dollars (millions). Cash Holding is the ratio of current assets over total assets. RD Intensity is the R&D expense scaled by total assets. The sample period is from 2012 to 2020. All continuous variables that are not constrained between 0 and 1 are winsorized at 1% and 99% level. Detailed variable definitions are provided in Appendix A.

Variable	Obs	Mean	STD	P1	P25	Med	P75	P99
Firm-year								
Log(GHG Emission)	1,974	6.46	0.90	4.72	5.89	6.44	6.97	9.40
Selected Green Ratio	1,974	0.01	0.06	0.00	0.00	0.00	0.00	0.14
Book-to-market	1,974	0.36	0.36	-0.30	0.17	0.30	0.47	1.46
Returns	1,974	0.16	0.62	-0.71	-0.10	0.09	0.31	2.38
Log(Assets)	1,974	8.68	2.12	3.89	7.34	8.62	10.19	12.87
Div/Inc	1,974	0.44	5.48	-1.50	0.00	0.15	0.39	3.14
Leverage	1,974	0.25	0.20	0.00	0.12	0.23	0.35	0.98
Cash Holding	1,974	0.24	0.22	0.00	0.08	0.16	0.32	0.93
RD Intensity	1,974	0.09	0.18	0.00	0.02	0.05	0.10	0.61
Firm Disaster	1,974	0.03	0.18	0.00	0.00	0.00	0.00	1.00