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Finance Working Paper N° 815/2022
March 2024

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ECGI Working Paper Series in Finance

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Abstract

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Keywords: Climate Change, Shareholder Voting, Mutual Funds

JEL Classifications: G30, Q54

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1 Introduction

Environmental issues in general, and climate change in particular, are growing concerns for investors (e.g., Krueger, Sautner, and Starks 2020; Stroebel and Wurgler 2021). Related studies confirm that investors have started to price climate risk (e.g., Bolton and Kacperczyk 2021; Ilhan, Sautner, and Vilkov 2021; Sautner et al. 2022) and engage with companies on climate issues (e.g., Dimson, Karakaş, and Li 2021). The shareholder proposal process represents an increasingly important channel through which investors can signal their concerns, express their views, and affect companies' environmental disclosure and decisions (e.g., Flammer, Toffel, and Viswanathan 2021; He, Kahraman, and Lowry 2023). Shareholder support for environmental proposals has increased rapidly, and some proposals on climate change have started to garner majority votes, which could mark a turning point.[1] Importantly, greater voting support for environmental proposals, even when they do not pass, contributes to the accumulated pressure on companies over environmental issues (e.g., Grewal, Serafeim, and Yoon 2016).

Several factors potentially influence voting support for proposals on environmental issues. For example, investors may support environmental proposals because they are motivated by value-maximization concerns (e.g., Flammer 2015) or ideology (Bolton et al. 2020). Alternatively, agency issues such as investor myopia, friendliness toward management, or strategic considerations among mutual funds have the potential to contribute to opposition to environmental proposals (e.g., He et al. 2023; Michaely, Ordonez-Calafi, and Rubio 2021).

In this paper, we explore whether, beyond motives related to these considerations, investors' personal experience with climate change affects their voting behavior on climate-change-related issues. We conjecture that personal experience with climate change influences investors' perceptions of the importance of climate issues and, thereby, increases their voting support for climate proposals (but not for proposals related to other topics). Our conjec-

1. Source: https://www.wsj.com/articles/more-shareholder-proposals-spotlight-climate-change-1518127308?tesla=y. Furthermore, despite the COVID-19 crisis, pressure on environmental issues remains strong: https://www.ft.com/content/c10056af-306f-4d9d-8e97-5ffa112ddf49.

ture builds on prior literature documenting that managers' decisions and actions are affected by their individual life experiences (e.g., Bernile, Bhagwat, and Rau 2017; Benmelech and Frydman 2015; Cronqvist and Yu 2017; Malmendier and Nagel 2011). Climate change is a complex phenomenon that people learn about both *abstractly* through media and education, and *concretely* through personal experiences (e.g., Sugerman, Li, and Johnson 2021). Importantly, prior research highlights the existence of a local warming effect whereby people's judgments about climate change are affected by recent local temperatures.

More precisely, exposure to abnormally hot temperatures increases people's awareness of climate change and its consequences (e.g., Akerlof et al. 2013; Choi, Gao, and Jiang 2020; Myers et al. 2013; Zaval et al. 2014). We therefore use investors' exposure to abnormally hot temperatures to proxy for their personal experience with climate change. Although abnormally hot temperatures affect people's awareness of climate change, whether personal experience with climate change has implications for the behavior of sophisticated investors such as mutual fund managers is an open question.

In our empirical analysis, we study whether mutual fund managers, who are dominant players in the proxy voting process, change their voting behavior on climate proposals after exposure to abnormally hot temperatures. We consider a fund manager to have experienced abnormally hot temperatures if for a given quarter, she has experienced an average deviation from "normal" temperatures that is greater than 2 degrees Celsius.[2]

Our empirical design involves a treatment (i.e., fund managers' exposure to abnormally hot temperatures) that occurs in a staggered way. Baker, Larcker, and Wang (2022) show that, in this case, staggered difference-in-differences (DiD) regression estimators are biased due to heterogeneous treatment effects and variation in treatment timing.[3] Following their

2. We focus on high abnormal temperatures because they represent salient events for fund managers (Choi et al. 2020). By contrast, small abnormal temperatures may go unnoticed and are therefore unlikely to trigger a change in awareness about climate change.

3. As we discuss in more detail in section 3.1, standard staggered DiD regressions introduce a "bad comparisons" problem. Specifically, in our setting, this problem arises from the fact that staggered DiD estimates would use both "good" comparisons between funds exposed to abnormally hot temperatures (i.e., treated) and not-yet-treated (or never-treated) funds, as well as bad comparisons between funds exposed to abnormally hot temperatures and funds that have already been exposed to abnormally hot temperatures in

recommendation, we use a stacked-regression approach (Cengiz et al. 2019). The core idea of this approach is to create event-specific datasets (i.e., cohorts) containing fund votes on climate proposals cast by treated and "clean" control funds. These cohorts are then stacked together, and a two-way fixed-effects DiD regression is estimated on the stacked dataset. Within each cohort, we control for unobserved heterogeneity using proposal and fund fixed effects. The proposal fixed effects capture each proposal for a given firm in a given annual meeting and therefore control for both any time-varying firm characteristics (e.g., size, profitability, ownership structure, corporate governance) and any proposal characteristics (e.g., whether the proposal has a positive ISS recommendation). Fund fixed effects capture any persistent characteristics at the fund level that may influence their voting behavior.

Analyzing 30,797 mutual fund votes on 713 climate-change-related proposals over the period 2006-2022, we find that funds whose managers have been exposed to abnormally hot temperatures provide significantly higher support for climate proposals than managers who were not exposed. The magnitude of the effect is sizable. Exposure to abnormally hot temperatures increases the likelihood of the fund manager supporting climate proposals by 11 percentage points (26% of its standard deviation). Importantly, we find that fund managers exposed to abnormally hot temperatures do not provide higher support for proposals related to governance issues or to non-climate environmental and social (ES) issues, indicating that the effect of personal experience with climate change is specific to climate proposals. These results suggest that the exposure of fund managers to abnormally hot temperatures is not related to unobservable factors influencing mutual fund ES votes in general. To further examine the effect of personal experience with climate change on mutual fund support for climate proposals, for each fund-quarter, we calculate the number of climate proposals the fund supports divided by the total number of climate proposals the fund votes on. We find that funds exposed to abnormally hot temperatures support a larger fraction of the climate proposals they vote on, confirming our baseline findings at the proposal level.

previous years (already-treated funds).

If the exposure to abnormally hot temperatures leads to a permanent change in beliefs about climate change, the effect should disappear or become less pronounced when fund managers are exposed a second time (or more).[4] Consistent with this prediction, we find that voting support for climate proposals increases the first time a fund manager is exposed to abnormally hot temperatures but not the subsequent times. In a related test, we examine the persistence of the effect of temperature shocks. We find that the effect is quite persistent because up to five years (20 quarters) after being exposed to abnormally hot temperatures, mutual fund managers remain significantly more likely to support climate proposals. Taken together, these two results suggest that the exposure to abnormally hot temperatures leads to a permanent change in fund managers' beliefs about climate change and in the support they provide for climate proposals.

We expect the effect of personal experience with climate change to be stronger for climate proposals targeting firms with greater climate risk, because those firms will suffer the most from the consequences of climate change. We test this conjecture using a host of measures of climate risk (Sautner et al. 2023; Kölbel et al. 2022; Ilhan et al. 2021). Regardless of the measure of climate risk we use, we find that the impact of personal experience with climate change on voting support for climate proposals is significantly larger in firms with greater climate risk. These results suggest that the increased support for climate proposals by shocked funds is more pronounced for firms on which climate change is likely to have the greatest value implications.

We also expect the effect of personal experience with climate change to differ depending on the quality of the proposal.[5] Even if they change their beliefs about climate change, fund managers exposed to abnormally hot temperatures may not support "bad" climate proposals (e.g., proposals viewed as inappropriate or unnecessary). We use two proxies for the quality of the proposal. The first is whether ISS recommends voting in favor of the proposal. The

4. Prior studies provide evidence that abnormally hot temperatures lead to people searching for more information about climate change (Choi et al. 2020; Lang 2014), which suggests that the change in beliefs is likely to be permanent.

5. Note that all our tests include proposal fixed effects which control for the quality of the proposal.

second is whether the aggregate support from all mutual funds received by the proposal is above the median. Using both proxies, we find that the effect of abnormally hot temperatures on mutual fund support for climate proposals is significantly stronger for "high-quality" proposals. Because the aggregate support for ES proposals contains information about the ES risks that firms face (He et al. 2023), this result further indicates that voting support is stronger for proposals targeting firms more exposed to climate risk.

We expect variation in the impact of personal experience with climate change across fund managers, depending on prior awareness of climate change. Simply stated, for climate-conscious investors, the exposure to abnormally hot temperatures is less likely to act as a shock raising awareness regarding climate issues and to trigger a change in support for climate proposals. We focus on three subsets of fund managers who are likely to exhibit greater awareness for climate issues: (i) managers of environmentally friendly mutual funds, (ii) mutual fund managers located in areas more receptive to scientific evidence on climate change, (iii) managers of mutual funds with high historical support for climate proposals. The first two proxies are fund characteristics that are likely to be related to climate consciousness, whereas the third captures more directly funds that already have a tendency to support climate proposals (regardless of the motivation or fund characteristics that could drive this support). We find some evidence that funds with greater (prior) awareness of climate change are less likely to change their voting support for climate proposals after being exposed to abnormally hot temperatures, although the effect is mainly significant for funds with greater historical support for climate proposals.

Overall, we observe an important heterogeneity in the voting patterns of shocked funds that depends on firms' climate risk, proposal quality, and funds' prior support for climate proposals. It indicates that fund managers do not uniformly and equally support all climate proposals after being exposed to abnormally hot temperatures.

Finally, we examine whether fund managers' personal experience with climate change matters for the outcome of climate proposals. We find that the aggregate support that

climate proposals receive increases with the fraction of mutual funds exposed to abnormally hot temperatures. This effect is specific to climate proposals as we find no impact on the aggregate voting support for governance or other ES proposals. Prior studies show that whereas ES proposals almost always fail, greater voting support matters, and in particular, contributes to the pressure on companies to act on ES issues (e.g., Grewal et al. 2016; He et al. 2023).[6] Our results therefore suggest that the voting behavior of mutual funds exposed to abnormally hot temperatures increases the pressure on companies to act on climate change.

Besides a change in mutual fund voting behavior on climate-change-related issues, personal experience with climate change may also affect their portfolio holdings. In the last part of our empirical analysis, we therefore examine whether, after being exposed to abnormally hot temperatures, fund managers reduce their holdings of stocks with greater exposure to climate change. We find evidence that they do. Unsurprisingly, we observe the divestment from stocks with greater climate change exposure only for non-index funds. Indexers exposed to abnormally hot temperatures do not change their holdings but they are significantly more likely to increase their support for climate proposals. These results are consistent with the notion that the voice channel is more important for indexers because they cannot vote with their feet by divesting from stocks with greater climate change exposure. Overall, although the question of whether voice or exit is the best approach to deal with climate risks remains open (Edmans, Levit, and Schneemeier 2022; Gantchev, Giannetti, and Li 2022; Krueger et al. 2020; Lowry, Wang, and Wei 2022), we provide evidence that both channels are at play for fund managers who have been exposed to abnormally hot temperatures.

Our paper adds to the literature on the determinants of mutual fund votes (e.g., Calluzzo and Kedia 2019; Cvijanović, Dasgupta, and Zachariadis 2016; Heath et al. 2022; Iliev and Lowry 2015). Our findings are particularly relevant to the literature on the determinants of

6. Anecdotal evidence confirms the role played by the aggregate voting support received by ES proposals in inducing managerial actions. For example, the US Sustainable Investment Forum explains that, often, a shareholder resolution will fail to win a majority of the shares voted but still succeeds in persuading management to adopt some or all of the requested changes because a significant number of shareholders favored the resolution (see https://www.ussif.org/resolutions).

mutual fund votes for ES proposals. Recent studies on ES votes highlight the role played by business connections, investment objectives, investment horizon, major hurricanes, and conflicts of interest between ES funds and their families (e.g., Dikolli et al. 2022; Fich and Xu 2021; He et al. 2023; Michaely et al. 2021). We contribute to this literature by showing that personal experience with climate change is a key determinant of mutual fund managers' voting behavior on climate proposals.[7]

Our paper is also related to the literature focusing on the growing concerns of institutional investors about environmental and climate risk (e.g., Flammer et al. 2021; Ilhan et al. 2023; Krueger et al. 2020; Ramelli et al. 2021). Although more and more institutional investors seem to care about climate risk, less is known about the factors that contribute to increasing climate-risk awareness. Most closely related to our paper, Choi et al. (2020) show that abnormally warm weather alters investment choices, leading stocks of carbon-intensive firms to underperform firms with low carbon emissions. However, they find that only retail investors and not institutional investors sell carbon-intensive firms when weather is abnormally warm.[8] Therefore, from their results, whether the exposure to abnormally hot temperatures has an effect on the decisions of sophisticated institutional investors such as mutual funds is unclear. Our work complements and differs from theirs by examining the effect of abnormally warm weather on mutual fund voting support for climate proposals and providing evidence that abnormally hot temperatures have implications for shareholder voice on climate issues, which institutional investors view as a better approach than divestment to deal with climate risk (e.g., Krueger et al. 2020).

The remainder of the paper is organized as follows. Section 2 describes the data and the empirical methodology. Section 3 presents the empirical results, and section 4 concludes.

7. A related stream of research focuses on the effect of air pollution on fund managers (e.g., Foroughi, Marcus, and Nguyen 2021; Huynh, Li, and Xia 2021). Air pollution mainly increases people's concerns about their health and perceived quality of life (e.g., Chang, Huang, and Wang 2018; Deguen et al. 2012; Weir 2012). We rather aim to capture a personal experience that specifically increases fund managers' awareness of climate change.

8. In a related study, Alekseev et al. (2021) examine how mutual fund managers trade in response to local heat events in order to build climate-risk hedge portfolios.

2 Mechanism, Data, and Measures

2.1 Mechanism

In this section, we describe the underlying mechanism through which local recent temperatures affect climate-change beliefs, and in turn fund's voting support for climate proposals. Local temperatures and climate change are two separate constructs on different time scales. Climate change is a long-term phenomenon that occurs on a decadal time scale, and therefore cannot be perceived by individuals. On the contrary, local recent temperatures over a shorter horizon (e.g., a month or a year) are more noticeable and attention-grabbing for individuals, even though factors other than climate change may affect them. Although local temperatures do not provide predictive power regarding climate change, a body of research on the "local warming" effect suggests that they affect people's judgments of climate change (see Sugerman et al. (2021) for a meta-analysis of the studies on the local warming effect). According to this literature, the main mechanism behind the relationship between local temperatures and people's beliefs about climate change is attribute substitution (Kahneman and Frederick 2002). Attribute substitution is a cognitive process in which a simple, accessible, and intuitive judgment (in our case, local temperatures) is used as a proxy for a more complex, less accessible, and more effortful judgment (in our case, climate change). Climate change is such a complex phenomenon that people learn about it not only abstractly through media and education, but also concretely through personal experiences. Although identifying climate change, of course, requires more than recent local temperature records, being exposed to abnormally hot temperatures would make taking climate change seriously easier. We note that the effect of local temperatures on individuals' beliefs regarding climate change may not only represent a behavioral response. Prior studies provide evidence that abnormally hot temperatures lead to people searching for more information about climate change (e.g., Choi et al. 2020; Lang 2014). Therefore, the update in beliefs regarding climate change following abnormally hot temperatures may be rational if people search for and learn

more about scientific studies and reports about climate change.

2.2 Main data sources and sample construction

Analyzing the effect of increased awareness of climate change among mutual fund managers through their exposure to abnormally hot temperatures requires data on mutual fund proxy voting, data on their headquarters' location, and temperature data. We describe the data sets used in the empirical analysis in this section.

We obtain mutual fund proxy voting records over the period 2006 to 2022 from Risk Metrics' ISS Voting Analytics. For every vote cast, this database provides a description of the item being voted on, the voting recommendations of the firm's management and of ISS, and the fund's vote. Our empirical analysis focuses on the set of climate proposals that belong to a broader group of proposals related to ES issues. ISS Voting Analytics provides category codes (*AgendaItemID*) to identify different types of shareholder proposals. We follow He et al. (2023) in their selection of ES proposal codes. Like them, we then refine this set of proposals in two ways. First, we remove a subset of proposals that either do not have a clear association with ES issues or appear to be data errors (e.g., proposals titled "Report on Pay Disparity" turn out to be about executive compensation as opposed to the gender pay gap). Second, we review the detailed description (*ItemDesc*) of 13 categories of proposals characterized by generic titles (e.g., "Company Specific-Governance Related"), and we eliminate those proposals that are not related to ES topics.

Given the purpose of our study, we further need to divide these ES proposals into proposals related to climate change and those that are not. To do so, we read through the brief description (*AgendaGeneralDesc*) or detailed description (*ItemDesc*) of each proposal. We start by considering proposals belonging to the following categories: "S0742 - Report on Climate Change," "S0743 GHG Emissions," "S0745 Climate Change Action," "S0748 Proposals Requesting Non-Binding Advisory Vote On Climate Action Plan," "S0779 Renewable Energy," and "S0780 Energy Efficiency." Then, we further include proposals whose category

name or description include one of the following keywords: "GLOBAL WARMING," "CLIMATE," "GHG," or "CARBON." We finally refine our classification by reviewing all other ES proposal descriptions manually and adding the few instances of proposals related to climate change that we miss using the above-mentioned screening strategy. Table A1 reports, by ISS proposal category code, the number of social, environmental but not climate, and climate proposals we identify.

We obtain data on the location (zip code) of mutual funds' headquarters from the CRSP mutual fund database (in the *contact_info* table). Our main proxy for the mutual fund manager's personal experience with climate change is the abnormally hot temperatures close to the fund's headquarters. Managers are likely to spend considerable time at the firm's headquarters and to be affected by events taking place in the vicinity (e.g., Dai et al. 2020; Deng and Gao 2013; Levine, Lin, and Wang 2018). Fund managers are therefore likely to be affected and to potentially react to abnormally hot temperatures at the fund's headquarters. Because no unique fund identifier that is common to ISS data and CRSP data exists, for each fund vote cast by a fund series in ISS, we download the associated N-PX filing from the SEC and retrieve the corresponding SEC fund series identifier. To find the corresponding SEC fund series identifiers, we do a matching by name within the N-PX filing. Finally, we match the ISS fund series to the CRSP fund series using the SEC fund series identifier as the common identifier. We report detailed information about the matching procedure in Appendix A2. From the CRSP mutual fund database, we also obtain time-varying controls at the fund level (e.g., turnover ratio and total net assets under management).

We obtain temperature data from the Global Surface Summary of Day (GSOD) Data, provided by the US National Centers for Environmental Information (NCEI) and generated by the National Climatic Data Center.[9] The dataset covers more than 9,000 weather stations from 1929 onward.[10] It provides, for each year, by station, the daily time series of mean

9. The National Climatic Data Center is a standard source for temperature data and is increasingly used in the finance literature to assess the effect of temperature on different outcomes (e.g., Choi et al. 2020; Kumar, Xin, and Zhang 2019)

10. We downloaded the data with the *GSODR* R package. *GSODR* aims to make finding, transfering,

temperatures.[11] We compute our measure of monthly temperature by taking the average of these daily temperatures over the month. We drop stations for which the time series of available daily temperature does not span 1996-2022.[12] The GSOD dataset also includes the location of the stations (longitude and latitude). We use the latter to identify the station that is the nearest to a given fund's headquarters. To complete this step, we first retrieve the longitude and latitude corresponding to a given zip code, using the SimpleMaps database of US zip codes.[13] Then, we match the zip code of a given fund to its nearest station based on their respective coordinates.[14]

The starting point for our sample construction comprises all votes on shareholder proposals of Russell 3000 firms over 2006-2022 by mutual funds at the intersection of the ISS and CRSP databases and for which we can obtain temperature data. We drop votes that are "None," "Split," or "One Year."[15] We winsorize continuous fund variables at the 1% and 99% percentiles. Our initial sample of fund votes comprises 2,565,514 mutual fund votes by 8,273 unique funds on 36,183 shareholder proposals for 4,399 unique companies over the 2006-2022 period. Among the unique proposals, 33,310 are governance proposals, 2,873 are ES proposals, and within the ES universe, 1,510 are more specifically social proposals, and 1,363 are more specifically environmental proposals. Finally, within the ES universe, we identify 713 climate proposals. Figure 1 shows the distribution of unique ES and climate proposals over time for our initial sample. They both trend up from 2013 onward. Table 1 provides further summary statistics. Echoing the statistics provided above, 24% of the votes

and formatting the GSOD data easier. The *get_GSOD* function queries and transfers files from the NCEI's webpage, reformats them, and returns a tidy data frame in R. When reformatting data, all units are converted from United States Customary System to International System of Units (e.g., Fahrenheit to Celsius).

11. The daily average temperature takes into account both daytime and nighttime temperatures. Considering overnight temperatures is important because anectodal and scientific evidence indicate that high overnight temperatures do not offer people the possibility of reprieve from the oppressive heat and erode human sleep (See, for example, https://edition.cnn.com/2023/06/30/weather/nighttime-heat-danger-climate-change-xpn-scn/index.html or https://www.cell.com/one-earth/fulltext/S2590-3322(22)00209-3)

12. We require at least 10 years of data to compute an abnormal temperature for a given station.

13. Source: https://simplemaps.com/data/us-zips

14. We use the Stata command *gnear()* to complete this task. We require a station to be at a distance of less than 50 kilometers from a city, however our main results hold if we remove this requirement.

15. We hence keep the "For," "Abstain," "Do not Vote," "Withhold," and "Against" votes.

are on ES proposals (as opposed to 76% on governance proposals), and 5% are on climate proposals.

2.3 Measures of fund exposure to abnormally hot temperatures

Our empirical analysis exploits the occurrence of abnormally hot temperatures in the area of a mutual fund's headquarters as a shock raising the awareness of fund managers regarding climate-change issues. Prior studies show that the exposure to abnormally hot temperatures leads to increased salience of climate-related issues and an increased perception of climate risk (e.g., Akerlof et al. 2013; Myers et al. 2013; Zaval et al. 2014).[16] Choi et al. (2020) provide supportive evidence that people and investors in particular pay more attention to climate change after experiencing abnormally hot temperatures.

Following Choi et al. (2020), we break down local temperatures into three components, which account for predictable, seasonal, and abnormal patterns. Therefore, the abnormal component is measured as follows:

$$\begin{aligned} Abnormal\ Temperature_{it} = Temperature_{it} - Average\ Temperature_{it} \\ - Monthly\ Temperature_{it} \end{aligned} \tag{1}$$

where $Temperature_{it}$ is the actual temperature measured in the city of the mutual fund's headquarters i in month t; $Average\ Temperature_{it}$ is the average monthly local temperature in the city i over the 120 months prior to t; and $Monthly\ Temperature_{it}$ is the average deviation of this month's temperature from the average, that is the average temperature in the city i in the same calendar month over the last 10 years minus $Average\ Temperature_{it}$.

The temperature shocks we use in our empirical analysis are based on local abnormal temperatures and are defined at the fund-quarter level. Specifically, we consider a fund manager to have been exposed to abnormally hot temperatures if the average monthly abnormal temperature at the fund's headquarters over the quarter is greater than 2°C . The 2°C cutoff

16. In a related study, Li, Johnson, and Zaval (2011) show that abnormally hot temperatures also influence actions because people are more likely to make donations to global-warming charities.

roughly corresponds to two standard deviations above the mean in the distribution of abnormal temperatures in our sample and is motivated by the fact that the highest abnormal local temperatures are the most salient.[17] Prior evidence suggests that investors pay more attention to infrequent dramatic changes than to frequent gradual changes (Choi et al. 2020; Da, Gurun, and Warachka 2014). An average quarterly abnormally hot temperature of at least 2°C likely represents an experience of climate change that is salient and noticeable for mutual fund managers. In our initial sample, about 7% of the fund votes are cast by funds that experience such an abnormally hot temperature shock.

Fund managers may experience several temperature shocks over our sample period (i.e., they can be treated several times). In our baseline tests, we concentrate on the first exposure of a fund manager to abnormally hot temperatures. If personal experience with climate change leads to a permanent adjustment in climate change beliefs, the first temperature shock should be more relevant. Moreover, the repetition of the same event makes it less unusual and salient. In complementary tests, we confirm that voting support for climate proposals increases the first time a fund manager is exposed to abnormally hot temperatures but not subsequent times. Figure 2 reports by year and quarter the number of unique funds experiencing, for the first time over our sample period, an abnormally hot temperature shock. The spikes in the number of shocked funds match well-documented episodes of abnormal heatwaves in the US.[18]

17. In untabulated tests, we check whether our results are similar if we consider lower thresholds, for instance, 1°C. We find that the results are much weaker then, suggesting that the temperature shock has to be salient to trigger a significant change in beliefs about climate change.

18. See, for example https://www.noaa.gov/news/january-2020-was-5th-warmest-on-record-for-us, https://www.cnbc.com/2015/11/06/record-breaking-heat-wavein-november.html, and https://www.climate.gov/news-features/featured-images/april-2010-warmest-record.

3 Empirical results

3.1 Empirical setting

We begin our empirical analysis by examining the notion that abnormally hot temperatures are likely to influence investors' perceptions of the importance of climate change, and as a consequence, the voting behavior of fund managers on climate proposals. Our empirical analysis exploits a treatment (i.e., temperature shocks) that occurs in a staggered way. Baker et al. (2022) show that in this case, staggered DiD regression estimates are biased. In particular, when units are treated at different points in time (as is the case with temperature shocks), a treatment unit can become a control and a control can become treated, introducing a "bad comparisons" problem. In the specific context of our paper, this potential "bad comparisons" problem arises from the fact that staggered DiD estimates would use both "good" comparisons between funds exposed to abnormally hot temperatures (i.e., treated) and not-yet or never-treated funds, as well as "bad comparisons" with funds that were exposed to abnormally hot temperatures in previous years (i.e., already-treated funds).

Following the recommendations from Baker et al. (2022), we use a stacked-regression approach (Cengiz et al. 2019). The core idea of this approach is to create event-specific datasets, including the outcome variable and controls for the treated units and all other observations that are "clean" controls within the treatment window. More precisely, for each year and quarter, we create a cohort containing fund votes on climate proposals cast by treated and control funds. Treated funds are funds that are exposed to abnormally hot temperatures for the first time over our sample period (i.e., the average monthly abnormal temperature over the quarter is above 2°C). Moreover, we ensure that control funds have never been shocked (included during the entire cohort period). For each year-quarter cohort, we include the votes from treated and control funds on climate proposals cast in the four quarters following ($Post = 1$) and preceding ($Post = 0$) the quarter of the temperature

shock for the treated funds.[19] We omit the quarter of the temperature shock itself. These different cohorts are then stacked together, and we estimate a two-way fixed-effects DiD regression on the stacked dataset. Specifically, we estimate the following regression:

$$Vote\ \ For_{ijg} = \beta_0 + \beta_1 Treated_{ijg} \times Post_{ijg} + \delta_{ig} + \lambda_{jg} + \epsilon_{ijg} \tag{2}$$

where the subscripts i, j, and g refer to funds, proposals, and cohorts, respectively. The dependent variable is a dummy variable equal to 1 if the fund votes in favor of the proposal. The main variable of interest is the interaction between $Treated$ and $Post$, which captures whether funds exposed to abnormally hot temperatures are significantly more likely to vote in favor of climate proposals compared to control funds. We control for unobserved heterogeneity by including cohort-proposal fixed effects (λ_{jg}) and cohort-fund fixed effects (δ_{ig}) in all regressions. That is, within each cohort, we control for proposal fixed effects, which capture each proposal voted on at the shareholder meeting of a given firm in a given year. The proposal fixed effects control for the nature and timing of the proposal, and proposal characteristics, including whether the proposal has a positive ISS recommendation. They also absorb the effect of any time-varying firm-level characteristics, such as profitability, size, or governance. Within each cohort, we also control for fund fixed effects to capture time-invariant fund characteristics that may influence mutual fund voting on ES proposals, such as fund ideology (Bolton et al. 2020; Michaely et al. 2021).[20]

We estimate a linear probability model as this allows us to include saturated fixed effects. The linear probability model also helps with the interpretation of interaction terms in our estimation (see Ai and Norton (2003) and Greene (2010)). We cluster standard errors at the cohort-fund level and the cohort-proposal level.

We do not form cohorts for the first three years of our sample, because we do not have enough history to generate clean controls. We also drop cohorts with less than 1% of treated observations.[21] Figure 3 reports the number of fund votes in the treated and control groups

19. In additional analyses, we consider longer time windows for the post period.
20. *Post* and *Treated* are absorbed by cohort-proposal and cohort-fund fixed effects, respectively.
21. The results are similar without these two precautions.

for each of the cohorts included in our main analysis. As expected, the proportion of treated observations relative to control observations is markedly higher in the year-quarter cohorts where a higher proportion of unique funds is exposed to abnormally hot temperatures.

3.2 Abnormally hot temperatures and mutual fund votes

Table 2, Panel A, presents the results of estimating Equation (2) for different samples of shareholder proposals. In Column 1, we consider all shareholder proposals (i.e., governance-related and ES-related proposals). In Column 2, we restrict the sample to environmental proposals. In Columns 3 and 4, we separate climate proposals and other environmental proposals. In Column 2, the coefficient on the interaction between *Treated* and *Post* is positive and statistically significant at the 1% level, indicating that funds whose managers have been exposed to abnormally hot temperatures are significantly more likely to vote in favor of proposals related to environmental issues. When we consider all shareholder proposals (Column 1), the coefficient on the interaction term is not statistically significant, indicating that the exposure to abnormally hot temperatures does not trigger a greater support for all shareholder proposals. These results are consistent with the conjecture that exposure to abnormally hot temperatures increases fund managers' awareness of the importance of environmental issues and translates into greater voting support only for environmental proposals, and not for proposals related to other topics.

The results from Columns 3 and 4 indicate that the greater support for environmental proposals by funds exposed to abnormally hot temperatures is driven by climate proposals. Support for environmental (climate) proposals by funds whose managers have been exposed to abnormally hot temperatures is economically important. The coefficient estimate of the interaction of *Treated* and *Post* reported in Column 2 (Column 3) indicates an increase of 6.4% (11.1%) in the likelihood of supporting environmental (climate) proposals, which represents about 26% (15%) of the standard deviation.

As an alternative to comparing the coefficients on the interaction between *Treated* and

Post from separate regressions on different subsets of shareholder proposals, we pool shareholder proposals together and include a triple interaction term singling out the incremental support for climate proposals. Table 2, Panel B, reports the results. The main variable of interest is the triple interaction between *Treated*, *Post*, and *Climate Proposal*, which captures how funds exposed to abnormally hot temperatures change their voting support relative to other funds, depending on whether the proposal is related to climate issues. In Column 1, we pool together all shareholder proposals and, in column 2, we pool together all environmental proposals. Consistent with our results from Panel A, the coefficient on the triple interaction term is positive and statistically significant at the 1% level in both columns. The coefficient on the interaction between *Treated* and *Post* that, in this context, captures the voting support of treated funds for all proposals in general is not statistically significant, confirming that the effect of temperature shocks is specific to climate proposals.

Our main analysis is conducted at the proposal level. To further examine the effect of personal experience with climate change on mutual fund support for climate proposals, we also aggregate the fraction of climate proposals that a fund supports. Specifically, for each fund-quarter, we calculate the number of climate proposals the fund supports divided by the total number of climate proposals voted on by the fund. The results from Table 2, Panel C, show that fund managers exposed to abnormally hot temperatures support a significantly larger fraction of the climate proposals they vote on, consistent with our baseline findings at the proposal level. The results also confirm that the effect is specific to climate proposals because we find no evidence that funds exposed to abnormally hot temperatures support a larger fraction of the governance or other ES proposals they vote on.

3.3 Subsequent temperature shocks and persistence of the effect

The climate literature on the local warming effect shows that local recent temperatures affect people's beliefs about climate change. However, whether the exposure to abnormally hot temperatures leads to a permanent change in beliefs about climate change and quantifying

the persistence of its effect on the voting support for climate proposals remains an empirical question. In this section, we propose two tests to investigate this issue.

First, if the first exposure to abnormally hot temperatures leads to a permanent change in beliefs about climate change, subsequent exposures should have less of an effect on mutual fund voting behavior. Table 3, Panel A, presents the results of estimating Equation (2) for the sample of climate proposals where the treatment is successively defined as first, second, third, and fourth exposure to abnormally hot temperatures. Except for Column 1 which reproduces our baseline findings, the coefficient on the interaction between *Treated* and *Post* is not statistically significant, indicating that voting support for climate proposals increases the first time a fund manager is exposed to abnormally hot temperatures but not the subsequent times. These results are consistent with the exposure to abnormally hot temperatures leading to a permanent change in beliefs about climate change.

In Panel B, we seek to quantify the persistence of the effect of temperature shocks by examining voting support for climate proposals over different horizons after a fund manager is shocked. The horizon is indicated at the top of each column. For example, Column 1 considers climate proposals voted on five to eight quarters after the temperature shock and Column 4 considers climate proposals voted on seventeen to twenty quarters after the temperature shock. In all columns, the coefficient on the interaction between *Treated* and *Post* is positive and statistically significant and its magnitude is roughly similar across different horizons. These results indicate that the effect of temperature shocks on mutual fund voting behavior is quite persistent, because up to five years (20 quarters) after being exposed to abnormally hot temperatures, shocked funds remain significantly more likely than control funds to support climate proposals.

Taken together, the results from this section suggest that the exposure to abnormally hot temperatures leads to a permanent change in fund managers' beliefs about climate change and in the support they provide for climate proposals.

3.4 Firm-level climate risk

Recent studies document substantial variation in climate risk across firms and its implications for firm value (e.g., Bolton and Kacperczyk 2021; Kölbel et al. 2022; Sautner et al. 2023). Therefore, the impact of personal experience with climate change on voting support for climate proposals could differ across firms, depending on their climate risk. We expect the effect of personal experience with climate change to be stronger for climate proposals targeting firms with greater climate risk, because those firms will suffer the most from climate change. We test this hypothesis using the following three measures of climate risk:

(i) The firm-level climate change exposure developed by Sautner et al. (2023). This measure is constructed using transcripts of earnings conference calls. As Sautner et al. (2023) argue, a key benefit of using conference calls is that they are less susceptible to "greenwashing" by management. The measure captures the proportion of the conversation during the call that is centered on climate change as a measure of the firm's exposure to climate change.

(ii) The measure of climate risk (notably transition and regulatory risk) based on mandatory disclosure developed by Kölbel et al. (2022). Specifically, they use BERT, an AI-based algorithm for language understanding, to analyze 10-K reports that firms are required to file with the SEC. The measure captures whether climate-relevant risks (i.e., transition and physical risks) are mentioned in item 1.A of 10-K reports.

(iii) The ranking of industries based on Scope 1 and Scope 2 carbon emissions constructed by Ilhan et al. (2021) in their analysis of carbon tail risk.[22]

In Table 4, we examine whether the effect of exposure to abnormally hot temperatures on mutual fund voting support for climate proposals is stronger for proposals targeting firms with greater climate risk. In all columns, the dependent variable is a dummy variable equal to 1 if the mutual fund votes in favor of the proposal, and 0 otherwise. The main variable of interest is the triple interaction between *Treated*, *Post*, and *High Climate Risk*. *High*

22. In unreported tests, we find similar results if we consider the ranking of emissions intensities (i.e., Scope 1 and Scope 2 emissions divided by firm market value).

Climate Risk is a generic dummy variable equal to 1 for votes related to firms with a level of climate risk above the median. We compute it using successively the three above-mentioned measures. At the top of each column, we indicate the measure on which the *High Climate Risk* dummy is based.

The results are very similar for the three measures of climate risk. In all columns, the coefficient on the triple interaction between *Treated*, *Post*, and *High Climate Risk* is positive and statistically significant, indicating that fund managers exposed to abnormally hot temperatures are significantly more likely to vote in favor of climate proposals when firms have high climate risk.

3.5 Proposal quality

Shareholder proposals often differ in terms of their quality. For example, one of the main explanations put forward by Big-Three investors for not supporting some proposals related to climate change is that they are inappropriate or unnecessary (e.g., Azar et al. 2021). In this section, we explore whether the effect of personal experience with climate change on support for climate proposals depends on the quality of the proposal.[23] Even if they change their beliefs about climate change, fund managers exposed to abnormally hot temperatures may not support "bad" climate proposals (e.g., proposals viewed as inappropriate or unnecessary).

We use two proxies for the quality of the proposal. The first is whether ISS recommends voting in favor of the proposal. The second is whether the aggregate support from all mutual funds received by the proposal is above the median. Using these two proxies, we examine whether the effect of abnormally hot temperatures on mutual fund support for climate proposals is significantly stronger for "high-quality" proposals. The results are reported in Table 5. The main variable of interest is the triple interaction between *Treated*, *Post*, and one of our proxies for proposal quality (i.e., *Positive ISS Reco.* in Column 1 and *High Aggregate Support* in Column 2). In both columns, we find that the coefficient on the triple interaction

23. Note that in all regressions, we include (within each cohort) proposal fixed effects that control for the quality of the proposal.

term is positive and statistically significant at the 1% level, indicating that fund managers exposed to abnormally hot temperatures are significantly more likely to vote in favor of climate proposals when they are of good quality.

Recent evidence indicates that the aggregate support for ES proposals contains information about the ES risks that firms face (He et al. 2023). From this perspective, the result from Column 2 further indicates that voting support is stronger for proposals targeting firms with greater climate risk.

3.6 Indexers versus non-indexers

Besides increasing their support for climate proposals, fund managers who have been exposed to abnormally hot temperatures may change their portfolio holdings (e.g., selling stocks of firms with greater exposure to climate change).[24] However, this exit option mainly exists for active investors and not for passive index funds that hold diversified portfolios and do not actively buy and sell stocks (Appel, Gormley, and Keim 2016; Azar et al. 2021). As a result, the main option of index-fund managers is to voice their concerns related to climate change. We therefore expect the change in voting support for climate proposals following the exposure to abnormally hot temperatures to be stronger for managers of index funds.

We identify indexers using CRSP mutual fund flags and define as indexers funds with the following flags: "Index-based fund," "Pure index fund," or "E-Index fund enhanced." Alternatively, we extend the definition of indexers to all ETF funds using the CRSP ETF flag. Using these two proxies, we examine whether the effect of abnormally hot temperatures on mutual fund support for climate proposals is significantly stronger for index funds. Table 6 reports the results. The main variable of interest is the triple interaction between *Treated*, *Post*, and *Indexer*. In both columns, we find that the coefficient on the triple interaction term is positive and statistically significant at the 1% level, indicating that managers of index funds exposed to abnormally hot temperatures are significantly more likely than other

24. In section 3.10, we provide evidence that funds exposed to abnormally hot temperatures reduce their stock holdings of firms with greater climate change exposure.

shocked funds to vote in favor of climate proposals. This result is consistent with the prediction that the voice channel should be particularly important for managers of index funds who do not have the option to vote with their feet.

3.7 The role of prior awareness regarding climate change

In this section, we explore how prior awareness of climate change affects fund managers' response to personal experience with climate change. For climate-conscious investors, the exposure to abnormally hot temperatures is less likely to act as a shock raising awareness regarding climate issues and to trigger a change in the support they provide for climate proposals.

We test this prediction using three characteristics that are likely to be related to fund managers' attitudes toward climate change : (i) managers of environmentally friendly funds, (ii) fund managers located in areas more receptive to scientific evidence on climate change, (iii) managers of funds exhibiting high past support for environmental or climate proposals.

Following He et al. (2023) and Michaely et al. (2021), we classify a fund as an environmentally friendly fund (E fund) if its name contains a string that identifies it as an environmentally responsible fund.[25] Regarding our second proxy, we use new publicly available data from the Yale Program on Climate Change Communication. This dataset captures the significant geographic variation of beliefs toward climate change documented and provided by Howe et al. (2015).[26] Based on the data provided by the authors, we aggregate, at the state level, the percentage of the population who believe climate change is happening. Regarding our third proxy, we capture the tendency of a fund to already support environmental

25. He et al. (2023) and Michaely et al. (2021) both examine ES funds. Given the particular focus of our paper, we seek to identify funds that are explicitly environmentally responsible. Following Michaely et al. (2021), we start with fund names containing one of following keyword: "green", "low carbon target", "clean", "climate", "ecology", "environment", "wind energy", and "solar energy". We then manually screen the funds and drop those that comply with the screening but do not pursue an environmental investment strategy. We identify few unique environmentally friendly funds in our initial sample, i.e., 45 unique funds, and even fewer that we can use in our stacked regressions with clean controls, i.e., 3 unique funds.

26. The data are available for the year 2016 and are obtained from the following website: http://climatecommunication.yale.edu/visualizationsdata/ycom-us-2016/.

(climate) proposals as follows. For each environmental (climate) proposal, we compute the average support it receives. We then compute the abnormal support of a fund for such a proposal as the deviation between its support and the average support. We then average the abnormal support for environmental (climate) proposals at the fund level over the previous year. Finally, we define funds that already have a tendency to support more environmental (climate) proposals as those whose average abnormal support is above the median.

The first two proxies are fund characteristics that are likely to be related to climate consciousness; however, they suffer from potential caveats. First, only a very small fraction of funds are environmentally friendly based on fund names. Second, the use of our second proxy relies on the implicit assumption that a fund manager's beliefs about climate change are similar to the beliefs of the average citizen living in the same county. The third proxy captures more directly funds that already have a greater tendency to support climate proposals, regardless of the motivation or fund characteristics that could drive this support.

In Table 7, we examine whether the effect of exposure to abnormally hot temperatures on mutual fund voting support for climate proposals is less pronounced for fund managers with greater prior awareness of climate change. In all columns, the dependent variable is a dummy variable equal to 1 if the mutual fund votes in favor of the proposal, and 0 otherwise. The main variable of interest is the triple interaction between *Treated*, *Post*, and *High Prior Awareness*, a generic dummy variable equal to 1 for fund managers with greater awareness of climate change. The *High Prior Awareness* dummy is computed using successively the three above-mentioned proxies. Specifically, in Column 1, *High Prior Awareness* is equal to 1 for environmentally-friendly funds. In Column 2, *High Prior Awareness* is equal to 1 if the mutual fund is located in an area where the percentage of county residents who believe climate change is happening is above the median of the distribution. In Column 3 (4), *High Prior Awareness* is equal to 1 if the fund's abnormal historical support for environmental (climate) proposals is above the median.

In all regressions, as in the baseline regression, the coefficient on the interaction between

Treated and *Post* is positive and statistically significant at the 1% level. However, the coefficient on the triple interaction between *Treated*, *Post*, and *High Prior Awareness* is negative in all regressions, although statistically significant only in Columns 3 and 4, indicating that fund managers with greater prior awareness of climate change are less likely to change their voting support for climate proposals after being exposed to abnormally hot temperatures. For example, according to Column 4, following the exposure to abnormally hot temperatures, the likelihood to support climate proposals increases by 15.3% for the average fund in our sample but only by 5.7% for funds with high historical support for climate proposals.

Overall, we observe an important heterogeneity in the voting patterns of shocked funds that depends on firms' climate risk, proposal quality, and funds' prior support for climate proposals or funds' investment strategy. It indicates that fund managers do not uniformly and equally support all climate proposals after being exposed to abnormally hot temperatures.

3.8 Robustness tests

In this section, we present empirical tests we have conducted to assess the robustness of our main results. All the tests are reported in Appendix A4.

First, individual mutual funds are often located in the same area as their family, which implies that our baseline definition of a temperature shock may also capture the effect of the temperature shocks on the fund family and the consequent changes in the family voting policies. To address this concern, in Column 1, we change the treatment definition and consider that treated funds are funds that have been exposed to abnormally hot temperatures while their family has not.[27] The results show that the coefficient on the interaction term is positive and statistically significant, indicating that when a fund, but not its family is exposed to abnormally hot temperatures, the fund remains more likely to support climate

27. We use the business address reported by the SEC to identify the localization of the fund-family headquarters. We drop instances where only one single individual fund is voting on a given proposal for a given family.

proposals. In Columns 2 and 3, we show that our main result holds if we add cohort-family-time fixed effects and cohort-family-proposal fixed effects, respectively, which capture general guidelines that fund families could provide to individual funds.

Second, firms may also be exposed to abnormally hot temperatures, which may affect their earnings (e.g., Addoum, Ng, and Ortiz-Bobea 2023). In this case, disentangling whether the greater voting support for climate proposals is due to the fund's exposure or to the firm's exposure to abnormally hot temperatures is impossible. In Column 4, we therefore check that our results hold if we drop observations for which the firm has been exposed to abnormally hot temperatures.

Third, given our stacked regression empirical design, we cluster standard errors by cohort-fund and cohort-proposal. A common approach is to cluster standard errors at the fund-level (e.g., He et al. 2023; Iliev and Lowry 2015). In Columns 5 and 6, we therefore cluster standard errors by cohort-fund only and cohort-proposal only, respectively. Our results are robust to these alternative clusterings of the standard errors.

Fourth, time-varying unobservable variables at the fund level may affect fund managers' voting behavior in different years. To better take into account these factors and strengthen identification, in Column 7, we further control for Cohort $\times$ Fund $\times$ Year fixed effects. Moreover, because our shocks are associated with the city where the fund is headquartered, they could also be related to other local trends. To address this issue, in Column 8, we add Cohort $\times$ State $\times$ Year fixed effects. Our results are robust to the inclusion of these additional fixed effects. In Column 9, we further control for the average expense ratio and the average management fees. Our main results remain unchanged.

Finally, in Column 10, we examine whether funds that have been exposed to abnormally cold temperatures change their voting support for climate proposals as a sort of placebo test. Abnormally cold temperatures are unkikely to lead fund managers, who are aware of climate change and its consequences, to revise their beliefs downwards. If anything, abnormally cold temperatures may comfort climate-change skeptics in the view that climate change does not

happen, but climate-change skeptic fund managers are unlikely to provide strong support for climate proposals to start with. The coefficient on the interaction between *Treated* and *Post* is not statistically significant, indicating that fund managers do not change their voting support for climate proposals after being exposed to abnormally cold temperatures.

3.9 Voting outcome

In this section, we examine the implications of our results for the outcome of climate proposals. As explained by He et al. (2023), ES proposals are unique in that they nearly always fail.[28] However, the aggregate voting support matters and in particular, contributes to the pressure on companies to act on climate issues (e.g., Grewal et al. 2016; He et al. 2023). We therefore focus on the aggregate support that climate proposals receive. More formally, we estimate the following equation:

$$\begin{aligned} Aggregate\ Support_{ipt} = \beta_0 + \beta_1 WMean\ Shocked\ Funds_{it} + \Gamma_1 Firm\ Controls_{it} \\ + \Gamma_2 Proposal\ \ Controls_{ip} + T_t + F_i + C_p \end{aligned} \tag{3}$$

where *Aggregate Support* is the fraction of votes in favor that proposal p in firm i receives in year-quarter t. *WMean Shocked Fund* is the share-weighted fraction of mutual funds exposed to abnormally hot temperatures for the first time over the last three years. Because the ownership stake is missing for some mutual funds, we also consider *Mean Shocked Fund*, the fraction of the number of mutual funds exposed to abnormally hot temperatures for the first time over the last three years to the total number of mutual funds in the firm's ownership. We control for several firm- and proposal-level variables. Controls at the proposal level include dummies for whether the firm management recommends voting in favor of the proposal. We also control for firm-level variables that may influence the outcome of the proposal (see Denes, Karpoff, and McWilliams (2017) for a review). Specifically, we control for size, profitability, and leverage. Finally, we include firm, ISS proposal category code, and year-quarter fixed effects.

28. In the sample, about 4% (5%) of the ES (climate) proposals pass.

Table 8, Columns 1 and 5, present the regression results of the estimation of Equation (3) for the sample of climate proposals. The results show that the aggregate voting support for a climate proposal is significantly larger when a greater fraction (either share-weighted or equally-weighted) of mutual funds are exposed to abnormally hot temperatures. Based on Column 1, a one-standard-deviation increase in the fraction of mutual funds exposed to abnormally hot temperatures (+19%) is associated with an increase of 7.6 (0.19×0.40) percentage points in the aggregate voting support. It represents 45% of a standard deviation in aggregate voting support for climate proposals.

To ensure that the effect is specific to climate proposals, we also estimate Equation (3) for other ES proposals (Columns 2 and 6), non-climate environmental proposals (Columns 3 and 7) and governance proposals (Columns 4 and 8). The results show that the fraction (either share-weighted or equally-weighted) of mutual funds exposed to abnormally hot temperatures is not associated with the aggregate voting support for these types of proposals. Overall, the results from Table 8 confirm that the role personal experience with climate change plays is specific to shareholder voice on climate issues and results in greater aggregate support for climate proposals, thereby increasing pressure on management to take action on climate issues.

3.10 Exit

Besides a change in mutual fund voting behavior on climate issues, personal experience with climate change may also have an effect on their portfolio holdings. Specifically, if fund managers exposed to abnormally hot temperatures revise their beliefs about climate change and its consequences, they may reduce their holdings of stocks with greater exposure to climate change. We test this prediction using the measure of firm-level climate change exposure developed by Sautner et al. (2023). More precisely, at the fund level, we compute the change in the holdings of stocks of firms with greater climate change exposure (i.e., above the median). The results are reported in Table 9, Panel A. In Column 1, we observe that the

coefficient on the interaction between *Treated* and *Post* is positive and significant, indicating that funds exposed to abnormally hot temperatures significantly reduce their stock-holding in firms with greater exposure to climate change. This finding is consistent with the idea that on top of voicing their concerns about climate change through greater support for climate proposals, some investors also vote with their feet by divesting from companies with greater exposure to climate change.

In Columns 2 and 3, we estimate the regression from Column 1 separately for indexers and non-indexers. Unsurprisingly, we find that only non-indexers significantly reduce their holdings in stocks with greater climate change exposure after being exposed to abnormally hot temperatures. Combined with our results from section 3.6 showing that indexers are significantly more likely than other funds to increase their support for climate proposals, the results confirm that the only option for index funds to express their concerns related to climate change is through their support for climate proposals.

In Panel B, we consider a value-weighted change in holdings of stocks with greater exposure to climate change (i.e., the change in holdings are weighted by the value of the stocks in the portfolio). The results confirm that fund managers exposed to abnormally hot temperatures are more likely to divest from stocks with greater climate change exposure.

Recent studies focus on the relative merits and efficiency of voice versus exit related to ES issues (e.g., Dimson et al. 2021; Edmans et al. 2022; Gantchev et al. 2022; He et al. 2023; Krueger et al. 2020; Lowry et al. 2022), we provide evidence that both channels are at play for fund managers who have been exposed to abnormally hot temperatures. We further show that the voice channel is more important for index funds that cannot vote with their feet by divesting from stocks with greater climate change exposure.

4 Conclusion

This paper studies how mutual fund managers' personal experience with climate change affects their voting behavior on climate proposals. We find that mutual fund managers exposed to abnormally hot temperatures are significantly more likely to vote in favor of climate proposals. These results are robust to a stringent set of fixed effects. Moreover, because the exposure to abnormally hot temperatures increases voting support for climate proposals but not for other types of shareholder proposals, our results are unlikely to be due to omitted factors.

Support for climate proposals following the exposure to abnormally hot temperatures does not increase in an undifferentiated way but is significantly more pronounced for proposals targeting firms with greater climate risk, for proposals of better quality, and for fund managers with a lower historical tendency to support climate proposals. We also show that fund managers' personal experience matters for the aggregate support of climate proposals. The aggregate support received is substantially higher when the fraction of mutual funds exposed to abnormally hot temperatures is high.

Finally, we also find evidence that the exposure to abnormally hot temperatures causes fund managers, especially those of non-index funds, to divest from stocks of firms with greater exposure to climate change. This finding suggests that the exposure to abnormally hot temperatures has implications both for voice and exit related to climate issues.

Overall, our study sheds light on the role personal experience with climate change plays in shareholder voice (and exit) on climate issues. The accumulation of scientific evidence such as IPCC reports and warnings may be insufficient in pushing market participants to consider climate change. Our results suggest that, for some fund managers, the exposure to abnormally hot temperature is an effective wake-up call leading investors to revise their perceptions about climate change and the associated risks.

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Figure 1. Number of unique ES and climate proposals per year

This figure reports the number of unique ES shareholder proposals and the number of unique climate-change-related shareholder proposals by year over our sample period (2006-2022).

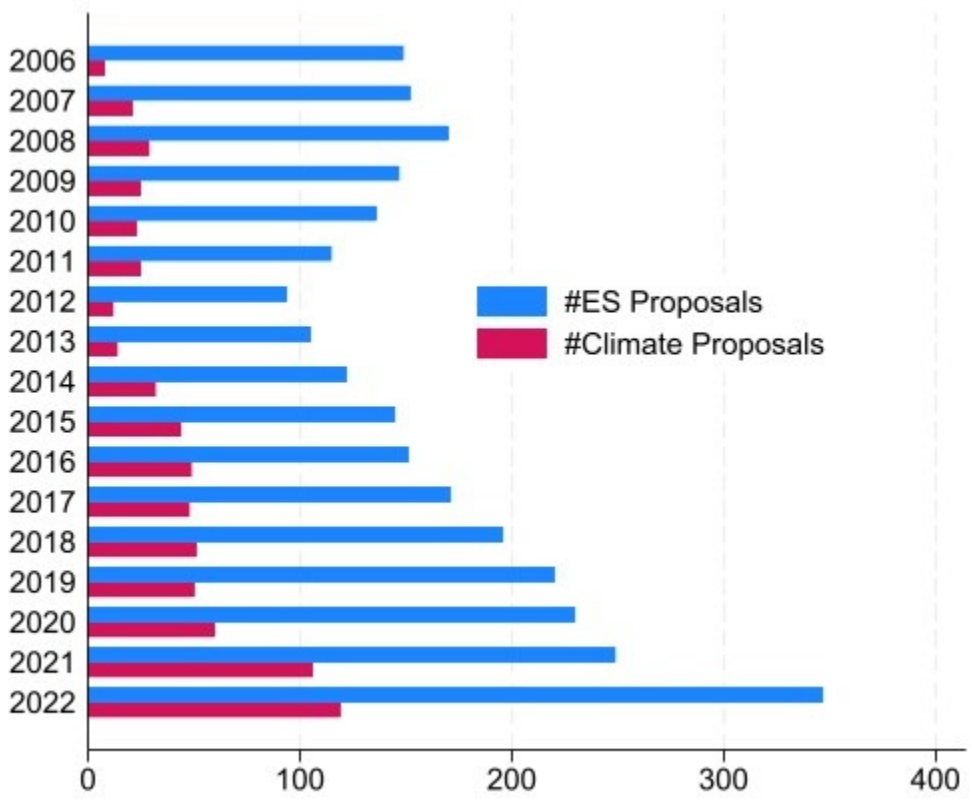

Figure 2. Number of unique first-time-shocked funds over time

This figure reports the number of unique funds shocked for the first time over the period 2006-2022, on a quarterly basis. A fund is shocked when it has been exposed to a quarterly abnormally hot temperature greater than or equal to 2°C. Quarters for which no funds are shocked for the first time are omitted.

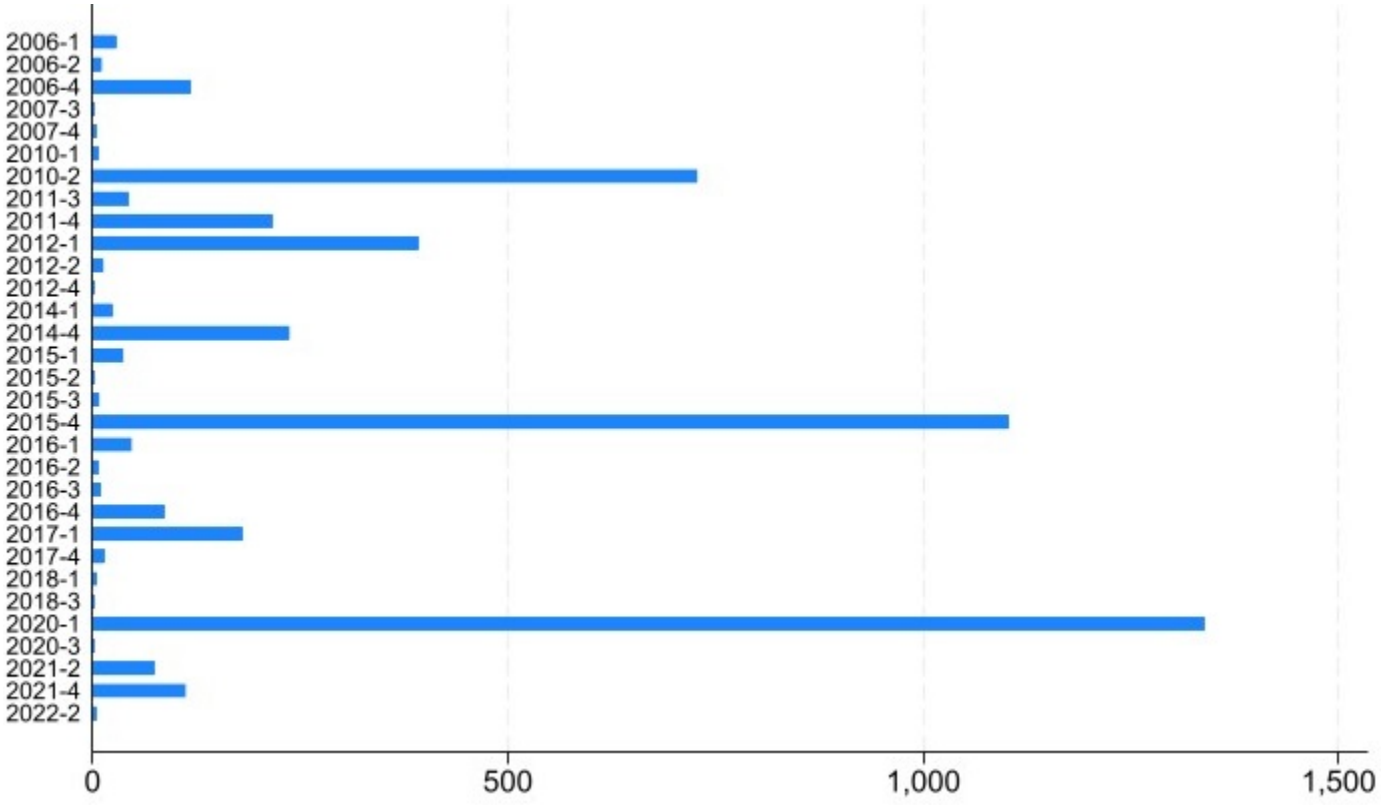

Figure 3. Stacked-regression cohorts on climate proposal voting

This figure reports the number of fund votes on climate proposals by treated and control funds in each cohort (as well as the year and quarter of the temperature shocks for treated funds). Each cohort includes the votes on climate proposals cast by treated and control funds in the four quarters before the quarter of the shock and in the four quarters following the quarter of the shock. Included cohorts are those for which at least 1% of the fund votes are cast by shocked funds. A fund is shocked when it is exposed, for the first time over 2006-2022, to a quarterly abnormally hot temperature greater than or equal to 2°C.

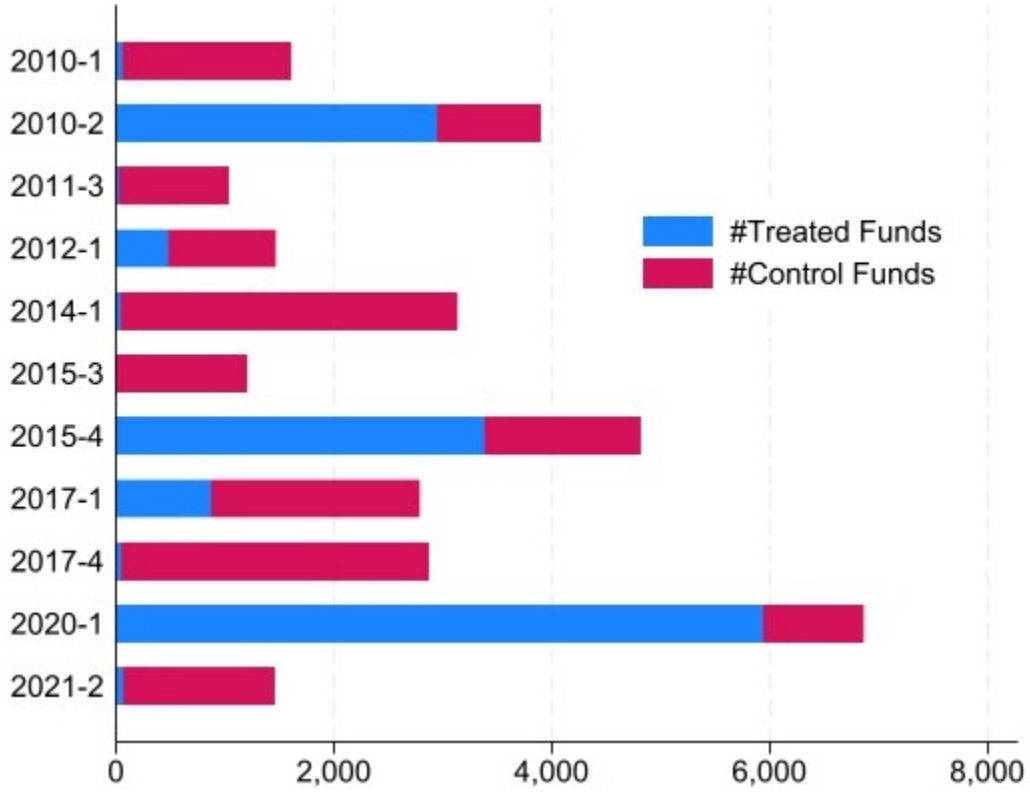

Table 1. Summary statistics

This table provides the summary statistics for our initial sample of fund votes on shareholder proposals over the period 2006-2022. The variables are defined in Appendix A3.

Variables	#Obs.	Mean	S.D.	0.25	Mdn	0.75
Vote For (%)	2,565,514	39.59	48.90	0.00	0.00	100.00
Climate Proposal	2,565,514	0.05	0.22	0.00	0.00	0.00
ES Proposal	2,565,514	0.24	0.43	0.00	0.00	0.00
E Proposal	2,565,514	0.09	0.29	0.00	0.00	0.00
S Proposal	2,565,514	0.15	0.36	0.00	0.00	0.00
Gov. Proposal	2,565,514	0.76	0.43	1.00	1.00	1.00
Ln(TNA)	2,547,148	6.49	2.34	4.91	6.52	8.09
Avg. Turnover Ratio	2,565,514	0.66	1.00	0.13	0.36	0.77
Avg. Expense Ratio (%)	2,537,911	0.67	0.49	0.24	0.61	1.00
Avg. Management Fee (%)	2,547,148	0.40	0.41	0.15	0.40	0.65
Quarterly Temperature (C°)	2,565,514	15.77	4.77	14.44	16.52	17.97
Quarterly Abnormal Temperature (C°)	2,565,514	0.18	0.98	-0.41	0.08	0.70
Climate Change Exposure (x1000)	1,949,785	1.27	2.89	0.16	0.37	0.96
Ranking Scope 1&2 Emissions	2,004,491	23.05	13.56	15.00	21.00	36.00
Climate Risk	823,830	0.11	0.15	0.00	0.05	0.14
Climate Fund Flag	2,565,513	0.00	0.06	0.00	0.00	0.00
Climate Change Attitude (%)	2,255,101	72.07	5.18	68.33	72.31	76.75
Indexer Dummy	2,565,514	0.48	0.50	0.00	0.00	1.00
Aggregate Proposal Support	2,110,152	0.31	0.22	0.13	0.29	0.42
Positive ISS Recommendation	1,365,086	0.68	0.47	0.00	1.00	1.00

Table 2. Temperature shocks and voting on climate proposals

This table reports the stacked difference-in-differences estimates of the effect of abnormally hot temperature shocks on mutual fund voting for climate proposals. Each cohort includes treated votes on shareholder proposals by treated and control funds. We stack the cohorts together in an OLS regression that includes cohort-fund fixed effects and cohort-proposal fixed effects. The dependent variable, *Vote For*, is a dummy variable equal to 1 if the fund votes in favor of the proposal. *Treated* is a dummy variable equal to 1 if a fund experiences, for the first time, a quarterly abnormally hot temperature greater than 2°C. *Post* is equal to 0 in the four quarters preceding the quarter of the shock and equal to 1 in the four quarters following the quarter of the shock. Panel A, Columns 1 to 4, report the estimation results for different subsets of shareholder proposals. We consider all shareholder proposals (Column 1), environmental proposals (Column 2), climate proposals (Column 3), and environmental proposals not related to climate (Column 4). In Panel B, we pool together climate proposals and all other shareholder proposals (Column 1) or climate proposals and other E proposals (Column 2) and include a triple-interaction term *Treated* × *Post* × *Climate Proposal*. Panel C reports the stacked difference-in-differences estimates of the effect of abnormally hot temperature shocks on the fraction of shareholder proposals supported by the fund in a given year-quarter. The dependent variable, *Average Support*, is the ratio of the number of proposals on a given topic that the fund supports divided by the total number of proposals on the topic voted by the fund. Columns 1 to 4 report the results for Governance proposals, ES proposals not related to climate, E proposals not related to climate, and climate proposals, respectively. Standard errors are robust to heteroskedasticity, clustered either by cohort-fund and cohort-proposal (Panels A & B) or cohort-fund and cohort-year-quarter (Panel C), and reported below in parentheses. Constant terms are not reported. ***, **, and * refer to significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Baseline results

Vote For (%)	All proposals	E proposals	Climate proposals	E but not climate proposals
Treated × Post	0.396	6.414***	11.155***	1.377
	(0.973)	(1.778)	(2.245)	(2.182)
Ln(TNA)	-0.639	-0.939	-0.057	-1.664*
	(0.432)	(0.765)	(1.065)	(0.872)
Avg. Turnover Ratio	0.698	0.761	1.112	0.064
	(0.957)	(1.105)	(1.549)	(1.043)
#Obs.	822,613	67,974	30,797	32,108
Cohort-Fund Fixed Effects	Yes	Yes	Yes	Yes
Cohort-Proposal Fixed Effects	Yes	Yes	Yes	Yes
R^2	0.603	0.625	0.634	0.653

Panel B. Interactions

Vote For (%)	(1) Climate proposals vs. all other proposals	(2) Climate proposals vs. all other E proposals
Treated × Post	0.019	1.919
	(0.977)	(2.201)
Treated × Post × Climate Proposal	7.542***	9.184***
	(1.995)	(2.675)
#Obs.	822,613	67,974
Controls as in Table 2, Panel A	Yes	Yes
Cohort-Fund Fixed Effects	Yes	Yes
Cohort-Proposal Fixed Effects	Yes	Yes
R^2	0.603	0.626

Panel C. Fund-level stacked regressions

Average Support	(1) Governance proposals	(2) ES but not climate proposals	(3) E but not climate proposals	(4) Climate proposals
Treated × Post	-1.039	0.289	1.656	8.514***
	(1.358)	(1.450)	(2.254)	(2.215)
Ln(TNA)	-0.621	0.086	-1.691	1.238
	(0.545)	(0.639)	(1.160)	(1.039)
Avg. Turnover Ratio	1.033	-0.109	-0.756	-0.330
	(0.917)	(0.851)	(1.162)	(1.545)
#Obs.	26,419	16,798	8,896	6,678
Cohort-Fund Fixed Effects	Yes	Yes	Yes	Yes
Cohort-YQ Fixed Effects	Yes	Yes	Yes	Yes
R^2	0.612	0.706	0.772	0.726

Table 3. Persistence of the effect

This table reports the results of stacked difference-in-differences estimates of the effect of abnormally hot temperature shocks on mutual fund voting support for climate proposals. Panel A, columns 1 to 4 report the results of our baseline regression (Table 2, Panel A, column 3) when the treatment is successively defined as first (baseline), second, third, and fourth exposures to abnormally hot temperatures. Panel B, Columns 1 to 4, report the results of our baseline regression (Table 2, Panel A, column 3) when considering different horizons after a fund manager is exposed to abnormally hot temperatures. The horizon is indicated at the top of each column. Standard errors are robust to heteroskedasticity, clustered by cohort-fund and cohort-proposal, and reported below in parentheses. Constant terms are not reported. ***, **, and * refer to significance at the 1%, 5%, and 10% levels, respectively.

Panel A. First shock vs. following shocks

Vote For (%)	First shock	Second shock	Third shock	Fourth shock
Treated × Post	11.155***	-0.942	0.782	1.011
	(2.245)	(2.511)	(2.368)	(2.480)
#Obs.	30,797	20,974	17,163	11,703
Controls as in Table 2, Panel A	Yes	Yes	Yes	Yes
Cohort-Fund Fixed Effects	Yes	Yes	Yes	Yes
Cohort-Proposal Fixed Effects	Yes	Yes	Yes	Yes
R^2	0.634	0.666	0.632	0.656

Panel B. Long-term effect of the temperature shocks

Vote For (%)	t+5 to t+8	t+9 to t+12	t+13 to t+16	t+17 to t+20
Treated × Post	9.930***	8.245***	10.114**	9.305***
	(2.319)	(2.879)	(4.173)	(3.452)
#Obs.	20,539	20,943	13,137	10,343
Controls as in Table 2, Panel A	Yes	Yes	Yes	Yes
Cohort-Fund Fixed Effects	Yes	Yes	Yes	Yes
Cohort-Proposal Fixed Effects	Yes	Yes	Yes	Yes
R^2	0.648	0.659	0.687	0.666

Table 4. Firm-level climate risk

This table reports the stacked difference-in-differences estimates of the effect of abnormally hot temperature shocks on mutual fund voting support for climate proposals conditional on firm-level climate risk. The main variable of interest is the triple interaction *Treat* × *Post* × *High Climate Risk*, where *High Climate Risk* is a dummy variable equal to 1 for proposals targeting firms with high climate risk (i.e., above the median). The measure of climate risk used is indicated at the top of each column. Standard errors are robust to heteroskedasticity, clustered by cohort-fund and cohort-proposal, and reported below in parentheses. Constant terms are not reported. ***, **, and * refer to significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
	Climate Change Exposure	Emission Ranking Scope 1&2	Climate Risk Mean
Vote For (%)	Sautner et al. (2023)	Ilhan et al. (2021)	Kolbel et al. (2022)
Treated x Post	3.565	7.304**	1.864
	(4.300)	(3.201)	(5.267)
Treated x Post x High Climate Risk	12.008**	8.039**	11.280*
	(4.663)	(3.914)	(5.837)
#Obs.	23,454	23,697	14,736
Controls as in Table 2, Panel A	Yes	Yes	Yes
Other Interaction Terms	Yes	Yes	Yes
Cohort-Fund Fixed Effects	Yes	Yes	Yes
Cohort-Proposal Fixed Effects	Yes	Yes	Yes
R^2	0.638	0.637	0.617

Table 5. Proposal quality

This table reports the stacked difference-in-differences estimates of the effect of abnormally hot temperature shocks on mutual fund voting support for climate proposals conditional on proposal quality. The main variable of interest is the triple interaction *Treat* × *Post* × *High proposal quality*. In Column 1, we measure proposal quality based on whether the proposal has a positive ISS recommendation. In Column 2, we measure proposal quality based on whether the aggregate voting support the proposal receives from all mutual funds is above the median. Standard errors are robust to heteroskedasticity, clustered by cohort-fund and cohort-proposal, and reported below in parentheses. Constant terms are not reported. ***, **, and * refer to significance at the 1%, 5%, and 10% levels, respectively.

Vote For (%)	(1)	(2)
Treated × Post	3.894	6.687**
	(2.570)	(2.602)
Treated × Post × ISS Positive Reco.	15.008***	
	(5.036)	
Treated × Post × High Aggregate Support		13.324***
		(4.360)
#Obs.	19,844	25,124
Controls as in Table 2, Panel A	Yes	Yes
Other Interaction Terms	Yes	Yes
Cohort-Fund Fixed Effects	Yes	Yes
Cohort-Proposal Fixed Effects	Yes	Yes
R^2	0.623	0.640

Table 6. Indexers

This table reports the stacked difference-in-differences estimates of the effect of abnormally hot temperature shocks on mutual fund voting support for climate proposals conditional on whether funds are indexers. The main variable of interest is the triple interaction between *Treat*, *Post*, and a dummy variable coding for whether the fund is an indexer (Column 1) or whether the fund is an indexer or an ETF (Column 2). Standard errors are robust to heteroskedasticity, clustered by cohort-fund and cohort-proposal, and reported below in parentheses. Constant terms are not reported. ***, **, and * refer to significance at the 1%, 5%, and 10% levels, respectively.

Vote For (%)	(1)	(2)
Treated × Post	7.571***	7.999***
	(2.082)	(2.110)
Treated × Post × Indexer	9.407***	
	(3.113)	
Treated × Post × Indexer & ETFs		8.394***
		(3.079)
#Obs.	30,797	30,797
Controls as in Table 2, Panel A	Yes	Yes
Other Interaction Terms	Yes	Yes
Cohort-Fund Fixed Effects	Yes	Yes
Cohort-Proposal Fixed Effects	Yes	Yes
R^2	0.635	0.635

Table 7. Prior awareness of climate change

This table reports the stacked difference-in-differences estimates of the effect of abnormally hot temperature shocks on mutual fund voting support for climate proposals conditional on funds' prior awareness of climate change. The main variable of interest is the triple interaction *Treat* × *Post* × *Prior Awareness*. *Prior Awareness* is a generic dummy variable equal to one for funds with greater awareness of climate change and is successively computed using four different proxies. The proxies are indicated at the top of each column. Standard errors are robust to heteroskedasticity, clustered by cohort-fund and cohort-proposal, and reported below in parentheses. Constant terms are not reported. ***, **, and * refer to significance at the 1%, 5%, and 10% levels, respectively.

Vote For (%)	(1) Environment-friendly funds based on fund names	(2) Located in a state with a strong belief in global warming	(3) Strong past support for environmental proposals	(4) Strong past support for climate proposals
Treated × Post	11.196***	11.849***	14.967***	15.372***
	(2.248)	(3.267)	(3.122)	(3.080)
Treated × Post × Prior Awareness	-3.849	-1.480	-8.834**	-9.602**
	(16.270)	(4.386)	(4.450)	(4.465)
#Obs.	30,797	30,797	30,797	30,797
Controls as in Table 2, Panel A	Yes	Yes	Yes	Yes
Other Interaction Terms	Yes	Yes	Yes	Yes
Cohort-Fund Fixed Effects	Yes	Yes	Yes	Yes
Cohort-Proposal Fixed Effects	Yes	Yes	Yes	Yes
R^2	0.634	0.634	0.639	0.637

Table 8. Voting outcome

This table reports estimates of the aggregate voting support a proposal receives on the fraction of mutual funds exposed to abnormally hot temperatures. The dependent variable, *% Favorable Votes*, is the proportion of favorable votes the proposal receives. The main independent variable, *Mean Shocked Funds*, is the proportion of the voting funds that have been shocked for the first time over the last three years. Columns 1 to 4 report the results for climate proposals, ES proposals not related to climate, E proposals not related to climate, and governance proposals, respectively. All regressions include time (year-quarter), firm, and proposal-category-code fixed effects. Columns 5 to 8 report the same results but replacing *Mean Shocked Funds* by the share-weighted proportion of shocked funds, *WMean Shocked Funds*. Standard errors are robust to heteroskedasticity, clustered by time (year-quarter) and ISS proposal category code, and reported below in parentheses. Constant terms are not reported. ***, **, and * refer to significance at the 1%, 5%, and 10% levels, respectively.

% Favorable Votes	(1) Climate proposals	(2) ES but not climate proposals	(3) E but not climate proposals	(4) Governance proposals	(5) Climate proposals	(6) ES but not climate proposals	(7) E but not climate proposals	(8) Governance proposals
Mean Shocked Funds	0.397**	0.008	-0.104	0.090				
	(0.136)	(0.190)	(0.073)	(0.089)				
WMean Shocked Funds					0.112**	-0.092	-0.001	0.017
					(0.036)	(0.076)	(0.034)	(0.021)
Positive Management Reco.	0.709***	0.175	0.455**	0.304***	0.715***	0.156	0.412**	0.265***
	(0.024)	(0.126)	(0.170)	(0.044)	(0.024)	(0.108)	(0.174)	(0.055)
Firm Size	-0.014	-0.044	-0.016	-0.001	-0.031	-0.048	-0.015	-0.008
	(0.016)	(0.072)	(0.010)	(0.009)	(0.017)	(0.072)	(0.013)	(0.010)
Firm ROA	-0.264	0.367*	0.234**	0.066**	-0.160	0.395*	0.227**	0.089***
	(0.176)	(0.202)	(0.095)	(0.029)	(0.196)	(0.220)	(0.100)	(0.028)
Firm Leverage	-0.172	-0.055	0.007	0.005	-0.098	-0.075	0.001	-0.058**
	(0.146)	(0.136)	(0.054)	(0.023)	(0.173)	(0.120)	(0.056)	(0.025)
#Obs.	344	291	1,481	6,451	331	281	1,430	3,921
Year-Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Company Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ISS Category Code Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.748	0.743	0.685	0.767	0.745	0.742	0.682	0.715

Table 9. Exit

This table reports the stacked difference-in-differences estimates of the effect of abnormally hot temperature shocks on the average change in holdings of stocks with greater climate change exposure (i.e., above the median) measured using Sautner et al. (2023). Observations are at the cohort-fund-year-quarter level. The dependent variable, *% Change in Shares Held*, is the quarterly average change in the shares held. The main independent variable is the interaction between *Treated*, *Post*. Panel A reports the results based on the raw percentage change in shares. Panel B reports the results based on the value-weighted percentage change in shares (i.e., percentage changes in shares weighted by the value of the stock in the portfolio). Standard errors are robust to heteroskedasticity, clustered by cohort-fund and cohort-year-quarter, and reported below in parentheses. Constant terms are not reported. ***, **, and * refer to significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Quarterly percentage change in shares held

	(1) Avg. % Change in Shares Held	(2) Avg. % Change in Shares Held for Non-Indexers Only	(3) Avg. % Change in Shares Held for Indexers Only
Treated × Post	-5.215*	-7.354**	0.532
	(2.815)	(3.414)	(6.432)
#Obs.	10,907	5,278	5,593
Fund Controls	Yes	Yes	Yes
Cohort-Fund Fixed Effects	Yes	Yes	Yes
Cohort-Year-Quarter Fixed Effects	Yes	Yes	Yes
R^2	0.340	0.370	0.342

Panel B. Quarterly value-weighted percentage change in shares held

	(1) Avg. % Change in Shares Held	(2) Avg. % Change in Shares Held for Non-Indexers Only	(3) Avg. % Change in Shares Held for Indexers Only
Treated × Post	-4.774**	-5.323*	-1.134
	(2.395)	(2.776)	(5.923)
#Obs.	10,907	5,278	5,593
Fund Controls	Yes	Yes	Yes
Cohort-Fund Fixed Effects	Yes	Yes	Yes
Cohort-Year-Quarter Fixed Effects	Yes	Yes	Yes
R^2	0.329	0.350	0.336

Appendix A1. Climate-change-related shareholder proposals

Our main sample includes fund votes on shareholder proposals related to climate-change issues. We define climate-change-related shareholder proposals among the broader sample of shareholder proposals related to environmental and social issues. We follow He, Kahraman, and Lowry (2023) to identify the set of ES proposals. We identify climate proposals based either on the general type of the proposal (*AgendaGeneralDesc*) or the description of the proposals (*ItemDesc*) using a bag-of-words approach. It includes: "S0742 - Report on Climate Change", "S0743 GHG Emissions", "S0745 Climate Change Action", "S0748 Proposals Requesting Non-Binding Advisory Vote On Climate Action Plan", "S0779 Renewable Energy", "S0780 Energy Efficiency", and proposals whose category name or description includes "GLOBAL WARMING", "CLIMATE", "GHG", or "CARBON". We refine our classification by reviewing all the proposal descriptions manually and adding instances of proposal related to climate change that we would have missed using the above screening strategy within the universe of ES proposals. This table provides the list of the different ES proposal categories. The table reports the unique ISS category code (*AgendaItemID*), the title description (*AgendaGeneralDesc*), and the number of climate proposals, other environmental proposals, and social proposals environmental it entails over our sample period (2006-2022).

ISS category code	Proposal description	#E proposals not related to climate change	#Climate -change proposals	#S proposals
S0205	Establish Other Governance Board Committee	7	0	2
S0206	Establish E/S Issue Board Committee	8	2	32
S0224	Require E/S Issue Qualifications for Director Nominees	14	0	9
S0352	Company Specific-Governance Related	0	0	9
S0411	MacBride Principles	0	0	20
S0412	Human Rights Risk Assessment	0	0	73
S0414	Improve Human Rights Standards or Policies	0	0	191
S0415	Vendor Standards	0	0	3
S0416	Human Rights-Related	0	0	1
S0417	Workplace Code of Conduct	0	0	6
S0419	Report on Outsourcing	0	0	1
S0423	Operations in High-Risk Countries	0	0	27
S0425	China Principles	0	0	4
S0427	Data Security, Privacy, and Internet Issues	0	0	30
S0428	Racial Equity and/or Civil Rights Audit	0	0	26
S0429	Miscellaneous Proposal - Social	0	0	16
S0510	Link Executive Pay to Social Criteria	0	7	57
S0602	Fair Lending	0	0	15
S0703	Tobacco - Related - Miscellaneous	0	0	9
S0704	Tobacco - Related - Prepare Report	0	0	4
S0708	Toxic Emissions	3	0	0
S0709	Nuclear Power - Related	193	10	0
S0710	Facility Safety	0	0	15
S0711	Nuclear Safety	1	0	0
S0725	Weapons - Related	0	0	21
S0727	Review Foreign Military Sales	0	0	20
S0729	Review Drug Pricing or Distribution	0	0	22
S0730	Report on Environmental Policies	27	1	0
S0731	Community- Environmental Impact	132	2	0
S0732	Sever Links with Tobacco Industry	0	0	1
S0733	Reduce Tobacco Harm to Health	0	0	7
S0734	Review Tobacco Marketing	0	0	16
S0735	Health Care - Related	0	0	47
S0736	Genetically Modified Organisms (GMO)	0	0	34
S0737	Toxic Substances	2	0	0
S0738	Product Safety	0	0	51
S0740	Environmental - Related Miscellaneous	11	2	0

Appendix A1. Continued ...

ISS category code	Proposal description	#E proposals not related to climate change	#E proposals related to climate change	#S proposals
S0741	Operations in Protected Areas	7	0	0
S0742	Report on Climate Change	0	253	0
S0743	GHG Emissions	0	236	0
S0744	Hydraulic Fracturing	15	0	0
S0745	Climate Change Action	0	66	0
S0748	Non-Binding Advisory Vote On Climate Action Plan	0	12	0
S0777	Report on Sustainability	155	0	7
S0778	Wood Procurement	8	0	0
S0779	Renewable Energy	0	94	0
S0780	Energy Efficiency	0	6	0
S0781	Recycling	54	0	0
S0782	Publish Two Degree Scenario Analysis	8	0	0
S0784	Miscellaneous Proposal - Environmental	4	1	0
S0811	Adopt Sexual Orientation Anti-bias Policy	0	0	90
S0812	Report on EEO	0	0	87
S0815	Labor Issues - Discrimination and Miscellaneous	0	0	50
S0816	Holy Land Principles	0	0	23
S0817	Gender Pay Gap	0	0	62
S0818	Income Inequality	0	0	4
S0819	Workplace Sexual Harassment	0	0	3
S0890	Animal Welfare	0	0	67
S0891	Animal Testing	0	0	25
S0892	Animal Slaughter Methods	0	0	22
S0911	Anti-Social Proposal	1	21	78
S0999	Social Proposal	0	0	222

Appendix A2. Matching ISS fund series to SEC fund series

Analyzing the effect of temperature shocks on mutual fund voting requires data on mutual fund proxy voting from ISS and data on their headquarters' location from the CRSP mutual fund database. Because no unique fund identifier exists that is common to these two data sources, we follow the standard approach in the literature (e.g., Matvos and Ostrovsky 2010; Iliev and Lowry 2015). In this Appendix, we provide details regarding the matching procedure we use.

Since 2003, mutual funds have been required to report their votes on form N-PX to be submitted to the SEC. Since 2006 onward, ISS Voting Analytics has provided the N-PX accession numbers it uses. For each N-PX identifier, we retrieve the corresponding CIK from the SEC. To that end, we use the EDGAR advanced search (https://www.sec.gov/edgar/search/). More specifically, we select "N-PX" as a filing type and pass the N-PX identifier. We then retrieve the CIK identifier returned by the search engine. Once we know the CIK of the fund that has filed the N-PX, we can access the N-PX filing stored in the SEC archives using the following URL: https://www.sec.gov/Archives/edgar/data/[CIK]/[N-PXidentifierwithoutdashes]/[N-PXidentifierwithdashes]-index.html. For instance, https://www.sec.gov/Archives/edgar/data/1418144/000119312516680752/0001193125-16-680752-index.html, where *1418144* is the CIK and *000119312516680752* the N-PX identifiers. Then, in the header of the N-PX filing, we extract the list of the fund series concerned by the filing (more precisely, the fund-series names and identifiers).

Next, for each N-PX identifier, we match the fund-series names as they appear in ISS to the fund-series names as they appear in the header of the N-PX filing. We use the fuzzy-matching Stata command *matchit()* to do so (for more information, see: https://github.com/julioraffo/matchit). *Matchit()* provides a similarity score between two different text strings which ranges from 0 to 1, with 1 being perfect similarity. We drop matches with a similarity score lower than 0.7. We keep perfect matches. For matches with similarity scores below 1 but above or equal to 0.7, we validate them manually (in this group, the average similarity

score is still high, about 0.87 on average). In most cases, the match is correct, but an extra word or punctuation is present either in the ISS fund-series name or in the SEC fund-series name (such as the words "fund" or "the"). We adopt a conservative approach and drop ambiguous matches. As a result, out of 53,675 unique pairs of N-PX/ISS fund series, we drop 4,846 pairs because the similarity score is below 0.7, we keep 32,697 perfect matches, and for the remainder (similarity score between 0.7 and 1) that we manually check (16,132 pairs), we drop 1,397 pairs (i.e., we keep 91% of the matches in the remainder group).

Now that we can map an ISS fund series to its correct counterpart within the N-PX filing, we know its SEC fund-series identifier. At the end of this process, we obtain the SEC fund-series identifiers of the ISS funds for 47,443 N-PX/fund series. We then can match the N-PX/ISS fund-series pairs to their CRSP counterparts based on their common SEC fund-series identifiers.

Appendix A3. Variable definitions

Variable	Definition	Source
Aggregate Proposal Support	For a given proposal, number of "voted for" divided by the number of "voted for" + "voted against" + "voted abstain."	ISS
Avg. Expense Ratio (%)	TNA-weighted average expense ratio across the contracts of a fund series, monthly.	CRSP
Avg. Management Fee (%)	TNA-weighted average management fees across the contracts of a fund series, monthly.	CRSP
Avg. Turnover Ratio	Average turnover ratio across the contracts of a fund series, monthly.	CRSP
Climate Change Attitude (%)	For a given state and year, the estimated percentage of the individuals who think global warming is happening.	Yale Program on Climate Change Communication
Climate Change Exposure	Measure of firm-level climate change exposure developed by Sautner et al. (2023).	Sautner et al. (2023)
E Fund	Fund series that we identify as having a name aligned with an environmental investment strategy. Our screening process has two steps. First, we select all fund names that include one of the following keywords: "GREEN", "LOW CARBON", "CLEAN", "CLIMATE", "ENVIRONMENT", "ENERGY", and "TRANSITION", Then, we review the matches manually and refine the list of keywords to remove names that do not to signal a fund's environmental investment strategy. The final list of names is based on this universe of keywords: "GREEN ENERGY", "GREEN ALPHA", "LOW CARBON", "CLEAN", "CLIMATE", "ENVIRONMENT", "WIND ENERGY", "SOLAR ENERGY", and "TRANSITION"	ISS

Variable	Definition	Source
Climate Proposal	Dummy variable equal to 1 of the proposal is related to climate-change issues. We identify climate-change-related shareholder proposals based on the general type of the proposal (AgendaGeneralDesc) or on the description of the proposals (ItemDesc) using a bag-of- words approach. Climate proposals include: "S0742 Report on Climate Change", "S0743 GHG Emissions", "S0745 Climate Change Action", "S0748 Proposals Requesting Non-Binding Advisory Vote On Climate Action Plan", "S0779 Renewable Energy", "S0780 Energy Efficiency", and proposals whose category name or description includes "GLOBAL WARMING", "CLIMATE", "GHG", or "CARBON". We refine our classification by reviewing all the proposal descriptions manually and adding instances of proposal related to climate change that we would have missed using the above screening strategy within the universe of ES proposals. Appendix A1 provides the list of climate, other environmental, and social proposals.	ISS
Climate Risk Mean	Measure of firm-level climate risk developed by Koelbel et al. (2022) based on textual analysis of firms' 10-K reports.	Koelbel et al. (2022)
Indexer	Dummy variable equal to 1 if the fund is an indexer or quasi-indexer. We assign a fund to this category if the CRSP index_fund_flag is "B - Index-based fund", "D - Pure Index fund" or "E - Index fund enhanced".	CRSP
Indexer & ETF	Dummy variable equal to 1 if the fund is an indexer, quasi-indexer, or ETF. We assign a fund to this category if the CRSP $index\_fund\_flag$ is "B - Index-based fund", "D - Pure Index fund" or "E - Index fund enhanced" and if CRSP et_flag is "F - ETF".	CRSP
Ln(TNA)	Natural logarithm of total net assets under management for a given fund series, monthly.	CRSP

Variable	Definition	Source
Past Abnormal Support for Climate Proposals	Abnormal support is computed as the difference between the fund support for a climate proposal and the average support the proposal receives. At the fund level, we average the abnormal support over the last four quarters.	ISS
Past Abnormal Support for E Proposals	Abnormal support is computed as the difference between the fund support for an environmental proposal and the average support the proposal receives. At the fund level, we average the abnormal support over the last four quarters.	ISS
Positive ISS Recommendation	Dummy variable equal to one if a proposal receives positive ISS recommendation. Data are missing for 2017-2022 from ISS global files.	ISS
Quarterly Abnormal Temperature (C°)	For each station, we compute the monthly abnormal temperature as the monthly temperature in excess of the average monthly temperature over the last 120 months and the mean excess temperature recorded for this month of the year over the last 10 years. We then average the monthly abnormal temperature at the quarterly level for each station.	NOAA-GSOD
Ranking Scope 1&2 Emissions	Industry (two-digit SIC codes) ranking in terms of CO2 emissions (Scope 1 & 2) developed by Ilhan et al. (2021).	Ihlan et al. (2021)
Vote For (%)	Dummy variable equal to one if a fund votes "For" on a proposal.	ISS

Appendix A4. Robustness checks

This table reports a series of additional regressions conducted to assess the robustness of our baseline results reported in Table 2, Panel A, Column 3. ***, **, and * refer to significance at the 1%, 5%, and 10% levels, respectively.

	(1) Fund's location is shocked but not the family location	(2) Add Cohort-Family -Time fixed effects	(3) Add Cohort-Family -Proposal fixed effects	(4) Fund's location is shocked but not the firm's location	(5) SE clustered by fund-cohort only	(6) SE clustered by proposal-cohort only	(7) Add Fund-Cohort-YQ fixed effects	(8) Add State-Cohort-YQ fixed effects	(9) Include extra fund controls	(10) Abn. low temp. shock
Treated x Post	17.246***	11.155***	11.060***	12.206***	11.155***	11.155***	11.155***	11.150***	11.124***	-6.357
	(4.552)	(2.263)	(2.384)	(2.699)	(1.840)	(1.726)	(2.245)	(2.263)	(2.230)	(4.939)
Observations	19,535	30,797	30,369	25,978	30,797	30,797	30,797	30,797	30,654	23,352
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort-fund FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort-proposal FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort-fund-yq FE	No	No	No	No	No	No	Yes	No	No	No
Cohort-state-yq FE	No	No	No	No	No	No	No	Yes	No	No
R^2	0.657	0.634	0.702	0.646	0.634	0.634	0.634	0.635	0.634	0.676

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