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The effect of temperature experiences on climate adaptation policy prioritization: Evidence from the European Union

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Jonas Heckenhahn

The Effect of Temperature Experiences on Climate Adaptation Policy Prioritization: Evidence from the European Union

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Jonas Heckenhahn*

The Effect of Temperature Experiences on Climate Adaptation Policy Prioritization: Evidence from the European Union

Abstract

As climate change intensifies, societies face more frequent and severe heatwaves, while cold episodes also continue to occur. This study investigates how heat and cold anomalies and extremes influence EU citizens' support for national climate adaptation policies—both relative to mitigation measures and in absolute terms. To address these questions, this study links large-scale cross-sectional preference data from the 2024 European Investment Bank Climate Survey with high-resolution ERA5 climate data. The analyses reveal that experiencing extreme heat and positive temperature anomalies significantly increases adaptation support, especially in relative terms, aligning with the construal matching premise rooted in the psychological distance framework. In contrast, cold exposure reduces absolute adaptation support and increases people's relative mitigation focus. Overall, these findings underscore the role of temperature experiences in shaping climate policy preferences and, as extreme weather worsens globally, highlight the need for targeted climate communication that balances immediate adaptation needs with essential long-term mitigation targets.

JEL-Codes: Q54, Q58, D72, D91, R11

Keywords: Climate change, heatwaves, cold extremes, climate adaptation, climate change mitigation, climate policy preferences

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1 Introduction

As global temperatures rise due to climate change, extreme weather events—particularly heatwaves—are becoming more frequent and intense, causing considerable damage to societies worldwide (Gallagher Re 2024; Adil et al. 2025). Specifically, heatwaves trigger public health emergencies, damage crops, and increase the risk of wildfires, as witnessed, for instance, during the record-breaking southern European heatwaves of 2024 (C3S and WMO 2025). While overall cold extremes are predicted to become less frequent due to climate change, they still occur, like in North America in January 2025, and may even intensify, in some regions, entailing human health risks and placing stress on infrastructure (IPCC 2021; Cohen et al. 2021; NCEI 2025). Notably, these opposed temperature phenomena likely influence how people perceive climate risks and prioritize the different climate policy approaches—possibly in distinct and even contrasting ways.

Public climate adaptation efforts are gaining societal and political support worldwide against the backdrop of increasingly severe extreme weather events (UNFCCC 2023; EIB 2024a; UNEP 2024). These measures aim to reduce or circumvent negative climate change impacts that have already occurred or are expected to occur, or to exploit opportunities for positive effects (IPCC 2007; Hisali et al. 2011). In contrast to climate change mitigation measures, which focus on reducing global greenhouse gas emissions and constitute a global public good, public adaptation can be characterized as a club good (Nordhaus 2006; Fussler and Klein 2006). Hence, public adaptation efforts can offer more localized benefits and face less severe coordination problems. Beyond that, while mitigation decreases climate impacts only in the long-run, climate adaptation can alleviate damages already in the short-run.

Previous research has already examined how objective exposure to extreme weather and temperature anomalies, which can be considered as largely exogenous events (Egan and Mullin 2012; Dell et al. 2014), influences environmental attitudes and climate policy preferences: Drawing on high-resolution climate indicators linked to Eurobarometer and election data across 34 European countries and multiple points in time, Hoffmann et al. (2022) show that recent exposure to positive temperature anomalies, heatwaves, and dry spells significantly heightens environmental concern and increases Green party support. Lang (2014) similarly finds that hot and dry conditions lead to increased climate-related internet searches, suggesting greater interest in climate issues following extreme weather experiences, while colder-than-normal winters and springs interestingly have the same effect. Gärtner and Schoen (2021) use panel-data analyses but find no lasting impact of unusual local weather events on German

respondents' climate beliefs or policy preferences. Finally, Pfeifer and Otto (2023) report that seasonal temperature changes have only weak effects on public support for mitigation policies.

Moreover, several studies combine self-reported experiences¹ with objective data to examine how extreme weather shapes climate policy preferences. Ray et al. (2017) integrate local weather indicators with U.S. survey data and find that respondents reporting recent extreme weather experiences express modestly higher support for adaptation policies—particularly coastal development restrictions. Zanocho et al. (2019) link perceived personal harm from events like floods or hurricanes with higher support for mitigation policies and validate these perceptions using objective extreme weather measures. Finally, Demski et al. (2017) show that direct flooding experiences strengthen the salience of climate change and boost support for both personal adaptation and public mitigation, using a design that combines targeted geographic sampling with self-reported impact indicators.

Overall, there remains a gap in understanding how temperature anomalies and extremes influence relative prioritization between adaptation and mitigation. Existing research examines the effect of temperature experiences on adaptation and mitigation separately, but does not assess how such experiences shift prioritization preferences between the two. This study addresses this gap by investigating how heat and cold temperature anomalies and extremes, influence the balancing between abstract adaptation and mitigation. In addition, this study provides novel evidence on such temperature phenomena's impact on absolute adaptation policy support.

Methodologically, this study links high-resolution objective climate data with survey-based public preferences. Specifically, it draws on cross-sectional data from the European Investment Bank 2024 Climate Survey, which includes responses from 23,138 individuals across 27 EU countries (EIB 2024b, a), and ERA5 climate data provided by the European Centre for Medium-Range Weather Forecasts (Muñoz Sabater et al. 2024), allowing for precise measurement of regional temperature anomalies and extreme temperature episodes. The European Investment Bank Climate Survey provides spatially explicit preference data on adaptation-mitigation prioritization and absolute adaptation policy support, along with comprehensive sociodemographic, attitudinal and self-reported extreme weather exposure data. ERA5 reanalysis data is used to generate indicators on regional temperature anomalies and extreme heat and cold episodes (Hoffmann et al. 2022).

¹ Self-reported experiences are prone to endogeneity bias, as individuals' perceptions of harm can be influenced by, for instance, their prior climate beliefs, potentially confounding observed relationships (Sambrook et al. 2021). A prominent example of a study relying exclusively on self-reported extreme weather experience is Spence et al. (2011).

Psychological theory offers a useful lens for understanding how heat exposure influences individuals' prioritization between adaptation and mitigation. In particular, the construal matching hypothesis, rooted in the concepts of psychological distance (Spence et al. 2012) and Construal Level Theory (Liberman and Trope 2008; Trope and Liberman 2010), provides a basis for deriving behavioral expectations in this context.

Specifically, the construal premise indicates that there is a stronger association between attitudes and behaviors or policy evaluations when the level of mental abstraction in the attitude matches the level of mental abstraction regarding the action or policy. Haden et al. (2012), Brügger et al. (2015), and Heckenhahn et al. (2024) provide evidence for this effect in the climate policy domain.² Specifically, Heckenhahn et al. (2024) find that larger mentally close risk perceptions increase adaptation relative to mitigation support, whereas amplified mentally distant risk perceptions strengthen people's mitigation focus. On this basis, I hypothesize that direct personal experiences with extreme heat lead individuals to place greater emphasis on adaptation relative to mitigation policies.

My results support this hypothesis: extreme heat episodes, as well as positive temperature anomalies, increase individuals' focus on adaptation when asked to prioritize between adaptation and mitigation. Moreover, the findings show that heat exposure also raises absolute support for adaptation, whereas cold exposure reduces support for adaptation in both relative and absolute terms. Heterogeneity analyses further suggest that the positive effect of heat exposure on adaptation support is stronger in poorer or more heat-affected regions, while the effect in wealthier countries remains ambiguous.

Generally, investigating the influence of experiences with temperature anomalies and extremes is key for better understanding public climate policy preference formation and developing effective climate communication strategies. As argued by Heckenhahn et al. (2024), an increasing exposure to extreme weather may shift public support toward adaptation and, given the limited national climate policy resources, away from mitigation. There is a substantial risk that critical emission reduction efforts may lose public acceptance over time, on this basis, potentially undermining the overall intertemporal efficiency of climate policy action.

² Further support for the construal matching premise comes from studies showing that lower psychological to climate change increases adaptation—but not mitigation—support, and that personal, not global, risk perceptions drive adaptation behavior (Netzel et al. 2021; Rubio Juan and Revilla 2021). Also, local climate information promotes personal adaptation, while global information encourages policy-level responses (Halperin and Walton 2018).

2 Psychological Theory

The concept of psychological distance describes how individuals perceive events that are beyond their immediate experience (Spence et al. 2012). The concept consists of four dimensions: 1) temporal distance, which refers to when an event occurs, 2) spatial distance, concerning where an event takes place, 3) social distance, which considers to whom an event happens, and 4) hypothetical distance, addressing how likely an event is to occur. Construal Level Theory builds on this framework. Specifically, it suggests that psychologically close events are processed in a concrete, detailed manner by individuals, which is described as low-level construal. On the other hand, mentally distant events are processed in a more abstract, decontextualized way, which is described as high-level construal (Liberman and Trope 2008; Trope and Liberman 2010).

Climate risk perceptions differ in psychological distance and construal level (Spence et al. 2012; van der Linden 2015; Heckenhahn et al. 2024). Risks perceived as imminent and affecting one's immediate environment, such as an intense heatwave impacting one's home city in the next days, are psychologically close, and are, therefore, mentally processed through low-level construal. In contrast, climate risks referring to long-term, global challenges, such as global extreme heat projections for the next century, are perceived as psychologically distant and processed in a more abstract manner. Hence, these risks require high-level construal for their mental representation.

The psychological distance of climate change mitigation and public adaptation measures also plays a role in shaping policy preferences. Mitigation efforts are typically perceived as psychologically distant because their effects are both global—since no one can be excluded from their benefits—and long-term, because it takes decades for greenhouse gas emission reductions to slowdown temperature rise. As a result, they require high-level construal for their mental representation. In contrast, public adaptation measures are more immediate, can address local, short-term climate damages and yield direct, tangible benefits (Füssel and Klein 2006).³ Hence, the mental representation of public adaptation efforts typically requires low-level construal instead.

The construal matching hypothesis with regards to climate policy (Haden et al. 2012; Brügger et al. 2015; Heckenhahn et al. 2024) builds on these premises. Specifically, it states that there is a stronger link between attitudes and climate-related behaviors or policy

³ Whereas adaptation is mainly short-term, in particular when compared to mitigation strategies, it can also be long-term in principle (Füssel and Klein 2006). Examples for short-term measures include early warning systems for heatwaves or floods and improvements to public health infrastructure.

evaluations when the level of mental abstraction in the attitude is at the same level of mental abstraction as the action or policy. This means, when people hold larger mentally close climate risk perceptions, which require low-level construal, they can be assumed to favor adaptation measures, which require low-level construal as well. Conversely, when people have a larger mentally distant climate risk perception, which requires high-level construal, support for mitigation policies can be assumed to be stronger, as the policies also require high-level construal for their mental representation. On this basis, I hypothesize that direct personal experiences with extreme heat, which can be assumed to strongly influence psychologically close climate risk perceptions, increase people's focus on adaptation policies relative to mitigation policies.

3 Data

3.1 Survey data

This analysis uses survey responses from The European Investment Bank Climate Survey of 2024 (EIB 2024b, a) to study the effect of temperature experiences on the prioritization of adaptation policies relative to mitigation policies and the absolute support for adaptation policies. The survey was conducted online by the BVA Group from August 6 to August 23, 2024, collecting responses from 23,138 individuals across the 27 EU countries.⁴ It focuses on preferences regarding climate adaptation while also collecting data on a broad set of individual characteristics, including socio-demographics, general and climate-specific attitudes, and self-reported extreme weather experiences and personal damages.

Specifically, the survey includes two items that serve as the dependent variables in my analysis. The first question captures respondents' preferences regarding the prioritization between abstract national adaptation and mitigation policies by asking: "What do you think is the best way for your country to address climate change?" with four categorical response options: (1) prioritise mitigation (reducing the causes of climate change), (2) prioritise adaptation (protecting from the impact of climate change), (3) pursue adaptation and mitigation efforts with the same level of priority, or (4) none of the above. The second question measures absolute support for adaptation by asking: "Among the actions that your country must take in

⁴ Note that around 1,000 participants from the U.S. also took part in the survey. However, they were excluded from the analysis because the U.S. data lacked sufficient spatial resolution as participants were only distributed across the 50 states making it impossible to apply high-resolution regional temperature indicators. Further note that respondents were randomly selected from nationally representative panels and completed the survey via a self-administered web-based questionnaire. Finally, to ensure representativeness, the quota method was applied.

the coming years, would you say that adapting to climate change is...” with categorical response options here being: (1) a priority, (2) important but not a priority, or (3) not important.

Furthermore, the survey includes a question capturing individuals’ psychologically close climate risk perception, specifically regarding personal property damage, which is used as mediator variable in the analyses. It is based on the following question: "How concerned are you that your home (house or apartment) or your car could be damaged in the coming years due to the impact of climate change?" Respondents had four categorical response options ranging from (1) very concerned, (2) somewhat concerned, (3) not very concerned, to (4) not concerned at all.

Moreover, the survey data includes information on respondents’ place of residence. Specifically, it covers responses from participants of 302 subnational regions across the 27 EU countries, which results in an average of about 11 regions per country. Most regions are at the Nomenclature of Territorial Units for Statistics⁵ (NUTS) 3 level (47%) and 2 level (42%), with a smaller share from NUTS 1 regions (11%). Since NUTS 3 regions represent the most fine-grained administrative level, followed by NUTS 2 and 1, this distribution allows for a relatively high spatial resolution. As each survey participant is assigned to a specific NUTS region, geomatching can be applied to integrate the European Investment Bank Survey’s responses with objective temperature indicators for the respective regions derived from climate data.

3.2 Temperature data

For the development of objective regional temperature indicators, this study uses post-processed daily statistics based on the ERA5-Land reanalysis dataset provided by the European Centre for Medium-Range Weather Forecasts, which offers gridded daily mean temperature values (C3S 2024; Muñoz Sabater et al. 2024). ERA5-Land data provides a consistent reconstruction of historical land variables by replaying the land component of the ERA5 reanalysis, using atmospheric forcing derived from ERA5, which combines model simulations with observations. With a $0.1^\circ \times 0.1^\circ$ resolution, it offers relatively high-precision estimates of land surface temperature variables. For this paper, the gridded daily mean temperature data is spatially aggregated to derive daily mean temperature values for the 301 EU NUTS regions considered in the European Investment Bank Climate Survey. During this process, individual grid cells are weighted according to the proportion of their area that falls within the respective NUTS region (Hoffmann et al. 2022).

⁵ The Nomenclature of Territorial Units for Statistics is a hierarchical system developed by the European Union for dividing up the economic territory of the EU for statistical and policy purposes (Eurostat 2025b).

Based on these daily-regional mean values, I develop two types of relative temperature indicators, which have been employed by Hoffmann et al. (2022) before: Firstly, heat episode days and cold episode days, which represent extreme heat and cold exposure. Heat episode days are defined as days occurring within a period of at least three consecutive days where the mean temperature surpasses the 95th percentile of the respective month's daily mean temperature distribution of the 1990–2019 baseline period.⁶ For example, days in August 2024 are assessed against the daily temperature values recorded in August during the baseline period. Similarly, cold episode days are identified as days within at least three consecutive day-long periods where the mean temperature falls below the 5th percentile of the respective month's baseline distribution. For each region, the total number of heat and cold episode days is recorded, and period-averages are computed by dividing the number of occurring hot or cold episode days by the total number of days in the period for which these days are counted. In the main analyses, these variables are calculated based on the 365 days preceding the midpoint of the survey, which falls on August 14, 2024.⁷

Secondly, using the daily-regional mean observations again, temperature anomalies are calculated as standardized deviations of monthly mean temperatures from the baseline periods monthly mean values, again calculating baseline monthly mean values and standard deviations based on the 1990-2019 period. While heat and cold episode days capture extreme temperature events, these monthly temperature anomalies account for both extreme and normal temperature fluctuations, providing a broader measure of climate variability. Period-averages are calculated by dividing the total number of standard deviations by the number of months considered preceding the survey, beginning with the first full month prior to the survey, which is July 2024. For positive anomalies, values below 0.5 are set to zero before calculating the period-averages, while for negative anomalies, values above -0.5 are set to zero. This is done to filter out small, possibly insignificant fluctuations and focus only on meaningful deviations from the baseline. In the main analyses, these variables are calculated based on the 12 months prior to the survey.⁸

⁶ Note that, on this basis, a higher value of the heat (cold) episode days variable does not necessarily indicate objectively higher (lower) temperatures but rather reflects how unusual recent temperatures are compared to what is typical for that region and month (that is, relative to what people are used to experiencing). For instance, a heat (cold) episode day in a generally cooler (hotter) region may involve lower (higher) absolute temperatures than in a warmer (cooler) region but still qualifies as a heat (cold) episode day if it exceeds the local 95th (5th) percentile.

⁷ This means the corresponding analysis period is from August 2023 to August 2024, including the record-breaking European heatwaves in the summer of 2024 (Copernicus Climate Change Service (C3S) and World Meteorological Organization (WMO) 2025).

⁸ Note that while temperature data are geomatched to respondents' regions, there remains uncertainty regarding the degree to which individuals experienced the specific temperature extremes or anomalies. Even within the same region, heterogeneity in personal exposure may arise due to exact place of residence (e.g., urban vs. rural), housing conditions, or other contextual factors such as local infrastructure and media coverage (Ray et al. 2017).

4 Empirical strategy

The analysis utilizes two dependent variables that capture both relative and absolute adaptation preferences and that are provided by the European Investment Bank Climate Survey data (see section 3.1 for more details). The first dependent variable measures how respondents believe their country should balance mitigation and adaptation. Note that in the analysis, responses selecting “none of the above” were excluded. Additionally, the order of answer options was recoded as follows: (1) prioritise adaptation, (2) pursue adaptation and mitigation with equal priority, and (3) prioritise mitigation. For the second dependent variable—whether respondents view adaptation as a national policy priority—the original answer scale was reversed so that higher values indicate stronger absolute support for adaptation. The same transformation was applied for the mediator variable, psychologically close climate risk perception, so that higher values indicate greater risk perception here.

To quantify objective extreme temperature and temperature fluctuations exposure, this study incorporates the previously introduced four climate indicators derived from the ERA5-Land reanalysis dataset (see section 3.2 for more details). Two variables capture extreme temperatures: heat episode days and cold episode days. The main analysis focuses on a 365-day period leading up to the European Investment Bank Climate Survey. In addition to these extreme temperature measures, the study includes standardized monthly temperature anomalies to capture deviations from the baseline. Here, the primary analysis focuses on the 12 months preceding the survey. Since the dependent variables can be characterized as ordinal, the estimation approach is ordered logistic regression, which relies on the proportional odds assumption (i.e., the relationship between independent variables and the odds of being in higher versus lower response categories is assumed constant across thresholds).

The general regression equation reads as follows:

$$Adaptation\ preference_i = \alpha + \beta T_i + \delta X_i + \varepsilon_i. \quad (1)$$

, where *Adaptation preference_i* represents one of the two dependent variables, either the relative or absolute adaptation preference measure. The key independent variable *T_i* represents one of the four climate exposure indicators (heat episode days, cold episode days, positive temperature anomalies, or negative temperature anomalies). *X_i* includes a range of individual-level control variables, including sociodemographic factors such as age, gender, income and political orientations, perceived national challenges as well as climate change-related variables, such as climate risk perceptions and views on adaptation measures. *ε_i* is an error term, while *α* is the

model intercept. β and δ represent the estimated coefficients for the climate exposure indicator and the vector of control variables, respectively.

Various robustness checks are performed to assess the reliability of the findings. Firstly, I estimate both a simple univariate model that includes only the respective temperature indicator as an explanatory variable (called small model from here on) and a comprehensive model that incorporates the full set of control variables as well (called large model from here on). Secondly, sensitivity analyses are conducted. These include alternative definitions of exposure to extreme heat and cold episode days by varying the exposure window, specifically using 30-day and 1,460-day periods instead of the 365-day standard timespan. Similarly, different time frames are applied to the calculation of positive and negative temperature anomalies, with 1-month and 48-month windows tested as alternatives to the standard 12-month period, in particular.

Beyond that, I estimate mediator models with heat or cold episode days as independent variables, psychologically close climate risk perceptions as mediator variables and relative or absolute adaptation policy support as dependent variables. These analyses are conducted to explore whether and to what extent extreme temperature experiences influence adaptation policy support indirectly through heightened mentally close climate risk perceptions, which have been shown to increase adaptation support previously (Brügger et al. 2015; Heckenhahn et al. 2024).

Finally, the study explores potential heterogeneity in the relationship between heat episode days exposure and relative and absolute adaptation preferences through interaction and subsample analyses. Firstly, it compares respondents from regions highly affected by extreme heat with those from less affected regions to assess whether the effect strengthens or weakens at higher exposure levels. Secondly, economic differences are examined by considering both individual income levels and whether respondents reside in wealthier or less affluent EU countries. This enables an examination of whether the impact of heat exposure on adaptation support depends on financial resources.

5 Analysis and results

5.1 Descriptive statistics

The European Investment Bank Climate Survey sample is broadly representative of the European population in terms of age and gender (see EIB 2024a for more detailed descriptive statistics). The gender distribution in the sample is 47.75% male and 52.25% female, closely matching the EU population split of approximately 49% male and 51% female (Eurostat 2025a). The mean age in the sample is 46.2 years, which is slightly above the EU median of around 45

years.⁹ When it comes to relative adaptation preferences, around 25% of respondents prioritize adaptation, 41% put equal weighting of adaptation and mitigation, and 34% prioritize mitigation. In terms of absolute preferences for adaptation, approximately 48% regard it as a priority, 47% see it as important though not a priority, while only 5% consider it unimportant.¹⁰

5.2 Full sample analyses

5.2.1 Relative adaptation preferences

Table 1 indicates that experiencing more heat episode days increases the likelihood for individuals to prioritize adaptation over mitigation substantially. In the small model without control variables the coefficient amounts to 1.01 ± 0.27 ($p < 0.001$), while this effect becomes slightly more pronounced in the large model reaching a size of 1.11 ± 0.31 ($p < 0.001$). Also, positive temperature anomalies over the previous year are linked to stronger relative adaptation preferences. The small model indicates a coefficient of 0.36 ± 0.08 ($p < 0.001$), and the effect in the large model amounts to 0.37 ± 0.09 ($p < 0.001$). Overall, there is strong evidence that experiencing heat episodes or positive temperature anomalies increases individuals' prioritization of adaptation over mitigation measures. These findings are in line with the construal matching premise and provide considerable evidence for the hypothesis.

In contrast, cold episode days show a clear association with increased relative mitigation prioritization. The small model yields an effect size of -4.40 ± 1.02 ($p < 0.001$), which rises to -5.18 ± 1.14 ($p < 0.001$) in the large model. Also, negative anomalies correlate with a shift toward mitigation. The coefficient of -1.49 ± 0.38 ($p < 0.001$) in the small model increases to -1.88 ± 0.41 ($p < 0.001$) in the large model. There is, thus, strong evidence that extreme cold and cooler temperatures increase people's relative focus on mitigation policies. Note that the coefficients are, on average, around 4-5 times larger than for heat or warmth effects, suggesting that cold has a stronger effect in increasing mitigation focus than heat has on relative adaptation support.¹¹

Finally, mediator analyses are conducted using psychologically close climate risk perception—specifically concerning property damage—as mediator variable between heat and

⁹ This slight deviation is likely due to the survey's minimum age requirement of 16 years.

¹⁰ At the country level, relative adaptation focus is strongest in Cyprus, Estonia, and Malta, while Sweden, Lithuania, and Finland favor mitigation the most. Absolute adaptation support is highest in Malta, Denmark, and Italy, and lowest in Latvia, Finland, and Estonia. Notably, island nations like Malta prioritize adaptation, likely due to their vulnerability to sea-level rise.

¹¹ Robustness checks incorporating alternative time spans for constructing heat, cold, and temperature anomaly indicators confirm the stability of the findings. Notably, the observed associations tend to strengthen when longer periods are used (e.g., 1,460 days for heat and cold episodes, and 48 months for temperature anomalies) and weaken when shorter windows (e.g., 30 days or 1 month) replace the 1-year standard time span.

cold episode days and relative adaptation prioritization (see Appendix A for full results). Here, the overall indirect effects turn out to be either insignificant or negligible in size. This suggests that the influence of temperature extremes on adaptation prioritization operates largely through alternative pathways and not mainly through property-related mentally close climate risk perceptions.

Table 1 Effect of temperature indicators on relative adaptation preferences (results based on ordered logistic regression model; dependent variable: relative adaptation support)

Temperature variable	Coefficient (small model)	Coefficient (large model)	Observations
Heat episode days	1.01*** (0.27)	1.11*** (0.31)	21,216
Positive temperature anomalies	0.36*** (0.08)	0.37*** (0.09)	21,216
Cold episode days	-4.40*** (1.02)	-5.18*** (1.14)	21,216
Negative temperature anomalies	-1.49*** (0.38)	-1.88*** (0.41)	21,216

Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; robust standard errors in parentheses

5.2.2 Absolute adaptation preferences

Table 2 shows that individuals exposed to more frequent heat episode days show a marked increase in absolute adaptation support in the small model, with a coefficient of 4.31 ± 0.27 ($p < 0.001$). However, when control variables are included, the effect reverses direction and loses statistical significance amounting to -0.09 ± 0.35 ($p = 0.805$). This suggests that the observed association is likely confounded by individual characteristics, which render the effect insignificant when accounted for. Similarly, positive temperature anomalies over the past year correlate with lower absolute adaptation support in the small model with an effect size of 0.95 ± 0.07 ($p < 0.001$). Yet, this effect turns negative to -0.26 ± 0.09 ($p = 0.007$) in the large model, again suggesting that individual background factors confounded the initial pattern.

In contrast, experiences of cold appear to consistently weaken absolute adaptation support. The presence of cold episode days is strongly associated with lower adaptation support in the small model yielding an effect size of -13.89 ± 1.07 ($p < 0.001$), and this relationship, although more subtle, remains weakly significant in the full model with -2.16 ± 1.29 ($p = 0.095$). The same tendency is evident in response to negative temperature anomalies. In the small model, the coefficient is -6.58 ± 0.42 ($p < 0.001$), while the effect decreases in absolute terms

to -3.12 ± 0.47 ($p < 0.001$) in the large model. Overall, colder conditions appear to reduce absolute adaptation support.¹²

Mediator analyses are also conducted for absolute adaptation prioritization, using psychologically close climate risk perceptions—specifically concerning property damage—as the mediator variable between heat and cold episode days and adaptation support (see Appendix A for full results). While the overall indirect effects are statistically significant and sizable in models without control variables, effect sizes drop to negligible levels once controls are included. This implies the influence of heat or cold exposure on absolute adaptation support is not meaningfully mediated by these specific mentally close risk perceptions.

Table 2 Effect of temperature indicators on absolute adaptation preferences (results based on ordered logistic regression model; dependent variable: absolute adaptation support)

Temperature variable	Coefficient (small model)	Coefficient (large model)	Observations
Heat episode days	4.31*** (0.27)	-0.09 (0.35)	23,051
Positive temperature anomalies	0.95*** (0.07)	-0.26*** (0.09)	23,051
Cold episode days	-13.89*** (1.07)	-2.16* (1.29)	23,051
Negative temperature anomalies	-6.58*** (0.42)	-3.12*** (0.47)	23,051

Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; robust standard errors in parentheses

5.3 Heterogeneity analyses

This section examines how the effect of heat episode days on adaptation support varies across different levels of heat exposure as well as individual income and national GDP per capita. To this end, interaction term and sample split analyses are conducted including the full set of controls, respectively. The section firstly focuses on heterogeneous effects on relative adaptation support and secondly on heterogeneous effects on absolute adaptation support.

As Table 3 shows, when splitting the sample based on regional heat exposure—measured by the number of heat episode days—the effect of heat exposure on relative adaptation preferences is significantly positive in regions with above-average relative levels of

¹² When again conducting robustness checks varying the time window used to measure exposure, the effect on absolute adaptation preferences shows notable shifts. For heat episode days, the association reverses or weakens when using shorter windows, such as 180 days, while longer periods yield consistently positive effects that generally increase in magnitude. A similar pattern is observed for positive temperature anomalies. For cold episode days, the effect also generally grows in absolute size when the considered time window is extended. While negative temperature anomalies cannot be reliably calculated for shorter time windows, their effect becomes progressively stronger as the exposure window increases, as well.

heat.¹³ In these regions, the coefficient is 1.94 ± 0.60 ($p = 0.001$), indicating a clear shift toward adaptation. In contrast, in regions with below-average heat exposure, the effect reverses sign and is not statistically significant, at -0.92 ± 0.94 ($p = 0.329$). This suggests that people living in already hot areas become more supportive of adaptation with increasing heat exposure, whereas in cooler regions, they even tend to increase relative mitigation support. Consistent with this interpretation, a model including a squared term for heat episode days reveals a convex relationship¹⁴, indicating that the effect of relative heat exposure on adaptation support intensifies at higher levels of exposure and may only begin to significantly boost adaptation support once a certain threshold is crossed.

Focusing on the heterogeneous effects of heat exposure across income levels, the interaction model reveals that individual income moderates the impact of heat episode days on relative adaptation support. Specifically, the interaction term coefficient is negative and significant ($p = 0.024$), indicating that individuals with lower income levels are more likely to shift toward adaptation over mitigation as heat exposure increases. Sample split analyses presented in Table 3 reinforce this finding: when dividing the sample at the mean income level, the lower-income group shows a strong and statistically significant increase in adaptation focus in response to heat exposure, while the effect for the higher-income group is statistically indistinguishable from zero (1.57 ± 0.44 vs. 0.54 ± 0.48). This pattern also persists when the sample is split by country-level GDP per capita instead of individual income, increasing the robustness of this finding further.

¹³Note that the regions with the highest relative heat exposure in the 365-day period are located in Southern Europe—specifically in Portugal, Spain, and Greece—which experienced record breaking heatwaves in summer 2024.

¹⁴This quadratic model includes both a linear and a squared term for heat episode days. The linear coefficient is -0.72 and not statistically significant ($p = 0.525$), while the squared term is 7.76 and weakly significant ($p = 0.091$). This pattern suggests a non-linear relationship: at lower levels of heat exposure, the effect on relative adaptation support is ambiguous, but as heat extremes become more frequent, the effect turns increasingly positive indicating a stronger shift toward adaptation.

Table 3 Heterogeneous effects of heat episode days on relative adaptation support (results based on ordered logistic regression model; dependent variable: relative adaptation support)

Sample split	Coefficient (subsample)	Coefficient (subsample)
Heat episode days	Below mean number of days	Above mean number of days
Coefficient	-0.92 (0.94)	1.94*** (0.60)
Observations	11,795	9,421
Individual income	Below mean	Above mean
Coefficient	1.57*** (0.44)	0.54 (0.48)
Observations	11,544	9,672
Resident country GDP per capita	Below mean	Above mean
Coefficient	0.95** (0.42)	0.12 (0.85)
Observations	12,987	8,229

Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; robust standard errors in parentheses

Turning to absolute adaptation preferences, Table 4 reveals substantial heterogeneity in how heat episode days influence adaptation support. In regions with fewer heat extremes, the effect is strongly negative, with a coefficient of -16.49 ± 1.16 ($p < 0.001$), indicating a decreased interest in adaptation when heat increases, which is surprising. Conversely, in high-exposure regions, the effect turns positive at 2.63 ± 0.70 ($p < 0.001$), indicating greater support for adaptation in regions highly affected by heat. This suggests that consistent with the pattern observed for relative adaptation support, the effect of heat exposure on absolute adaptation support intensifies with higher overall exposure (i.e., follows a convex shape).¹⁵

Income factors further shape the heat exposure effect. The interaction term between individual income and heat exposure is negative and statistically significant ($p < 0.001$), indicating that the positive effect of heat episode days on absolute adaptation support weakens as individual income increases. However, this pattern is not reflected in the sample split analysis by individual income, as both the below- and above-mean income subsamples show statistically insignificant effects. In contrast, a split by national GDP per capita confirms the interaction pattern: in lower-income countries, the coefficient is 5.34 ± 0.49 ($p < 0.001$), while in wealthier countries, the sign reverses, and the coefficient becomes strongly negative at -6.91 ± 0.89 ($p < 0.001$).

¹⁵ Estimating a quadratic model extends the evidence for a nonlinear relationship here: the squared heat episode term is positive and highly significant with 71.56 ± 6.56 ($p < 0.001$), while the linear term is negative -16.71 ± 1.52 ($p < 0.001$). This suggests that adaptation support initially declines with increasing heat exposure but begins to rise again beyond a certain threshold.

Overall, this suggests that individuals with lower incomes are more responsive to heat when expressing support for adaptation measures, possibly because they rely more heavily on public interventions. In contrast, higher-income individuals may possess greater personal resources to manage the impacts of climate change independently and, therefore, show less immediate increases in absolute adaptation policy support in response to heat episodes.

Table 4 Heterogeneous effects of heat episode days on absolute adaptation support (results based on ordered logistic regression model; dependent variable: absolute adaptation support)

Sample split	Coefficient (subsample)	Coefficient (subsample)
Heat episode days	Below mean number of days	Above mean number of days
Coefficient	-16.49*** (1.16)	2.63*** (0.70)
Observations	12,416	10,635
Individual income	Below mean	Above mean
Coefficient	-0.13 (0.52)	0.01 (0.48)
Observations	10,208	12,843
Resident country GDP per capita	Below mean	Above mean
Coefficient	5.34*** (0.49)	-6.91*** (0.89)
Observations	14,013	9,038

Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; robust standard errors in parentheses

6 Discussion and conclusion

This study links temperature indicators based on high-resolution ERA5 climate data (Hoffmann et al. 2022; Muñoz Sabater et al. 2024) with survey responses from over 23,000 individuals across the 27 EU countries, drawn from the 2024 European Investment Bank Climate Survey (EIB 2024b, a). On this basis, the study provides new empirical insights into how objective experiences of relatively hot and cold temperatures shape public support for national climate adaptation policies. Unlike similar studies that focus on preferences for mitigation or adaptation policies (e.g., Ray et al. 2017; Pfeifer and Otto 2023) or assess support for adaptation and mitigation separately (e.g., Demski et al. 2017) this study captures both absolute support for national adaptation policy and relative preferences in the trade-off between adaptation and mitigation.

The main results show that experiencing heat episodes and positive temperature anomalies consistently increase relative adaptation focus, aligning with the hypothesis for this investigation, which in turn is based on the construal matching premise (Haden et al. 2012;

Brügger et al. 2015; Heckenhahn et al. 2024). Conversely, cold exposure shifts public focus toward mitigation. Moreover, the analyses reveal mixed findings on the effect of temperature experiences on absolute adaptation support which is consistent with Ray et al. (2017), who as well receive ambiguous results in this regard. Specifically, the effect of heat episode days and positive anomalies on absolute adaptation support varies by model specification and becomes insignificant or even negative when controls are included. However, on the other hand, cold exposure decreases absolute adaptation support throughout.

Heterogeneity analyses on the effect of experiencing heat episodes yield interesting insights: heat episodes increase relative and absolute adaptation support only in regions with above-average heat exposure. Furthermore, it shows that people with higher individual income or people living in wealthier EU countries show no significant increase, and even a decrease, in adaptation support after heat exposure. In contrast, poorer individuals or those in poorer countries respond with higher relative and absolute support.

The study has several limitations. Its cross-sectional design limits causal interpretation, and although comprehensive controls and robustness checks were used, endogeneity and omitted variables cannot be ruled out. Generally, exposure to temperature anomalies or extremes, when measured with objective climate data, can be considered largely exogenous and offers clear advantages over self-reported experiences (Egan and Mullin 2012; Dell et al. 2014). However, individuals' responses may still be influenced by unobserved contextual factors, such as local political culture or media framing. Further, the study is limited to European respondents, so that the findings may not be generalizable to other cultural, institutional, or climatic contexts. Also, the analysis relies exclusively on relative temperature indicators and does not examine whether absolute temperature levels have similar effects. Finally, other relevant climate-related extreme events, such as flooding, are excluded from the analysis, limiting insight into the broader range of factors influencing the adaptation–mitigation trade-off.

Looking ahead, the increasing frequency and intensity of extreme weather, specifically heat extremes, yielding various damages for societies around the world may further shift public attention toward adaptation. While enhancing climate resilience is of central importance, particularly in vulnerable communities, this change in focus may entail undesired consequences. Given that national climate policy resources are limited, a disproportionate emphasis on adaptation could indeed diminish support for mitigation efforts, which are essential for keeping climate impacts level manageable in the long run (Heckenhahn et al. 2024). Recognizing this tendency is crucial for decision-makers. Climate communication strategies

need to strike a balance between emphasizing growing climate damages in the here and now that call for adaptation measures and highlighting the long-term, global nature of the challenge, which requires stepping up mitigation efforts to keep future climate impacts manageable and avoid intertemporally ineffective climate action.

7 Appendix

Appendix A: Mediator Analyses

The mediator analyses build on the idea that heat episode days may strengthen psychologically close climate risk perceptions, which—according to the construal matching premise—could in turn increase relative adaptation focus, thereby establishing a potential indirect pathway from heat exposure to adaptation preferences. However, mediator analyses results using mentally close climate risk perceptions—specifically concerning property damage—as the mediator variable and heat episode days as the independent variable do not support this idea. Table A.1 shows that although the overall indirect pathway (heat episode days → mentally close climate risk perception → relative adaptation prioritization) is statistically significant ($p < 0.001$), its effect size is negligible when including controls (estimate = -0.000). Consequently, the direct effect of heat episode days on relative adaptation prioritization is substantial and highly significant in this model, amounting to 0.43 ± 0.12 ($p < 0.001$). This suggests that the influence of heat exposure on relative adaptation preferences operates largely outside of this specific indirect pathway.

As Table A.1 demonstrates as well, mediator analyses yield a similar pattern for cold episode days. When cold episode days are used as the independent variable and mentally close climate risk perception as the mediator, the indirect effect (cold episode days → mentally close climate risk perception → relative adaptation prioritization) is statistically highly significant ($p < 0.001$), yet negligible in magnitude (estimate = 0.000). By contrast, the direct effect is substantial, with an estimate of -2.08 ± 0.46 ($p < 0.001$), indicating that the influence of cold exposure on adaptation prioritization largely operates through other pathways as well.

Table A.1 Mediator analyses with mentally close climate risk perceptions as mediator variable (results based on ordered logistic regression model; dependent variable: relative adaptation focus)

	<u>Variables</u> IV: heat episode days MV: mentally close climate risk perception		<u>Variables</u> IV: cold episode days MV: mentally close climate risk perception	
	Full sample	Full sample	Full sample	Full sample
	No controls	All controls	No controls	All controls
Direct effect				
Temperature indicator → Relative adaptation focus	0.40*** (0.12)	0.43*** (0.12)	-1.80*** (0.44)	-2.08*** (0.46)
Indirect effects				
a: Temperature indicator → Climate risk perception	5.05*** (0.12)	-0.00*** (0.00)	-18.97*** (0.5)	0.00*** (0.00)
b: Climate risk perception → Relative adaptation focus	0.01 (0.01)	0.03*** (0.01)	0.01 (0.01)	0.03*** (0.01)
ab (indirect effect of IV on DV via MV)	0.04 (0.03)	-0.00*** (0.00)	-0.17 (0.12)	0.00*** (0.00)
Total effect				
Temperature indicator → Relative adaptation focus	0.44*** (0.11)	0.43*** (0.12)	-1.96*** (0.43)	-2.08*** (0.46)
Observations	21,216	21,216	21,216	21,216

Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ IV = Independent variable; MV = Mediator variable; robust standard errors in parentheses

The mediator analyses for absolute adaptation prioritization, as outlined in Table A.2, show that the indirect effects of both heat and cold episode days—via psychologically close climate risk perceptions—are statistically significant, but also negligible once controls are included. For the heat episode days pathway (heat episode days → mentally close climate risk perception → absolute adaptation prioritization), the indirect effect is 1.03 ± 0.03 ($p < 0.001$) without controls, but it drops to -0.00 ± 0.00 ($p < 0.001$) when controls are added. A similar pattern holds for the cold episode days pathway (cold episode days → mentally close climate risk perception → absolute adaptation prioritization): the effect is -3.78 ± 0.13 ($p < 0.001$) without controls and turns 0.00 ± 0.00 ($p < 0.001$) once those are included. These findings suggest that the influence of heat and cold extremes on absolute adaptation support is not mainly channeled through property-related climate risk perceptions, but instead likely operates through other mechanisms. The evidence regarding direct effects remains ambiguous here.

Table A.2 Mediator analyses with mentally close climate risk perceptions as mediator variable (results based on ordered logistic regression model; dependent variable: absolute adaptation focus)

	<u>Variables</u> IV: heat episode days MV: mentally close climate risk perception		<u>Variables</u> IV: cold episode days MV: mentally close climate risk perception	
	Full sample	Full sample	Full sample	Full sample
	No controls	All controls	No controls	All controls
Direct effect				
Temperature indicator → Absolute adaptation focus	0.25*** (0.08)	0.01 (0.08)	-0.39 (0.33)	-0.5* (0.29)
Indirect effects				
a: Temperature indicator → Climate risk perception	5.13*** (0.12)	-0.00*** (0.00)	-18.57*** (0.49)	0.00*** (0.00)
b: Climate risk perception → Absolute adaptation focus	0.2*** (0.01)	0.02*** (0.01)	0.2*** (0.00)	0.02*** (0.01)
ab (indirect effect of IV on DV via MV)	1.03*** (0.03)	-0.00*** (0.00)	-3.78*** (0.13)	0.00*** (0.00)
Total effect				
Temperature indicator → Absolute adaptation focus	1.28*** (0.08)	0.01 (0.08)	-4.18*** (0.33)	-0.5* (0.29)
Observations	23,051	23,051	23,051	23,051

Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ IV = Independent variable; MV = Mediator variable; robust standard errors in parentheses

One possible explanation for the limited explanatory power of the indirect pathway may be that the measure of psychologically close climate risk perception specifically captures concerns about damage to personal property—such as homes or cars. However, in the public, heatwaves and cold spells are likely rather associated with health risks, energy costs, or disruptions to daily life than with direct physical damage to property. As a result, this specific form of risk perception may not adequately reflect the types of concerns that influence people's adaptation policy preferences in response to temperature extremes. Finally, note that the European Investment Bank Climate Survey did not include any variable capturing broader psychologically close climate risk perceptions or mentally close risk perceptions related to other types of damages, which could have been tested as potential mediators between temperature indicators and adaptation policy preferences

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