Temperature, institutions, and the political climate

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July 22, 2025

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Abstract

Despite widespread recognition of climate change as a threat to global stability, its political consequences remain undertheorized. This paper addresses that gap by deriving two competing hypotheses on how political preferences and institutions respond to environmental shocks, repurposing influential theories of demand-led political transition. The mercury uprising hypothesis posits that adverse climate shocks reduce the opportunity cost of contesting autocratic rule, thereby increasing pressure for democratic reform. In contrast, the state of exception hypothesis views these shocks as crisis events that prompt citizens to sacrifice negative liberties for security, diminishing support for democracy and enabling autocratic drift. I test these hypotheses by estimating the dynamic impacts of identified temperature shocks on survey-based proxies for democratic demand and on institutional quality, using multi-valued and binary measures of democracy. Results indicate that economically adverse shocks reduce democratic sentiment and increase the risk of democratic backsliding. A 0.5°C shock reduces the annual probability of democratization in autocracies by 1.5-3.7 percentage points, depending on local climate and the democracy measure used. In warm-climate democracies, the same shock increases the risk of democratic reversal by 0.6-2.0pp, with no comparable effect in cooler, typically more developed contexts. These findings support the state of exception hypothesis and suggest that sufficient state capacity may insulate democracies from climate-driven political disruption.

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"A change in the weather is sufficient to recreate the world and ourselves."

Marcel Proust, *In Search of Lost Time*

1 Introduction

In 2007, a panel of retired United States military officers published an assessment of the geopolitical implications of climate change, concluding that projected environmental pressures would lead to "the likelihood of failed states" and "movement toward increased authoritarianism" worldwide (Sullivan et al. 2007). In a period of opportunistic military-industrial expansion and the mainstreaming of climate advocacy, the report found influence by popularizing the term "threat multiplier" to describe how climate change might amplify social risks interpreted as relevant to national security (Goodman and Baudu 2023). By the following year, the government of the United Kingdom had adopted the framing, naming climate change "potentially the greatest challenge to global stability" in its revised national security strategy (Her Majesty's Government 2008).

In the nearly two decades since, a prolific social scientific literature has emerged dedicated to empirically studying climate change as a phenomenon of social disruption (Carleton and Hsiang 2016). For example, there is now robust evidence that global heating reduces economic productivity and threatens food security while elevating mortality and morbidity (Team et al. 2023). Critically, these impacts are generally found to concentrate in countries with warmer geographies and limited state capacity. While it is intuitive that such environmental pressures should induce political transformation, it is not self-evident that it should manifest in the erosion of democracy predicted by the Military Advisory Board. To date, the geopolitical consequences of environmental shocks remain largely unstudied both theoretically and empirically in the existing environmental political economy literature.

This paper seeks to address this research gap by studying the effects of adverse temperature shocks on political preferences and institutional quality. To do so, Section 2 derives two opposing hypotheses by repurposing influential theories of demand-led political transition for environmental contexts. A"mercury uprising" hypothesis posits that such shocks should facilitate democratization by reducing the opportunity cost of contesting political inequality, making the threat of political revolution credible. In contrast, a "state of exception" hypothesis would suggest that the same shocks instead diminish democracy by legitimizing emergency rule. The remainder of the paper empirically tests the relative validity of these theories by estimating the dynamic effects of these shocks on political preferences and measures of institutional democracy.

Section 3 describes the data used in these empirical analyses. To measure variation in political sentiment, I use country-year panel data on representative survey responses from over 140,000 individuals across up to 68 countries. To mitigate bias from multiple hypothesis testing, I construct separate indices to summarize variables measuring support for democratic institutions, skepticism of the effectiveness of democracy, support for authoritarian forms of leadership, and how inclusively democracy is defined by the respondent. I interpret these indices as proxies for the public demand for democratic institutions (or their negation).

To measure institutional quality, we make use of democracy 'scores' commonly used in the political economy literature. Multi-valued indexes are interpreted as an intensive measure of democracy. Binary democracy indicators are interpreted as extensive measures of democracy, enabling analysis of the propensity for regime change into or away from democracy. For both, we include results from a variety of data products which operationalize democracy differently.

Section 4 describes the empirical approach used to estimate impacts to each category of outcomes. Since the survey data is indexed temporally by irregular month-years, we define local temperature shocks idiosyncratically for each respondent using weather observations over the 12 months preceding the month-year they were interviewed. For the institutional quality results, estimation entails estimating the dynamic effect of a temperature shock on the outcome of interest using the simple single-equation method of local projections, exploiting the balanced panel structure of the data.

The first set of results indicate that an economically adverse temperature shock significantly reduces support for democracy while increasing skepticism of the effectiveness of democracy. These impacts are most pronounced for warmer geographies: for a representative 26° country, an adverse 0.5° shock is expected to reduce support for democracy by 0.13 standard deviations [0.045, 0.22] and support for inclusive institutions by 0.11 [0.045, 0.22] while increasing skepticism of democracy by 0.40 [0.32, 0.47]. These effects are similarly signed but insignificant for a representative 10° country.

The results for institutional outcomes imply that the same shocks decrease the probability of an autocracy transitioning into a democracy by 1.5-3.7 percentage points in the period of the shock depending on the local climate and the operating definition of democracy. These effects show little evidence of persistence beyond the year of the shock. The same shocks are found to increase the probability of democratic reversal by 0.6-2.0pp in a representative 26° democracy but with no significant effect on a 10° democracy. Estimated effects along the intensive margin—where the outcome variable quantifies the degree of democracy in a given regime-year—are consistent with these extensive-margin results though less interpretable and for some measures, insignificant.

Altogether, I interpret these findings as internally consistent evidence supporting the state of exception hypothesis but also suggesting that sufficiently credible state capacity may insulate democratic institutions from environmental disruption.

1.1 Related literature

Section 2 overviews the sparse existing literature studying the impacts of environmental events on the demand for democracy and the likelihood of regime change. The related but distinct question of whether one regime type is better suited to respond to climate change is a much more active subject of public and academic debate. Shortly after the conclusion of the Cold War, then-senator and vice presidential candidate Al Gore wrote that "an essential prerequisite for saving the environment is the spread of democratic government to more nations of the world." (Gore 1992) This liberal consensus would be challenged in the ensuing decades by China's rise as a global superpower and assumption of global leadership in renewables, which many observers interpreted as legitimizing a 'authoritarian environmentalist' perspective (Shearman and Smith 2007; Fiorino 2018). Other academic works have advanced intermediate perspectives by rejecting the dichotomy of regime type Kneuer (2012) or downplaying the relevance of regime type compared to factors such as corruption, income and wealth inequality, and state capacity (Povitkina 2018; Lindvall and Karlsson 2024) or the economy's level of development (Grossman and Krueger 1995; Dasgupta et al. 2002; Shen 2024).

The present analysis is also closely related to an active subset of the interdisciplinary climate impacts literature relating various environmental outcomes to the onset of conflict. Koubi (2019) and Buhaug and Uexkull (2021) provide reviews of this research, construing conflict broadly enough to include outcomes ranging from psychological aggression to the incidence of self-harm to the outbreak of war. Bellemare (2014) links food prices to various expressions of social unrest.

2 Theories of political transformation under climate change

A growing body of empirical work has explored how weather events may influence political attitudes. For example, political turnover has been found to be highly influenced by the random occurrence of natural disasters (Obradovich 2017) and the incumbent party's relief efforts in their wake Cole et al. (2012). Similarly, a tertiary result in Dell et al. (2012) suggests that years with elevated temperatures are associated with irregular changes in political leadership in developing countries.

A complementary line of research explores macro-scale impacts to institutional quality. Casualties from natural disasters have been shown to diminish institutional quality and increase authoritarian consolidation in island nations and other developing contexts (Rahman et al. 2022; Khurana et al. 2022). Exogenous shocks to commodity prices have been found to exacerbate autocratic tendencies in moderately entrenched regimes while having limited effect in democracies and entrenched autocracies (Caselli and Tesei 2016).

Collectively, these results provide strong prima facie evidence that environmental pressures and resource endowments can influence political behavior and outcomes but do not constitute a coherent theory of how the environment may influence political attitudes and institutions. To this end, I derive two provisional hypotheses from the broader political economy literature on demand-side determinants of democratic deepening, transition, and stability (as well as their negations).

2.1 Climate change as an economic shock: The 'mercury uprising' hypothesis

Under a "mercury uprising" theory, adverse weather events induce broad reductions in income, thereby reducing the opportunity cost of contesting exclusionary governance as those impacted have less to lose, so to speak, even if temporarily. Thus, the adverse weather event admits a "democratic window of opportunity" during which public sentiment towards democracy is heightened and the threat of democratic revolution is made more credible. In a partial political equilibrium negotiated between a disenfranchised majority and a ruling elite, this demand shock should result either in concessionary democratic consolidation or discrete democratization by revolution.

This theory draws from the influential model of political transition in Acemoglu and Robinson (2001). This model has been empirically adapted in a variety of contexts in the decades since its publication. For example, Burke and Leigh (2010) reports evidence that economic downturns worldwide are associated with democratic improvements while Acemoglu, Naidu, et al. (2019) highlight that democratization events are generally preceded by temporary reductions in GDP growth rates, both consistent with the predictions of the model. Aidt and Leon (2015) finds that constituencies exposed to the English peasantry-led Swing Riots of 1830-1831 improved public support for reformist parliamentary candidates in the subsequent election.

To repurpose this framework for the context of climate change is to understand adverse environmental shocks mainly as an economic phenomenon, affecting the demand for democracy primarily through its effect on income- or wealth-based personal utility relative to the perceived value of reformist militancy. Brückner and Ciccone (2011) is one empirical study which adopts a similar framing to document that drought-induced income shocks temporarily increase the propensity for sub-Saharan autocracies to democratize. Elsewhere, Aidt and Leon (2015) reports complementary evidence linking drought-induced rioting to improvements in democratic institutions.

2.2 Climate change as an emergency: The 'state of exception' hypothesis

Clearly, the first hypothesis would contradict the Military Advisory Board's expectation of a global drift towards authoritarianism in response to the threat of climate change. To accommodate this latter possibility, an alternative intuition is available which models adverse environmental shocks as a force which primarily impacts political preferences not by making social unrest preferable to inaction but by fundamentally transforming the social environment. The scientist James Lovelock provided a concise summary of this 'state of exception' hypothesis in a 2010 interview: "Even the best democracies agree that when a major war approaches, democracy must be put on hold for the time being. I have a feeling that climate change may be an issue as severe as a war." (Hickman 2010)

The outset of the COVID-19 pandemic provided a salient example of this dynamic. Sudden and indefinite restrictions on movement and privacy and centralized surveillance measures at the outset of the pandemic were generally implemented with broad public approval and widely perceived as delivering positive public health outcomes. At the same time, individual exercises of those normally protected freedoms were met with opprobrium and perceived as self-serving and dangerous. These emergency conditions inspired a wave of real-time research studying its impact on the public's willingness to trade off individual liberties for social security. Alsan et al. (2023) and Vasilopoulos et al. (2022) found that self-reported feelings of fear and experimentally induced perceptions of health insecurity were associated with a diminished priority to preserve civil liberties.

Similarly, Davis and Silver (2004) found that Americans who felt most threatened by terrorism in the aftermath of the September 11 attacks were more likely to support intrusive security measures that would compromise personal liberties. These effects were found to entirely flatten pre-existing differences between self-identified liberals and conservatives.

The upshot of this literature is that even firmly held attitudes towards democracy are observed to be highly state-contingent. The 'state of exception' hypothesis holds that adverse environmental shocks are best understood as crisis events of this kind, dissuading demand for democratic reform and legitimizing authoritarian forms of governance by provoking insecurity, uncertainty, and fear. Such a psychological mechanism is further supported by experimental evidence that simply reminding student subjects of how climate change is expected to adversely impact their country increased authoritarian sentiment, diminished tolerance of out-groups, and for those who most closely identify with their nationality, promoted system-justifying beliefs. (Fritsche et al. 2012).

3 Data

3.1 Surveys of political preferences

Survey data is derived from the Integrated Values Survey, which harmonizes data from the World Values Survey (Haerpfer et al. 2024) and the European Values Study (2022). In our main results, our estimation sample represents responses of up to 141,261 respondents to more than 100 nationally representative surveys conducted in up to 68 countries. This sample represents to the minority subset of survey data where the month and year of interview were available for precise construction of relevant local weather shocks. We retain data on the respondent's demographic information, including their birth country, immigration status, income range, and political preferences.

Table 1: Summary statistics for IVS respondent data

	Unique	Missing Pct.	Mean	SD	Min	Median	Max
Year	36	0	2005.2	10.3	1981.0	2007.0	2022.0
Male	2	1	0.47	0.53	0.0	0.0	1.0
Citizen	2	74	0.98	0.1	0.0	1.0	1.0
Support index	41	55	0.0	0.8	-3.4	0.1	0.8
Skepticism index	65	72	0.0	0.8	-1.7	0.0	2.0
Authoritarian index	65	30	0.0	0.7	-1.3	-0.1	1.9
Inclusiveness index	140902	69	0.0	0.5	-2.0	-0.1	1.2
Democracy	2	38	0.74	0.36	0.0	1.0	1.0
Polity score	19	41	6.3	5.3	-10.0	9.0	10.0

Our primary outcomes of interest are derived from responses to questions representing attitudes towards democracy or its negation. We assign these questions to one of four categories as summarized in Table 2. For each category, we then construct an inverse-covariance weighted index of responses to the questions using the method of Anderson (2008), which assigns greater weight to more informative component questions.

3.2 Multi-valued measures of democracy

I use two sources of democracy 'scores' which purport to measure how democratic a given country-year regime is. The first is a measure provided by the Polity Project (Marshall and Gurr 2020) which ranges discretely between -10 and 10 in increments of 0.5 with more positive values corresponding to higher perceived levels of democracy. The Project recommends a classification where country-years scoring below -5 are labeled autocracies, those above +5 are democracies, and those in between are 'anocracies'.

The second source of democracy scores comes from the Varieties of Democracy (V-Dem) Project (Coppedge et al. 2025). These measures are produced by combining primary sourcing with expert elicitation to assign a panel of country-year observations a score ranging continuously between 0 and 1. There are up to 400 variables by which observations are scored and these are in turn aggregated to produce five indices which operationalize democracy according to its deliberative, egalitarian, electoral, liberal, and participatory connotations respectively. Differences between these concepts of democracy can be pertinent if, for example, the extension of civil liberties is a systematically slower-moving process or is considered a much greater democratic concession than the administration of a nominally competitive election. A contemporary example is Chile's ongoing constitutional reform process which began in 2021 in response to civil uprising in 2019. That the drawn-out process has seen the rejection of multiple proposed constitutions by referendum may be interpreted as an exercise of improved democratic deliberation and participation. But until a replacement is ratified, democracy as measured by formalized rights and protections are still constrained by the 1980 Constitution being challenged.

The distribution of scores are summarized in Section A1, showing a bimodal distribution with peaks at -6 and +10 for the Polity IV scores and heavily right-skewed distributions for each of the V-Dem scores. Correlations between these indexes are summarized in Table A1. The wide use of these ambitious intensive measurements of democracy seems likely to reflect their usefulness

Table 2: Categorization of survey questions from the Integrated Values Surveys

1. Support for democratic institutions

- (Strongly) agree: Democracies are good for governance
- (Strongly) agree: Democracy has its problems but is better than all alternatives

2. Democratic skepticism/ineffectiveness

- (Strongly) agree: Democracies cause disorder
- (Strongly) agree: Democracies are too bureaucratic
- (Strongly) agree: Democracies are bad for the economy

3. Support for authoritarian leadership

- Preference for a strong leader who does not bother with parliament and elections
- Preference for army rule
- Preference for governance by experts over elected officials

4. Inclusiveness of definition of democracy

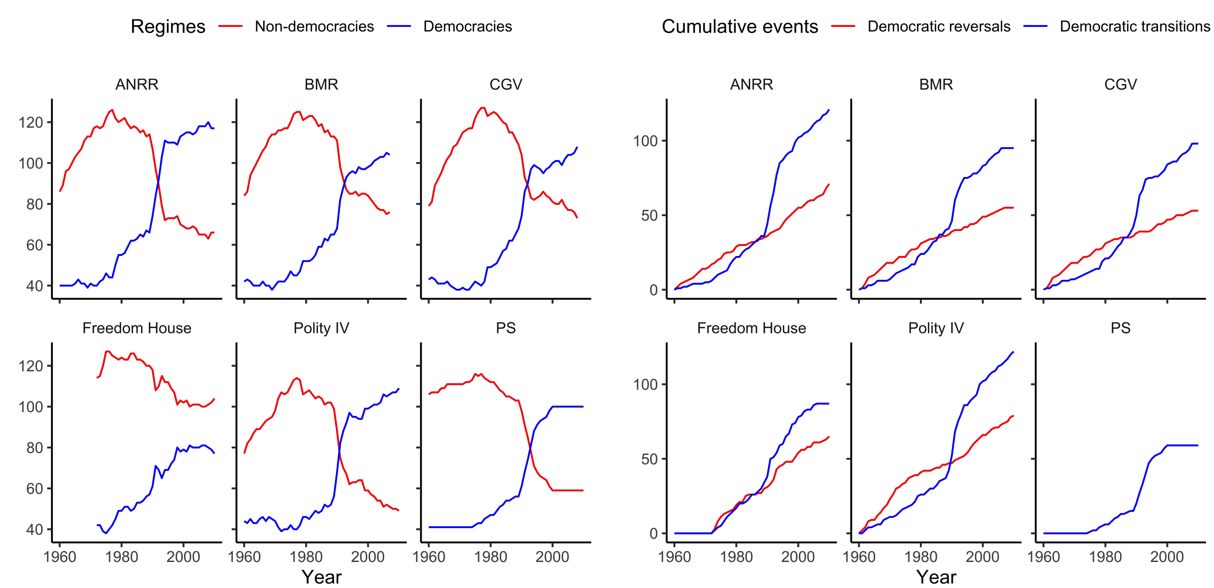
- (Strongly) agree: Holds open elections
- (Strongly) agree: Extends civil rights
- (Strongly) agree: Promotes equality of women
- (Strongly) disagree: Army takes over when government is incompetent
- (Strongly) agree: Redistributes from the rich to the poor
- (Strongly) agree: Provides unemployment insurance
- (Strongly) disagree: Government by religious leaders

more so than it does their credibility, especially for capturing intra-regime variation; Knutsen et al. (2024) and Little and Meng (2024) provide thoughtful critiques of these data products along these lines.

3.3 Dichotomous indicators of democracy

To study systematic transitions in and out of democracy, we require data which crudely labels country-year regimes a label of 'free' or 'democratic' or their negation. Table A2 summarizes differences between notable products which serve this purpose and have been commonly used in the political economy literature. For each data product, Figure 1 plots the time series of the number of democracies and non-democracies worldwide as well as the cumulative number of transition events. In our main results, we will restrict attention to the aforementioned Polity index (made dichotomous by using a score of +5 as a threshold for democratic status) as well as the panel datasets from Acemoglu, Naidu, et al. (2019) and Cheibub et al. (2010).

Figure 1: Time series of regime types and regime changes by data source



Left panel depicts the number of democracies (blue) and non-democracies (red) active in a given year. Note the sharp increase in total regimes in the aftermath of mid-century decolonization movements. Right panel depicts cumulative numbers of transitions to and from democracy (red and blue, respectively). PS only counts 'permanent' democracies and thus does not observe democratic reversals by definition. Table A2 provides more detail on differences in definitions across datasets.

3.4 Weather shocks

We merge all data with population-weighted near-surface air temperature data derived from the Global Meteorological Forcing Dataset for Land Surface Modeling (GMFD). This data corrects model-based biases in NCEP/NCAR reanalysis product using observational meteorological station data (Sheffield et al. 2006). The GMFD reports historical weather data for the entire global surface at 0.25-degree resolution[2] for every three hours from the start of January 1, 1948 to the end of December 31, 2015. For interpretive convenience, we center population-weighted average temperatures $\overline{T}$ at 18°C, roughly the 40th percentile of country-year temperatures in our dataset.

It has been customary in the climate impacts literature to use functions of observed weather variables such as temperature or precipitation as explanatory variables in causal analyses. Historically, their use in panel settings has been justified by an intuition that annual fluctuations in these geophysical conditions are plausibly exogenous with respect to most economic activity. This intuition has been increasingly challenged by works such as Nath et al. (2024), which argues that because levels of temperature do not satisfy conditions of an identified shock[3] and exhibit substantial autocorrelation, they are ill-suited for dynamic causal inference.

Addressing these concerns, I define temperature shocks $\widehat{\tau}_{it}$ as deviations in temperature levels relative to a climate 'state' variable $\overline{T}_{it}$. This state variable is in turn defined as the M-period moving average of local temperature $\overline{T}_{it}$:

$$\overline{T}_{it} := \frac{1}{M}\sum_{m=1}^{M} T_{i,t-m} - 18 \tag{1a}$$

$$\widehat{\tau}_{it} := T_{it} - \overline{T}_{it} \tag{1b}$$

This definition of the state variable $\overline{T}_{it}$ can be contrasted against the time-invariant state variable used in Nath et al. (2024) where the climate state variable is constant for each country. I favor this moving-average construction because the median country in my sample observes, on average, a 0.26°C (IQR: 0.18-0.36) increase in this state variable every 15 years as a result of global warming trends. Additionally, this definition of the state variable has an appealing coherence with the convention in climatology of using long-run moving averages of weather realizations to define the slow-moving state of the climate at a fixed period. Most commonly, these "climate normals" are defined as 30-year averages to accommodate natural variation which would occur even in a stable climate[4] and so we set $M = 30$ in our main analysis; Kahn et al. (2021) is another economics study which uses the same construction.

We subtract 18 in Equation (1a) so that the main effects we attribute to the temperature shock τ correspond to an intermediate representative climate of 18°C, roughly the 40th percentile of average temperatures in our country-year data. Figure A1 depicts the implied history of temperature shocks $\widehat{\tau}_{it}$ constructed in this manner with individual points corresponding to distinct country-year observations. These observations are divided into three equally sized groups according to their corresponding climate states $\overline{T}_{it}$; points and local regression curves are colored accordingly. The marginal distribution plots on the right demonstrate that colder seasonal countries experience more positive and more volatile temperature shocks than their warmer counterparts, a reflection of both greater natural weather variability in these settings and the fact that absolute anthro-

[2] At this resolution, cells near the equator are approximately 27 km^2 (17 mi^2).

[3] As outlined in the handbook chapter of Ramey (2016), a valid shock in a time series setting must i) measure unanticipated movements in relevant exogenous variables, ii) be exogenous with respect to current and lagged endogenous variables, and iii) be uncorrelated with other exogenous shocks included in the model. Temperature specified in levels do not satisfy the first condition and the third condition is violated in commonly used non-linear specifications where temperature enters as a polynomial.

[4] The most economically relevant example of this natural variability is the El Niño Southern Oscillation, an ocean-warming phenomenon which can vary average global surface temperatures by as much as 0.4°C across its three phase cycles which may span 2-7 years. Other minor oscillations can span multiple decades.

pogenic warming is greater in regions closer to the Earth's poles. That the curves take positive values over almost the entire observation period reflects that systematic warming is characterized by the increased frequency and greater magnitude of positive (hot) shocks relative to negative (cold) shocks. Intervals where the curves are closer to 0 thus reflect relative balance in the incidence of hot and cold shocks, corresponding to periods of relative climate stability and slower warming.

In the dataset used to study impacts on these measures of political preferences, we restrict our sample to IVS observations for which interview month-year metadata is available in order to standardize the precision of these impacts in relation to the timing of shocks. When merging with measures and indicators of democracy which are provided as annual panels, shocks are defined using the 12 months of the associated calendar year.

4 Methods

4.1 The demand for democracy

To estimate the effect of temperature shocks on attitudes towards democracy, we estimate the following regression for each index of interest Y derived from IVS data:

$$Y_{i,w,c,t} = \sum_{\ell=0}^{L} \left(\beta_{1,\ell}\widehat{\tau}_{c,t-\ell} + \beta_{2,\ell}(\widehat{\tau}_{c,t-\ell} \times \overline{T}_{ct})\right) + \boldsymbol{\gamma}^{\top}\mathbf{W}_{i,w,c,t} + \varepsilon_{i,w,c,t} \tag{2}$$

Subscripts index a respondent i residing in country c who in *month-year* t was surveyed as part of IVS wave w. The matrix $\mathbf{W}_{i,w,c,t,a}$ of controls include the expected temperature $\overline{T}_{ct}$ in country c at year t, logged precipitation, respondent gender, the size of the town in which respondent i resides, and fixed effects for country, year of survey, year of birth , and IVS wave. Standard errors are clustered at the country and year levels.

The set of coefficients $\{\beta_{1,\ell} + \beta_{2,\ell}\overline{T}\}_{\ell=0}^{L}$ represents the state-dependent change in Y attributed to lag ℓ of a unit temperature shock; we set maximal lag $L = 2$. Since Y is constructed as a weighted average of standardized survey responses, coefficients are interpreted in terms of a weighted average of standard deviation changes in the component survey questions. For simplicity, we simply refer to changes in the index in units of standard deviation even though Section 3.1 shows these variables do not necessarily exhibit unit variance in our sample.

The cross-sectional design of the IVS surveys limits our ability to isolate the impact of temperature shocks independent of their impact on future temperature shocks and to precisely and flexibly estimate dynamic effects. For this reason, we interpret these results with some degree of caution and favor the institutional results using the regression specification described next.

4.2 Democratic deepening and backsliding

To estimate dynamic effects of temperature shocks on an outcome y measuring the degree of democracy, we estimate a series of state-dependent local projection regressions on a panel of country-year regime observations for projection horizons $h \in \{0, ...H\}$:

$$y_{c,t+h} = \beta_{1h}\widehat{\tau}_{ct} + \beta_{2h}(\widehat{\tau}_{ct} \times \overline{T}_{ct}) + \lambda_h\overline{T}_{ct} + \gamma_h^{\top}\mathbf{Z}_{ct} + \mu_c + \eta_t + u_{c,t+h} \tag{3}$$

The primary quantity of interest for each projection horizon is $\beta_{1h} + \beta_{2h}\overline{T}_{it}$, the first derivative of the equation with respect to the temperature shock $\widehat{\tau}$. The first term represents the expected effect of a unit temperature shock on the outcome of interest for a country-year with an expected temperature of 18°C. The second term represents the linear dependence of this effect for country-years with different expected temperatuers. For example, the model would imply that a unit shock in a country with an expected annual temperature of 26°C would be expected to increase outcome y for the country by $\widehat{\beta_{1h}} + \widehat{\beta_{2h}} \cdot (26 - 18)$ units h periods after the shock relative to the counterfactual where no shock occurred.

Controls $\mathbf{Z}_{ct}$ include lags $\ell \in \{1, ..., L\}$ lags each of the shock $\widehat{\tau}_{c,t-\ell}$, the shock $\widehat{\tau}_{c,t-\ell}$ interacted with expected temperature $\overline{T}_{c,t}$, logged precipitation, GDP growth, and the outcome variable $y_{c,t-\ell}$. The reader may also refer to the appendix of Alampay Davis (2025) for further exposition of this method and this state-dependent implementation.

4.3 Discrete regime change

To measure impacts on the propensity for autocracies to transition to democracies and vice versa, we estimate Equation (3) using a binary dependent variable indicating the country-year's regime type as the outcome variable. The corresponding coefficient estimates are interpreted as the state-dependent effect of an exogenous 1°C shock on the absolute propensity to transition to a democracy (or regress to an autocracy) h years after the shock. For interpretation as a proportional hazard, the magnitude of this effect can be compared to the unconditional annual propensity to undergo a regime change.

4.4 Identifying *adverse* temperature shocks

The state-dependent term β_{2h} in Equation (3) allows for the estimated impact of the temperature shock on the outcome of interest to vary linearly with the expected temperature $\overline{T}_{ct}$. This will be important for interpretation as whether a given temperature shock is economically adverse or beneficial will depend on the value of this state variable for the country-year on which it is incident.

The appendix of Alampay Davis (2025) reports the results of running this regression using country-year logged GDP as the outcome variable. Estimates imply that the threshold temperature at which the contemporaneous effect of the shock changes sign—calculated as $-\beta_{2,0}/\beta_{1,0} + 18$—is approximately 12.5°C [12.3,12.6]. That is to say, a marginal positive temperature shock is conducive to GDP growth for states cooler than this threshold temperature but a drag on growth for states warmer than this threshold. The magnitude of these impacts scales linearly with deviations from this threshold temperature.

5 Results

Referring back to the time series of temperature shocks illustrated in Figure A1, the median magnitude of a shock varies by the rate of climate change which will in turn vary across geographies and time. For the warmest 33% of country-years in our data, the median shock was approximately 0.19°C in absolute value in the 1970s and then increased to between 0.30-0.37° in the ensuing decades. Thus, effects of a 1° shock in settings above 25° can be understood as responses to a shock 3-5 times larger than is typically observed.

For the coldest 33% of country-years, the median magnitude of a shock was approximately 0.35° in the 1970s and 1980s, 0.51-0.53° in the 1990s and 2000s, and 0.59° in the 2010s. Their effect sizes then can be interpreted as the response to a shock just 2-3 times larger in magnitude than typical.

By the assumption of linearity inherent in the local projections model specified in Equation (3), we can scale down these estimated effects accordingly to infer the impact of a typical shock on the probability of democratic transition. For this reason, the following set of results are presented in terms of responses to a positive 0.5°C shock. Importantly, as shown in the appendix to Alampay Davis (2025), a positive temperature is economically adverse only for climates warmer than approximately 12.4°C but beneficial for cooler climates. Accordingly, we will prefer to summarize results in terms of *adverse* 0.5° shocks although regression results in tables and figures will be expressed in terms of positive 0.5° shocks.

5.1 The demand for democracy

To minimize inferential error from multiple hypothesis testing, we restrict attention here to the four survey category indices though we provide the equivalent results for their component survey questions in Section A2.1.

Table 3 reports the regression results of our main demand analysis.

These results imply large and significant state-dependent effects of temperature shocks on all four categories of preferences. The signs of these effects are internally consistent in that a temperature shock in a sufficiently warm country is associated with diminished preferences for pro-social institutions (Models 1 and 4, two periods after the shock) and increased skepticism of democratic institutions (Model 2, the period after the shock). Interestingly, support for authoritarian features of government (Model 3) are found to diminish in the year of a shock but this is almost exactly offset in the next two periods. By linearity, the signs of these relationships are exactly opposite for sufficiently cool countries, consistent with the convention that positive temperature shocks induce opposite-signed economic impacts for warm vs. cool countries.

To aid interpretation of these dynamic state-dependent effects, Figure 2 depicts these cumulative effects graphically as a function of the expected temperatures in the respondent's country of residence in the year of their survey. These cumulative effects and their 90% confidence intervals are derived as the sum of main and interactive effects in lagged periods where either the main effect or the interaction effect are found to be significant at the 5% level. Measures of pro-democratic and anti-democratic preferences are colored in blue and orange respectively.

The magnitude of these effects, expressed in units of standard deviations, are large. For a 26°C country, an adverse 0.5°C temperature shock is associated with a decrease in support for democracy by 0.13 [0.045, 0.22] standard deviations and in support for inclusive institutions of a 0.12 [0.047, 0.18]. The same shocks are expected to increase skepticism of democracy by 0.40 [0.32, 0.47] while effects on preferences for authoritarian features of governance imprecise and null. For a representative 10° country, these effects are signed similarly but are smaller and null across all indices.

While the repeated cross-sectional design of the IVS surveys limits our ability to test the persistence of these impacts, the fact that these effects manifest with a lag relative to the occurrence of the shock suggests it is not a direct psychological effect of heat on aggression driving these effects. Additionally, that the impact of a positive temperature shock changes sign for all outcomes at some intermediate temperature well within the range of human habitation evokes a robust finding in the climate impacts literature that marginal temperature shocks are economically harmful in economies above approximately 12.4°C but null or beneficial for cooler climates (Burke, Hsiang, et al. 2015; Nath et al. 2024).

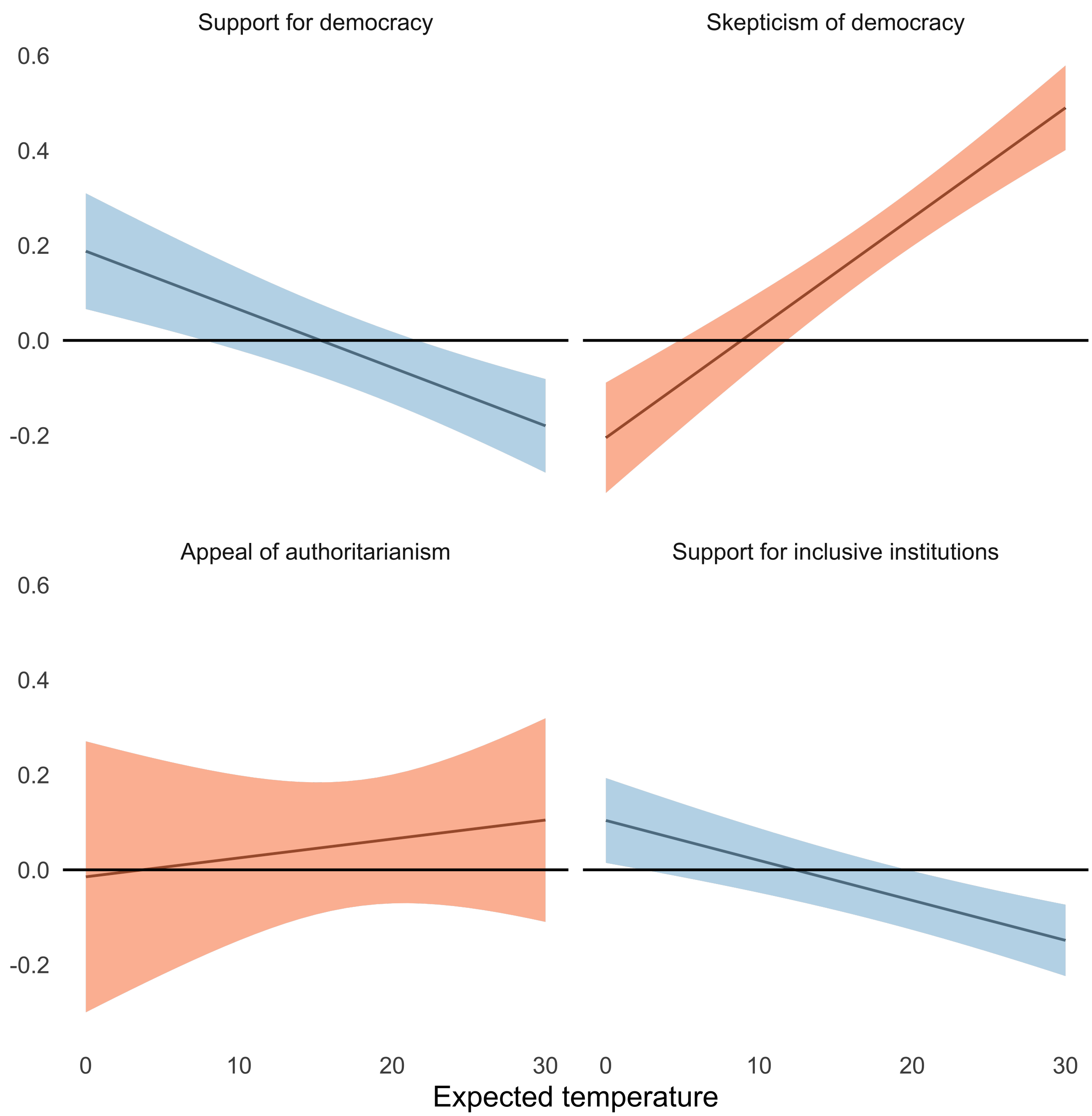
All in all, these results are consistent with the 'state of exception' demand story with effects particularly pronounced for warmer countries in countries with limited state capacity.

Table 3: Impact of a 1°C temperature shock on political preferences

Index:	Support	Skepticism	Authoritarian	Inclusiveness
Model:	(1)	(2)	(3)	(4)
Variables				
Shock	0.0029	-0.1395	-0.1893*	0.0778
	(0.0633)	(0.2643)	(0.0766)	(0.0496)
Shock × $\overline{T}$	-0.0004	-0.0098	-0.0253**	0.0065
	(0.0123)	(0.0234)	(0.0074)	(0.0067)
Shock, L1	-0.1351	0.4238**	0.1508***	-0.0544
	(0.1507)	(0.0717)	(0.0333)	(0.0840)
Shock, L1 × $\overline{T}$	-0.0143	0.0463**	0.0184***	-0.0052
	(0.0178)	(0.0068)	(0.0041)	(0.0081)
Shock, L2	-0.0656	-0.0625	0.1525*	-0.0951
	(0.0909)	(0.0855)	(0.0512)	(0.0748)
Shock, L2 × $\overline{T}$	-0.0245**	-0.0056	0.0148*	-0.0168*
	(0.0065)	(0.0067)	(0.0055)	(0.0044)
$\overline{T}$	-0.3175	-0.0463	-0.3568	-0.3901*
	(0.2603)	(0.3755)	(0.2267)	(0.1344)
Gender	Yes	Yes	Yes	Yes
Precipitation	Yes	Yes	Yes	Yes
Fixed-effects				
# Country	50	45	68	50
# Year	7	6	13	6
# Birth year	88	92	101	86
# Survey wave	4	3	7	3
Observations	73,663	70,752	141,261	64,007
Outcome mean	0.06575	-0.01313	-0.08535	0.00869
R^2	0.10195	0.10511	0.21184	0.19318

Clustered (Country & Year) standard-errors in parentheses
*Signif. Codes: ***: 0.001, **: 0.01, *: 0.05, .: 0.1*

Figure 2: Effect of a 0.5°C shock on political preferences (standard deviations)

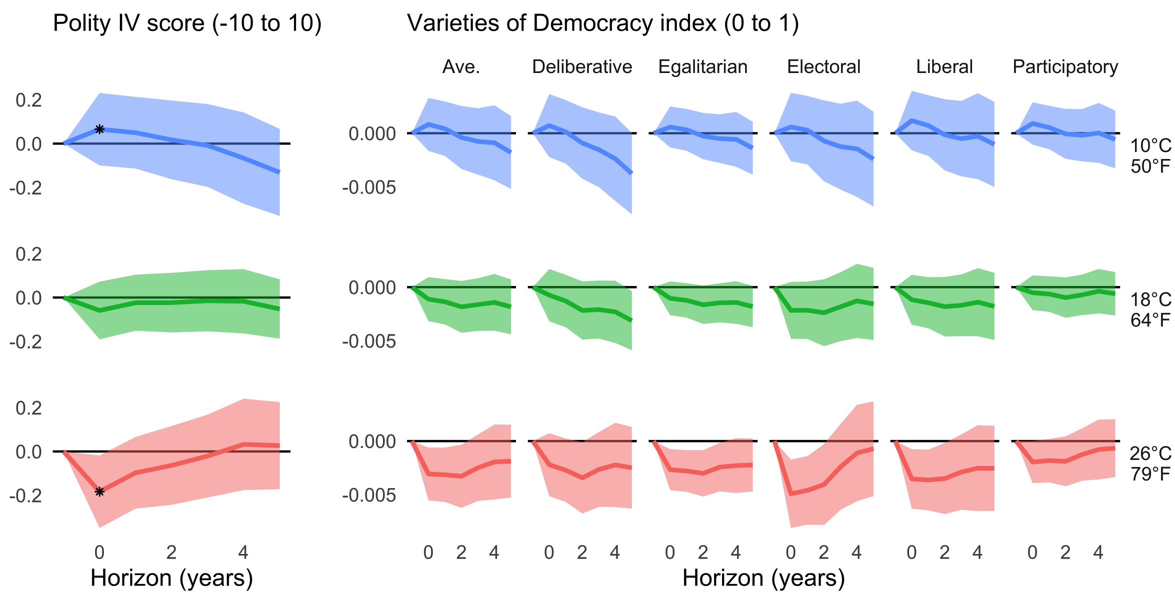


The vertical axis for all panels correspond to standard-deviation changes in an index of related survey questions associated with exposure to a unit temperature shock in the years preceding a respondent's interview. Estimates are derived from the regression results in Table 3 such that for each index, coefficients from lagged periods where either the main shock effect or its interaction with the state variable are found to be significant at the 5% level are summed to represent a cumulative effect two periods after a shock. Colors correspond to attitudes associated with support for progressive institutions (blue) or their negation (orange).

5.2 Institutional change

While our prior results provided evidence that adverse temperature shocks diminish the latent demand for democracy, they do not directly speak to whether these changed preferences manifest in material institutional change. To this end, Figures 3 and 4 depict the dynamic state-dependent cumulative responses of institutional democracy to these shocks as measured along intensive and extensive margins respectively.

Figure 3: Intensive margin – Effect of 0.5°C shock on democracy scores



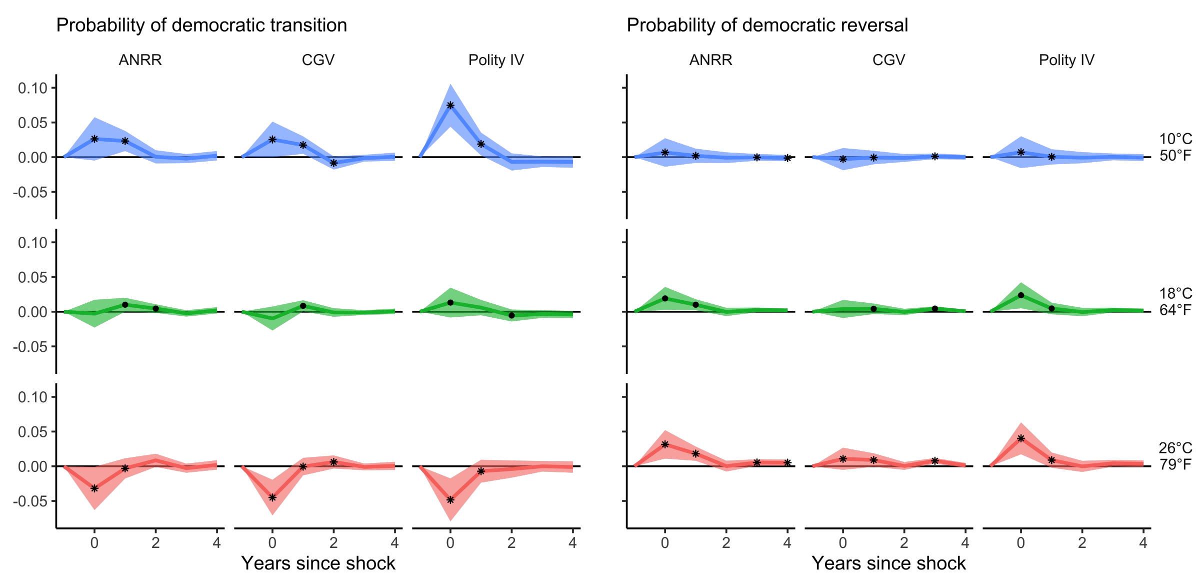
Plots represent the marginal effect of an identified temperature shock on democracy scores for regimes in three representative climates, net of the shock's effect on ensuing temperature shocks. The left panel depicts impacts measured by the widely used Polity IV score while the results in the right panel correspond to scores from the Varieties of Democracy Project which grade country-year regimes according to distinct aspects of democracy.

The Polity IV results displayed in Figure 3 indicate a significant state-dependent effect contemporaneous with an identified temperature shock. As with the demand results, this effect is found to be larger for warm-climate polities.Point estimates imply that an adverse 0.5° temperature shock induces a transitory 0.09 [0.01, 0.17] reduction in a 26° country's polity score. While not exactly rich in intuitive meaning, this magnitude is roughly 1% of the difference between a full autocracy and a full democracy under the group's suggested categorization. The results for the V-Dem scores are qualitatively similar but report null effects across the board.

Our final results are summarized in Figure 4. The left panel indicates that a transitory temperature shock substantially and significantly increases the propensity of temperate autocracies to democratize by 1.5-3.7 percentage depending on the local climate and how different data sources operationalize democracy in their constructions. Compared to an unconditional transition probability of approximately 0.03[5], these represent proportional increases to the probability of a 10° autocracy to democratically transition of 48% by the ANRR measure, 59% by the CGV measure, and 126% by the Polity IV measure. Referring to Table A2, the relative responsiveness of the Polity IV score may be explained by its relatively limited focus on "competitiveness of political participation and constraints on executive authority". Indeed, the ANRR definition of democracy is strictly more selective since classification as a democracy by Polity IV standards is used as a necessary but insufficient qualifying condition.

The right panel reports analogous results for the propensity of democracies to break down. These too exhibit large state dependencies. Impacts to a representative 26° country are substantial, significant, and persistent, ascribing increases of 0.6-2.0 percentage points in the probability of democratic reversal in the year of the shock. Compared to unconditional transition probabilities of between 0.033-0.048, these responses to a 0.5° shock represent proportional increases of 16.5%, 46.9%, and 45.5% for the ANRR, CGV, and Polity IV measures respectively. In contrast, impacts to sufficiently temperate democracies are found to be null, suggesting cool-climate democracies are the most stable, broadly consistent with the headline result in Acemoglu, Ajzenman, et al. (2025) that successful high-capacity democracies are self-sustaining and "breed their own support."

Figure 4: Extensive margin – Effect of 0.5°C shock on regime change



Values on the vertical axis measure the estimated impact of a unit shock on the propensity for autocracies to transition to democracies (left panel) and for democracies to regress to autocracies (right panel). Columns within a panel correspond to different data sources which vary in their operating definition of a democracy (see Table A2).

[5]The unconditional probability to democratize in any given period is surprisingly consistent across climates: 0.027 for autocracies cooler than 17° compared to 0.024 for those warmer than 25°by the ANRR measure, 0.024 vs. 0.019 by the CGV measure, and 0.030 vs. 0.032 by the Polity IV measure.

6 Conclusion

This paper seeks to structure and inform our understanding of climate change as a threat to global stability. Identifying a critical absence of academic work on this subject, I derive and empirically test two candidate theories of how democracy is likely to evolve under unmitigated global warming. The "mercury uprising" and "state of exception" demand-side hypotheses presented in Section 2 are each grounded in established political economy literature repurposed for the context of climate change yet with opposite implications for democracy worldwide.

The former interprets adverse weather shocks as fundamentally economic disruptions that reduce the opportunity cost of political contestation, thereby opening a 'window of opportunity' to credibly threaten political militancy and extract democratic concessions from a ruling elite. The latter draws on salient models of social crisis by interpreting these same shocks as exceptional threats to social security which a public perceives as requiring heavy-handed emergency powers to address.

The empirical results of this paper provide internally consistent support only for the latter theory. Across both attitudinal and institutional measures, adverse temperature shocks are found to undermine pro-democratic public sentiment and enable democratic backsliding and reversions to autocracy. These impacts are most pronounced but not exclusive to countries with already warm climates, which are typically characterized by lower levels of development. The mercury uprising mechanism, while theoretically compelling, finds no support in the data. These results underscore the fragility of democratic legitimacy under environmental pressures, especially in settings with limited state capacity.

These findings should not be interpreted as an endorsement of authoritarianism, nor as a resignation to its inevitability. The implication that a public may be predisposed towards exclusionary forms of governance only heightens the urgency of immediate and ambitious climate policy as a means of preventing authoritarian consolidation globally. Indeed, these threats to political equality, legitimacy, and institutional integrity may be considered among the most profound social costs of climate change, even if market-based measures of climate impacts which predominantly influence climate policy are unfit to incorporate them.

At the same time, the frameworks presented here can only be considered partial; a more general theory of democracy under climate change would integrate the 'supply-side' determinants of democracy. For example, the "mercury uprising" model could be augmented to allow for political elites to internalize the threat of political revolution by pre-emptive violent suppression, cooptation of political movements, or exploitation of latent social grievances to divide an organized resistance (Aidt and Franck 2015; Wood and Wright 2016). The "state of exception" theory could also be improved to consider the political elite's ability to further legitimize emergency powers whether by inciting fear and insecurity or simply through political inertia (Rahman et al. 2022). In either case, a more compelling equilibrium framework would allow for mass preferences and elite incentives to jointly determine political outcomes.

Moreover, recent evidence documented in Alampay Davis (2025) has made clearer than ever how climate change is expected to segment winners from losers even within polities, which is likely to complicate how political preferences translate into aggregate political change. Variables such as inequality, corruption, development, labor militancy, and sectoral composition likely mediate the relationship between temperature, institutions, and the political climate. Both theories presented here would benefit from additional work extending the underlying models in these directions.

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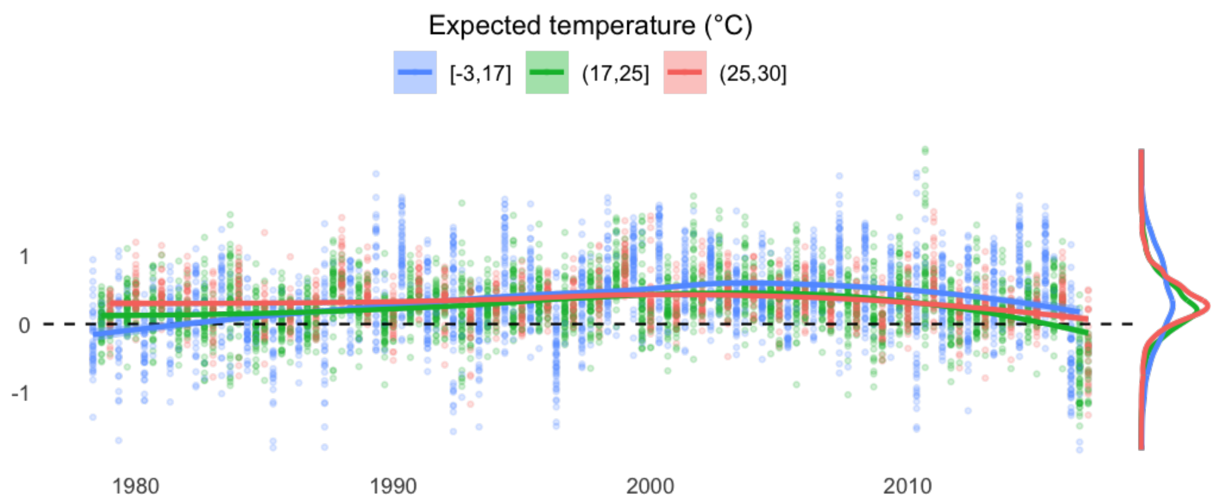
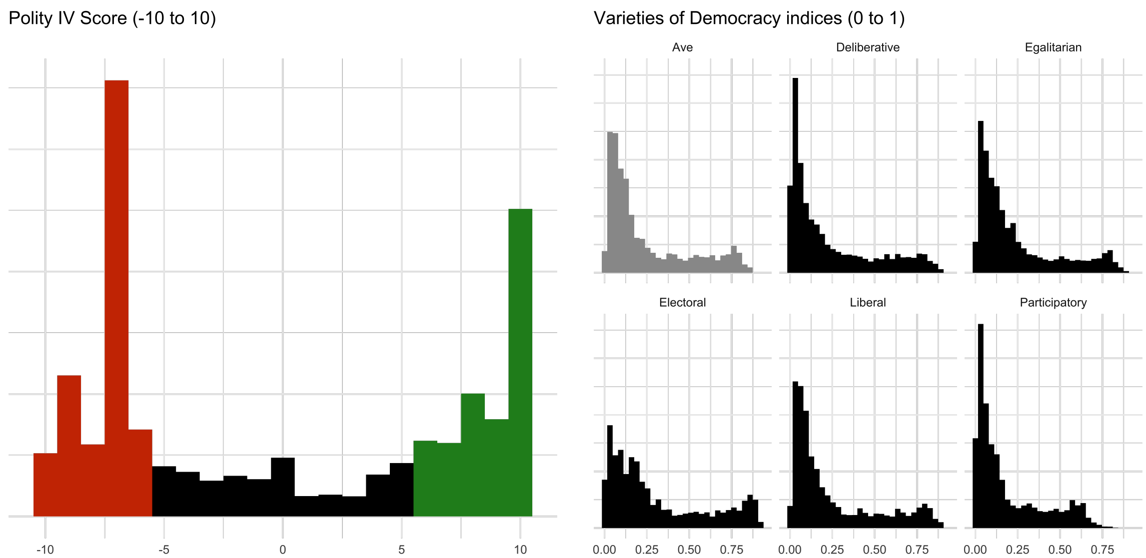
A1 Data

Figure A1: Country-level time series of identified temperature shocks



Points correspond to shocks observed in individual country-years. The three colors correspond to an equal-sized binning of country-years according to their moving-average temperature. Flexible local regression curves describe time trends for each bin; segments with more positive values correspond to periods of greater systematic warming. Marginal distribution plots on the right show that cooler country-years observe greater variance in shocks and more positive values.

Figure A2: Distribution of democracy scores by data source



For both sources, higher numbers correspond to 'deeper' levels of demcoracy. For Polity IV scores, colors correspond to suggested thresholds defining autocracies (orange) and democracies (green).

Table A1: Correlations between democracy indices after de-meaning by country

	Polity	V-Ave	V-Elec	V-Lib	V-Part	V-Delib	V-Egal
Polity	1.000	0.707	0.679	0.706	0.698	0.699	0.697
VDem-Average	0.707	1.000	0.987	0.990	0.988	0.990	0.979
VDem-Electoral	0.679	0.987	1.000	0.973	0.971	0.968	0.952
VDem-Liberal	0.706	0.990	0.973	1.000	0.973	0.979	0.959
VDem-Participatory	0.698	0.988	0.971	0.973	1.000	0.972	0.964
VDem-Deliberative	0.699	0.990	0.968	0.979	0.972	1.000	0.962
VDemx -Egalitarian	0.697	0.979	0.952	0.959	0.964	0.962	1.000

Table A2: Summary of different binary democracy indicators

Marshall and Gurr 2020 (Polity IV)

- Country-year regimes scored between -10 and +10 based on competitiveness of political participation and constraints on executive authority
- A country-year is labeled a democracy if scoring at least +5, autocracy if scoring at most -5, anocracy otherwise

Freedom House 2022 (FH)

- Country-year regimes classified as 'free', 'partially free', or 'not free' based on assessment of political rights and civil liberties
- A country-year is labeled a democracy if free or partially free

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Cheibub et al. 2010 (CGV)

- Country-year regimes deemed 'democratic' if determined to satisfy four conditions for competitive elections
  1. Chief executive chosen by popular election or elected body
  2. Legislature is popularly elected
  3. More than one party competes in elections
  4. Alternation in power under identical electoral rules

Boix et al. 2012 (BMR)

- Country-year regimes are deemed democratic if it is determined that
  1. Political leaders are chosen through free and fair elections
  2. The electorate satisfies a threshold value of suffrage
- Missing values are assigned to observations during international war or state collapse, unlike other measures that retain these cases
- Long time frame (1800-2007) but in the dataset, only 48 years of data used, the second lowest after FH

Papaioannou and Siourounis 2008 (PS)

- Focuses only on permanent transitions to democracy, no democratic breakdowns or transitory transitions
- ANRR suggests susceptibility to endogeneity in growth regressions

Acemoglu, Naidu, et al. 2019 (ANRR)

- A country-year regime is deemed free if either:
  1. FH labels it free or partially free and Polity IV assigns a positive score
  2. If FH or Polity IV data is unavailable, CGV or BMR label it as democratic

A2 Supplementary results

A2.1 Impacts on responses to survey questions by category

Table A3: Impact of temperature shock on support for democracy

Outcome:	Important to live in	Better than alternatives	Index
Model:	(1)	(2)	(3)
Variables			
Tshock	0.0379	0.2292	0.0029
	(0.0999)	(0.1533)	(0.0633)
Tshock $\times$ $\overline{T}$	-0.0037	0.0215	-0.0004
	(0.0309)	(0.0148)	(0.0123)
Tshock, L1	-0.4262	-0.3422**	-0.1351
	(0.3094)	(0.0819)	(0.1507)
Tshock, L1 $\times$ $\overline{T}$	-0.0356	-0.0345*	-0.0143
	(0.0481)	(0.0090)	(0.0178)
Tshock, L2	-0.0850	-0.1414·	-0.0656
	(0.1414)	(0.0564)	(0.0909)
Tshock, L2 $\times$ $\overline{T}$	-0.0492·	-0.0107*	-0.0245**
	(0.0211)	(0.0041)	(0.0065)
$\overline{T}$	-1.393	0.5673	-0.3175
	(0.8750)	(0.3314)	(0.2603)
Gender	Yes	Yes	Yes
Precip	Yes	Yes	Yes
Fixed-effects			
# Country	51	45	50
# Year	7	6	7
# Birth year	88	92	88
# Survey wave	4	3	4
Observations	78,223	79,822	73,663
Outcome mean	8.4826	3.2694	0.06575
R^2	0.07186	0.09830	0.10195

Clustered (Country & Year) standard-errors in parentheses
*Signif. Codes: ***: 0.001, **: 0.01, *: 0.05, .: 0.1*

Table A4: Impact of temperature shock on skepticism of democracy

Outcome:	Causes disorder	Too bureaucratic	Bad for economy	Index
Model:	(1)	(2)	(3)	(4)
Variables				
Tshock	-0.0951	-0.3033	-0.0169	-0.1395
	(0.1215)	(0.3042)	(0.2311)	(0.2643)
Tshock $\times$ $\overline{T}$	-0.0096	-0.0207	0.0009	-0.0098
	(0.0110)	(0.0276)	(0.0201)	(0.0234)
Tshock, L1	0.4524***	0.2319*	0.3077**	0.4238**
	(0.0348)	(0.0628)	(0.0712)	(0.0717)
Tshock, L1 $\times$ $\overline{T}$	0.0421***	0.0310**	0.0350**	0.0463**
	(0.0034)	(0.0058)	(0.0066)	(0.0068)
Tshock, L2	0.0080	-0.1220	-0.0644	-0.0625
	(0.0359)	(0.1043)	(0.0791)	(0.0855)
Tshock, L2 $\times$ $\overline{T}$	0.0019	-0.0114	-0.0062	-0.0056
	(0.0025)	(0.0083)	(0.0063)	(0.0067)
$\overline{T}$	0.0128	0.0680	-0.0366	-0.0463
	(0.2609)	(0.3612)	(0.3505)	(0.3755)
Gender	Yes	Yes	Yes	Yes
Precip	Yes	Yes	Yes	Yes
Fixed-effects				
Country (45)	Yes	Yes	Yes	Yes
Year (6)	Yes	Yes	Yes	Yes
# Birth year	94	94	94	92
Survey wave (3)	Yes	Yes	Yes	Yes
Observations	77,183	77,370	75,156	70,752
Outcome mean	2.2536	2.5495	2.2552	-0.01313
R^2	0.10072	0.08585	0.07878	0.10511

Clustered (Country & Year) standard-errors in parentheses
*Signif. Codes: ***: 0.001, **: 0.01, *: 0.05, .: 0.1*

Table A5: Impact of temperature shock on appeal of authoritarian features

Outcome:	Strongman	Army rule	Experts over government	Index
Model:	(1)	(2)	(3)	(4)
Variables				
Tshock	-0.2896*	-0.0722	-0.1921	-0.1893*
	(0.1167)	(0.0637)	(0.1149)	(0.0766)
Tshock $\times$ $\overline{T}$	-0.0357**	-0.0106	-0.0269*	-0.0253**
	(0.0113)	(0.0060)	(0.0110)	(0.0074)
Tshock, L1	0.2552**	0.1693**	0.0373	0.1508***
	(0.0644)	(0.0416)	(0.0646)	(0.0333)
Tshock, L1 $\times \overline{T}$	0.0261**	0.0232***	0.0071	0.0184***
	(0.0085)	(0.0048)	(0.0059)	(0.0041)
Tshock, L2	0.2326	0.0439	0.1625	0.1525*
	(0.1476)	(0.0477)	(0.1094)	(0.0512)
Tshock, L2 $\times$ $\overline{T}$	0.0268$^{\cdot}$	0.0064	0.0131	0.0148*
	(0.0139)	(0.0043)	(0.0122)	(0.0055)
$\overline{T}$	-0.4084	-0.4888	-0.1129	-0.3568
	(0.2969)	(0.2782)	(0.2998)	(0.2267)
Gender	Yes	Yes	Yes	Yes
Precip	Yes	Yes	Yes	Yes
Fixed-effects				
# Country	70	68	70	68
Year (13)	Yes	Yes	Yes	Yes
Birth year (101)	Yes	Yes	Yes	Yes
Survey wave (7)	Yes	Yes	Yes	Yes
Observations	155,513	154,986	151,601	141,261
Outcome mean	2.1665	1.6512	2.6439	-0.08535
R^2	0.19141	0.21441	0.13118	0.21184

Clustered (Country & Year) standard-errors in parentheses
*Signif. Codes: ***: 0.001, **: 0.01, *: 0.05, .: 0.1*

Table A6: Impact of temperature shock on support for inclusive institutions

Outcome:	Free elections	Civil rights	Gender equality	Tax the rich	Income equality	Unemployment aid	Index
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variables							
Tshock	0.1486	-0.2567	-0.6264*	-0.1744	0.5447	0.1002	0.0778
	(0.1721)	(0.2007)	(0.2093)	(0.3634)	(0.5144)	(0.3292)	(0.0496)
Tshock $\times$ $\overline{T}$	0.0048	-0.0173	-0.0798*	0.0156	0.0680	-0.0250	0.0065
	(0.0355)	(0.0298)	(0.0246)	(0.0438)	(0.0502)	(0.0570)	(0.0067)
Tshock, L1	-0.6634$^{\cdot}$	-0.8526**	-0.4974	0.0889	-0.1745	-0.6112$^{\cdot}$	-0.0544
	(0.3153)	(0.1683)	(0.2581)	(0.2518)	(0.3299)	(0.2798)	(0.0840)
Tshock, L1 $\times$ $\overline{T}$	-0.0782*	-0.0924**	-0.0654*	-0.0004	0.0320	-0.0708$^{\cdot}$	-0.0052
	(0.0282)	(0.0208)	(0.0188)	(0.0404)	(0.0493)	(0.0357)	(0.0081)
Tshock, L2	-0.5877	-0.7866	-1.141*	-0.6262	-0.8490*	-0.3577	-0.0951
	(0.4634)	(0.4773)	(0.3734)	(0.5447)	(0.2752)	(0.3553)	(0.0748)
Tshock, L2 $\times$ $\overline{T}$	-0.1373**	-0.1542***	-0.1653**	-0.1701**	-0.1084	-0.1007**	-0.0168*
	(0.0231)	(0.0188)	(0.0382)	(0.0445)	(0.0540)	(0.0259)	(0.0044)
$\overline{T}$	-2.316$^{\cdot}$	-4.008*	-3.472*	-7.058**	-3.745	-2.619$^{\cdot}$	-0.3901*
	(1.050)	(1.173)	(0.9670)	(1.488)	(1.868)	(1.310)	(0.1344)
Gender	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Precip	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed-effects							
# Country	51	51	51	51	51	51	50
# Year	7	7	7	7	6	7	6
# Birth year	88	88	88	88	87	88	86
# Survey wave	4	4	4	4	3	4	3
Observations	78,134	76,091	78,658	77,241	72,258	78,014	64,007
Outcome mean	8.3297	7.6747	8.1762	6.2444	5.8621	7.2154	0.00869
R^2	0.06789	0.06470	0.12605	0.10900	0.13886	0.09665	0.19318

Clustered (Country & Year) standard-errors in parentheses *Signif. Codes: ***: 0.001, **: 0.01, *: 0.05, .: 0.1*

A2.2 Counts of shocks

We complement the demand results in the main text with a related analysis which makes use of data from IVS surveys which only include the year of interview but not the month. Because we cannot infer the month of the year all respondents were surveyed, constructing shocks using temperature observed in the calendar year of the survey would potentially amount to regressing an outcome on a treatment that most respondents would not have received. Thus, we can only consider shocks preceding the year of interview.

While no longer predetermined, using time-indexed treatments still amounts to estimating the effects of treatments inconsistently defined for respondents surveyed at different months of the year. While not a perfect solution, we can greatly mitigate this concern by aggregating multiple lags of shocks over a longer period. A common way to do this is to use counts of shocks over this extended period, similarly to how Acemoglu, Ajzenman, et al. (2025) construct their 'exposure to democracy' treatment: we define a variable τ_{ct}^{N} representing the number of temperature shocks a respondent in country c over the$N$ calendar years preceding their interview in year t:

$$\tau_{ct}^{N} := \sum_{j=1}^{N} \mathbb{1}(\widehat{\tau}_{c,t-j} > \underline{\tau}) \tag{4}$$

This variable also depends on the value $\underline{\tau}$, the threshold value defining a temperature shock. As a benchmark, we use a common value of 1°C (corresponding to roughly the 92nd percentile in our full estimation sample) for all settings though there is also a reasonable case to use relative thresholds, for example based on country-specific variability in temperature.

In our preferred construction, we set $N = 3$ so that our count variable spans the typical persistence in temperature shocks. We modify the regression model specified in Equation (5) accordingly:

$$Y_{i,w,c,t,a} = \beta_1 \tau_{ct}^{N} + \beta_2(\tau_{ct}^{N} \times \overline{T}_{ct}) + \gamma^{\top}\mathbf{W}_{i,w,c,t,a} + \varepsilon_{i,w,c,t,a} \tag{5}$$

The results of this exercise are summarized in Table A7. Figure A3 depicts these coefficients graphically as a function of the expected temperature in the respondent's country of residence in the year of their survey.

Our favored specification, depicted as a green filled line with a corresponding 90% confidence interval, uses an explanatory variable defined as the number of temperature shocks above 1°C the respondent was exposed to in the three years preceding the year of the interview. Additional dashed lines correspond to alternative constructions which vary the number of years considered.

The coefficients on the main effect imply that recent exposure to an additional positive temperature shock for respondents in a representative 18°C decreases support for democracy and leads respondents to favor more restrictive definitions of democracy while increasing skepticism of democracy and preferences for authoritarian features of government. These effects are large in magnitude, ranging between 0.12-0.13 standard deviations for the attitudinal indexes and 0.46 standard deviations for the inclusiveness index.

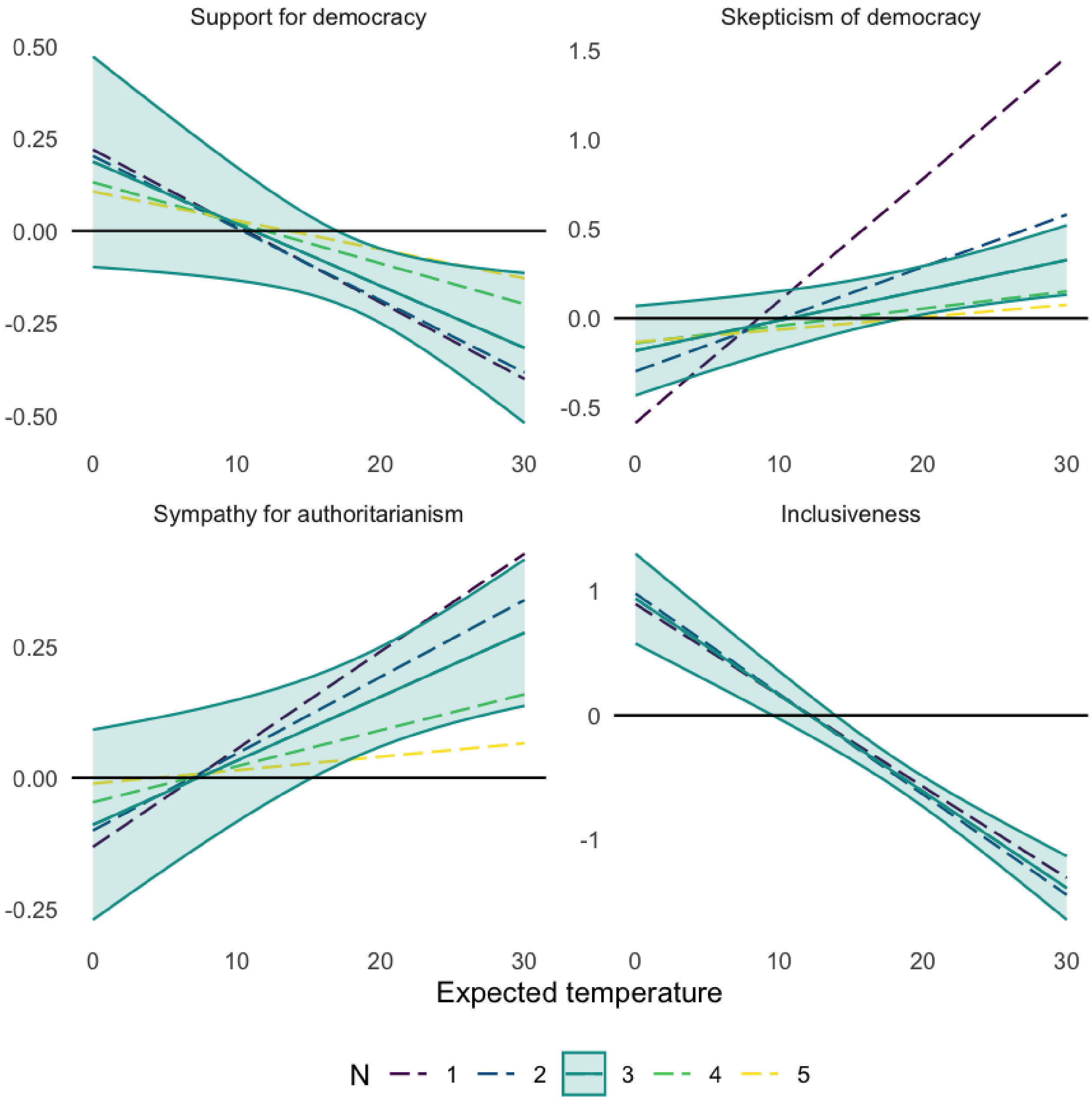
The state-dependency in this effect is significant at the 5% level for all outcomes except the democracy-support index. Among cold countries, effects are positive but nell with the exception of the large and highly significant impacts to the inclusiveness index. That the impacts are larger in magnitude and much more precisely estimated for the inclusiveness index despite being estimated for by far the smallest sample is most likely a reflection of the diversity and informativeness of questions from which it is constructed compared to the two highly correlated variables which comprise the democratic support index (see Table 2).

Table A7: Impact of an additional 1°C shock in prior three years on political preferences

Index:	Support	Skepticism	Authoritarian	Inclusiveness
Model:	(1)	(2)	(3)	(4)
Variables				
# 1°C Shocks	-0.1152$^{\cdot}$	0.1235	0.1303*	-0.4582**
	(0.0585)	(0.0815)	(0.0568)	(0.0704)
# 1°C Shocks × $\overline{T}$	-0.0168$^{\cdot}$	0.0169*	0.0122*	-0.0775**
	(0.0090)	(0.0072)	(0.0052)	(0.0116)
$\overline{T}$	-0.6651$^{\cdot}$	-0.2732	0.0832	-0.3258*
	(0.3382)	(0.3732)	(0.1460)	(0.0970)
Gender	Yes	Yes	Yes	Yes
Precipitation	Yes	Yes	Yes	Yes
Fixed effects, # unique values				
Country	75	76	98	58
Year	11	13	21	6
Age	84	87	87	83
Birth year	92	93	101	86
Survey wave	4	4	8	3
Observations	150,292	170,798	317,655	77,392
Outcome mean	0.02250	-0.00387	-0.03017	-0.05107
R^2	0.08924	0.10248	0.18527	0.17156

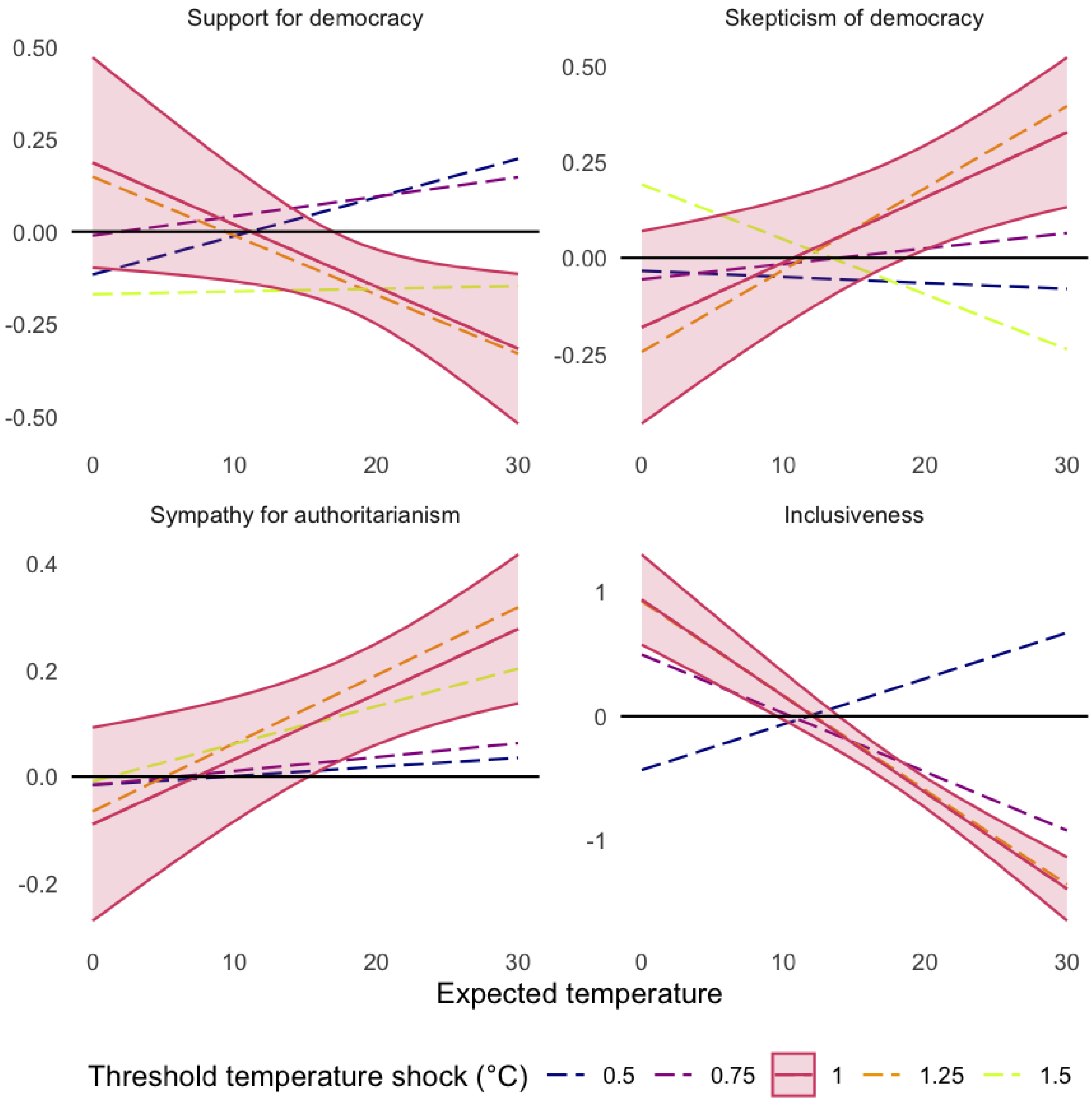
Clustered (Country & Year) standard-errors in parentheses
*Signif. Codes: ***: 0.001, **: 0.01, *: 0.05, .: 0.1*

Figure A3: Effect on political preferences of an additional 1°C shock in last N years



These estimates are generally consistent as we vary the period of exposure defining the temperature shock as in Figure A4. We find that restricting attention to more recent environmental exposure tends to increase the magnitude of the impact. While the repeated cross-sectional design and other limitations of the survey data limits our ability to capture dynamic impacts, this provides some suggestive evidence that these demand effects are concentrated either contemporaneous to the period of the shock or with a one-period lag and unlikely to be highly persistent.

Figure A4: Effect on political preferences of an additional 1°C shock in last three years



Analogous to Figure A3 but instead of varying the number of years over which shocks are enumerated, we vary the minimum magnitude to qualify as a temperature shock.

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