Retrospectively sweaty? The effects of temperature changes on presidential approval

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POL837 Issues in Comparative Politics

Spring 2024

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Word count: 4,670

1 Introduction

Whether voters can truly capture a realistic appraisal of the state of the world at the polls remains a core research topic in the study of politics. In an ideal scenario, individuals will be able to adequately judge the strengths and weaknesses of politicians, punishing poor performers and providing incentives for new leaders to perform competently while in office. This well known argument of *voter rationality*[1] builds the foundation of retrospective voting, which models citizens as rational observers of government past-performance.[2] Accurate retrospective voting has been theorized to lead to efficient political outcomes, where politicians who underperform leave office, resulting in greater democratic accountability.[3]

However, modern researchers have challenged the view that voters can accurately appraise politician performance. A variety of biases have been found in the way voters attribute responsibility to political leaders, which challenge the basis of the perfect retrospective voter.[4] In this paper, I contribute to this stream of the literature by focusing on how seemingly irrelevant events can affect perceptions of the president. I focus in presidential approval as the outcome of interest given its applicability to the retrospective voting context and its wide availability in world data. Further, I leverage variation in short-term temperature changes in Ecuador as events over which politicians hold no control. Thus, my research question is ¿do short daily

[1] Key, *The Responsible Electorate*.
[2] Ferejohn, "Incumbent Performance and Electoral Control"; Healy and Malhotra, "Retrospective Voting Reconsidered."
[3] Besley, *Principled Agents?*; Persson and Tabellini, *Political Economics*.
[4] Healy and Malhotra, "Retrospective Voting Reconsidered."

temperature changes affect presidential approval ratings in Ecuador?

I follow[5] and use daily temperature data from the CPC Global Unified temperature data[6] for Ecuador, and use AmericasBarometer survey data for presidential approval and other socioeconomic and public opinion controls. Given that daily temperature changes can be assumed to be uncorrelated to political behaviour, I can consistently estimate the impact of daily temperature changes on presidential approval ratings in a regression framework.

The core result of the paper is that higher temperatures have a negative and statistically significant relationship with presidential approval, which suggests that voters commit attribution errors when evaluating politicians. I ascribe this result to mood misattributions, where individuals' moods are affected by weather they perceive to be unpleasant.[7] Individuals look to validate their negative moods by looking for external causes,[8] which justify the reduced presidential approval.

Other research has found evidence of cognitive biases in voters' perceptions of politicians,[9] yet few papers studied the impact of random events.[10] Weather-related events have been used

[5]Quijano-Ruiz, "Assessing the reliability of self-rated health: the effects of transient weather fluctuations on perceived health."

[6]National Oceanic and Atmospheric Administration (NOAA) Physical Sciences Laboratory (PSL), "CPC Global Unified Temperature."

[7]Keller et al., "A Warm Heart and a Clear Head"; Barrington-Leigh and Behzadnejad, "The Impact of Daily Weather Conditions on Life Satisfaction"; Lignier et al., "Does the Climate Impact Satisfaction with Life?"

[8]Schwarz and Clore, "Mood, Misattribution, and Judgments of Well-Being"; Bower, "Mood and Memory."

[9]Hart and Matthews, *Quality Control*; Kahneman and Tversky, "On the Study of Statistical Intuitions"; Beck, "Does There Exist a Political Business Cycle"; Tilley and Hobolt, "Is the Government to Blame? An Experimental Test of How Partisanship Shapes Perceptions of Performance and Responsibility."

[10]Healy et al., "Irrelevant Events Affect Voters' Evaluations of Government Performance"; Healy and Malhotra, "Random Events, Economic Losses, and Retrospective Voting"; Achen and Bartels, "Blind Retrospection."

in quasiexperimental studies to draw causal statements about voter behaviour,[11] but their direct effect on performance ratings and the implications for retrospective voting are yet to be understood.

Understanding how voters misattribute their mood to political leaders is a question whose importance has been well established by the literature. Extending the applicability of retrospective voting models based on cognitive biases to the context of a developing country in the tropics like Ecuador holds additional importance. Significant mood misattributions like the one I find may partially explain democratic accountability crises, as voters may persistently fail to properly evaluate incumbent performance and fail to provide good incentives for political leaders. Further, understanding what factors outside the common variables may be a better way to understand the modern issues the region faces.

The rest of the paper proceeds as follows. In the next section, I review the theory which informs the paper's empirical approach. Section 3 presents the empirical approach. In section 4, I discuss the paper's results. Section 5 concludes.

[11] Healy and Malhotra, "Myopic Voters and Natural Disaster Policy"; Bassi, "Weather, Risk, and Voting"; Liao and Ruiz Junco, "Extreme Weather and the Politics of Climate Change"; Visconti, "After the Flood"; Bastos and Miller, "Politics Under the Weather."

2 Retrospective voting and weather

In this section, I review the theory which informs my empirical approach. I analyze relevant literature on retrospective voting, which has mostly centered on economic voting, as well as the literature on presidential approval. I then provide an overview of my causal argument based on psychology theory on mood. Further, I review existing results on the impact of weather on mood and decision-making.

Economic voting research has long discussed if the economy truly explains voting behaviour (i.e. voters will punish politicians for poor management of the economy), or if the economy is seen through a partisan lens, implying that the management of the economy itself is irrelevant.[12] Difficult identification challenges emerge from this type of performance models due to the endogeneity of the public's perceptions of the economy and vote choice.[13] This endogeneity presents itself in even the most basic analyses: one cannot identify causality from correlations of Republican vote share and economic growth, since Republican president's may be more likely to be elected in times of economic growth.

Most retrospective voting research in Latin America has focused on economic voting too, as well as on populism and the recent rise of leftist parties and populism.[14] The literature finds no

[12] Wlezien, Franklin, and Twiggs, "Economic Perceptions and Vote Choice"; Lewis-Beck, "Does Economics Still Matter?"; Lewis-Beck, Nadeau, and Elias, "Economics, Party, and the Vote."
[13] Anderson, "The End of Economic Voting?"; Kiewiet and Rivers, "A Retrospective on Retrospective Voting."
[14] Benton, "Dissatisfied Democrats or Retrospective Voters?"; Lee, "Party Responsiveness to the Collective Judgment of the Electorate"; Wiesehomeier and Doyle, "Discontent and the Left Turn in Latin America"; Murillo, Oliveros, and Vaishnav, "Electoral Revolution or Democratic Alternation?"

clear conclusions. However, Veiga[15] finds that usual macroeconomic variables are not reliable predictors of vote choice on Latin American countries. Regarding leftist parties and populism, evidence has shown that the early 2000's *pink tide* in Latin America may have been a result of retrospective voting and discontent with establishment parties.[16]

The literature on presidential approval is adjacent to economic voting, since it has mostly focused on estimating *popularity functions* to determine the relationship between presidential popularity and other variables.[17] Macroeconomic variables such as inflation and unemployment have been found to significantly affect presidential approval in some cases, however, no definitive results have been found. Results are highly dependent on context, and on the researcher's choice of variables, model specification, frequency, time frame, among others. donovan_etal20 show that presidential approval is also impacted by the public's partisan identity. Recent findings show that perceptions of corruption can act as significant predictors of presidential approval,[18] especially in Latin America, where other work has shown a reduced importance of standard economic variables.[19]

The debate that retrospective voting has given rise to has incentivized the use of advanced causal inference and experimental techniques to overcome identification challenges. This renewed approach has allowed for a more precise understanding of the mechanisms behind retrospective voting. Some of the recent work involves the mistakes that voters make when

[15] "Economic Voting in an Age of Growth and Poverty Reduction."
[16] Wiesehomeier and Doyle, "Discontent and the Left Turn in Latin America."
[17] Berlemann and Enkelmann, "The Economic Determinants of U.S. Presidential Approval."
[18] Jung and Oh, "Determinants of Presidential Approval Ratings."
[19] Cerda and Vergara, "Economic Growth and Political Approval Ratings."

evaluating politicians' performance, going beyond the lack of knowledge about economic information. Rather, recent research has found that citizens tend to commit errors consistent with decision-making beyond political life.

Events that should be irrelevant to the vote choice are one type of such biases. Though disputed, Achen and Bartels[20] famously presented evidence of shark attacks impacting Woodrow Wilson's vote share in 1916. Further, Healy et al.[21] find that football games can positively impact the vote share of incumbents, results also consistent with irrelevant events impacting voting behaviour. Events that politicians have no control upon can impact their electoral outcomes if voters are assumed to be affected by mood in their performance judgments, a well-documented phenomenon in other fields. In an experimental setting, Schwarz and Clore[22] show how inducing positive moods led subjects to report more feelings of satisfaction relative to subjects which were induced negative moods. Most importantly, it was shown that *people in bad moods were more likely to search for information to explain their mood* relative to those in a happy mood. This is direct evidence for attribution errors: if an outside circumstance induces a negative mood, people may be more likely to attribute their mood to search for information that confirms their mood, rather than the other way around. Additionally, Bower[23] show that people who were induced a mood were more likely to recall information that was congruent with their mood. This can confirm misattribution errors in voters, who may be more likely to recall

[20] "Blind Retrospection."
[21] "Irrelevant Events Affect Voters' Evaluations of Government Performance."
[22] "Mood, Misattribution, and Judgments of Well-Being."
[23] "Mood and Memory."

negative information about politicians if they are in a bad mood, and vice versa.

Fields other than political science have studied weather extensively, mostly showing significant impacts across a range of variables. Notably, Keller et al.[24] find that pleasant weather (higher temperature or barometric pressure) has a positive impact on mood for U.S. subjects. Kämpfer and Mutz[25] and Schmiedeberg and Schröder[26] find conflicting results of the impact of sunnier days on life satisfaction using survey data from Germany. Lucas and Lawless[27], do not find reliable evidence of weather impacting life satisfaction using U.S. survey data. In Canada, Barrington-Leigh[28] finds a positive effect of sunnier days on trust in neighbours using Canadian survey data. Further, Barrington-Leigh and Behzadnejad[29], find that temporary rainfall variations have a significant, yet small negative impact in life satisfaction, especially for individuals with poor health and women. Lignier et al.[30] find that higher temperatures in prolonged dry temperatures have a negative impact on life satisfaction in Australia. Beyond life satisfaction, Deller and Michels[31] show that cloudy days have a significant impact on the way that managers evaluate subordinates across field experiments in the United States. Additionally, Quijano-Ruiz[32], using the same CPC daily weather data for Ecuador, finds an effect of daily temperature changes on self-rated health for female survey respondents only.

[24] "A Warm Heart and a Clear Head."
[25] "On the Sunny Side of Life."
[26] "Does Weather Really Influence the Measurement of Life Satisfaction?"
[27] "Does Life Seem Better on a Sunny Day?"
[28] "Weather as a Transient Influence on Survey-Reported Satisfaction with Life."
[29] "The Impact of Daily Weather Conditions on Life Satisfaction."
[30] "Does the Climate Impact Satisfaction with Life?"
[31] "The Effect of Weather on Subjective Performance Evaluation."
[32] "Assessing the reliability of self-rated health: the effects of transient weather fluctuations on perceived health."

The causal mechanism that the article's empirical approach leverages draws from Schwarz and Clore[33] and Bower[34]. Weather impacts mood, which then causes citizens to attribute their moods to external circumstances. If citizens consider higher temperatures to be "bad weather", their mood can be negatively impacted, making them more likely to negatively evaluate the president as a result of their discomfort. The effect is particularly salient for the president given the importance attributed to the executive for the management of domestic affairs. According to the theory, voters will attribute their mood to a external situation (the question being asked by the interviewer, which in this case relates to the president) and may even justify it by searching for negative events that confirm their mood, as proposed by Bower[35].

In summary, retrospective voting literature has had an economic focus, which underscores the importance of controlling for economic perceptions in any formal empirical model of political behaviour. The Latin American context has shown some degree of resemblance to developed countries, but also some differences, notably in how certain ideological factors may moderate political behaviour to larger extent than developed countries. Presidential approval rating is extensive and has provided many recommendations for the estimation of popularity functions, notably, incorporating data at many frequencies and aggregations. However, this may not be possible or applicable in all contexts due to data availability. My theory on the impact of weather on presidential approval is supported by a growing literature on the impact of weather on mood and life satisfaction, which has shown mostly significant impacts of "better" weather

[33] "Mood, Misattribution, and Judgments of Well-Being."
[34] "Mood and Memory."
[35] Ibid.

across several variables. The causal mechanism I draw from is supported by psychological theory, which has shown that mood can impact the way that individuals process information, and how they attribute their mood to external circumstances.

I thus hypothesize that because Ecuador is a tropical country, citizens may be more likely to attribute their discomfort to the president on hotter days, which will lead to a decrease in presidential approval. The effect of a higher daily temperature on presidential approval is then expected to be negative.

3 Empirical Approach

3.1 Data

My data are composed of a pooled cross section of the AmericasBarometer (AB) merged with daily CPC Global Unified temperature, based on interview date and cantons in Ecuador[36]. The AB is a public opinion survey conducted by the Latin American Public Opinion Project (LAPOP), which has conducted biennial survey waves of 1,500 - 3,000 in Ecuador and other countries from 2004 to 2023. I use the subscriber LAPOP datasets available through Universidad San Francisco de Quito's research affiliation with LAPOP, focusing on the eight

[36] Cantons are the second level of the political-administrative division of the country, akin to municipalities or counties.

survey waves carried out between 2008 to 2023[37]. The surveys are based on a multi-stage national probability design, representative at the national level, except for 2021, where the survey switched to a random-digit-dialing design due to the COVID-19 pandemic.

The explained variable of interest is presidential job approval, which the AmericasBarometer measures as in a 1-5 scale in the question: "Speaking in general of the current administration, how would you rate the job performance of President [NAME]"[38] (p.14), where 1 represents a very good performance and 5 terrible performance. This question is worded similarly to the classic Gallup presidential approval question, which the literature has used extensively[39] and has not been found to significantly deviate from other presidential popularity measures. I dichotomize the variable following LAPOP research reports[40] where responses lower than 3 are considered as approval for the incumbent president.

Table 1 displays descriptive statistics for some of the variables used in the empirical analysis. I collect perceptions of personal and country economic situations, also measured on a 1-5 scale, where 1 represents a very good situation and 5 a terrible situation. I include a binary variable indicating if the respondent voted for the incumbent in the past election[41]. Political ideology is represented in a 0-10 scale, where 0 represents the "extreme left" and 10 the "extreme right".

[37]The 2004 and 2006 waves did not record interview dates. The eight waves took place every two years between 2008 and 2016. The 2018/19 wave took place between late 2018 and 2019 across Latin America, and exclusively in early 2019 for Ecuador. The two most recent two survey waves were carried out in 2021 and 2023.

[38]LAPOP, "The AmericasBarometer by the Latin American Public Opinion Project (LAPOP) Ecuador 2004 - 2023 Merged File."

[39]Berlemann and Enkelmann, "The Economic Determinants of U.S. Presidential Approval."

[40]Layton et al., "Chapter 3. Citizen Security, Evaluations of the State, and Policy Preferences."

[41]The AmericasBarometer only asks about retrospective vote of the first round of elections in Ecuador. In all elections except 2006 and 2013, Ecuador has had a runoff election.

Table 1: Descriptive statistics for the matched AB data and weather variables

	N	Missing (%)	Mean	Std. dev.	Min	Median	Max
Presidential approval	14997	10	0.5	0.5	0.0	0.0	1.0
Daily minimum temperature (C)	15749	6	16.3	6.6	−2.2	18.3	27.8
Daily maximum temperature (C)	15749	6	24.4	4.9	8.4	25.3	34.3
Daily average temperature (C)	15749	6	20.4	5.5	4.6	22.0	29.3
Daily precipitation (mm)	15820	5	5.2	8.5	0.0	2.1	236.5
Female	15058	10	0.5	0.5	0.0	1.0	1.0
Age (years)	16649	0	37.9	15.7	16.0	35.0	96.0
Rural status	16562	1	0.6	0.5	0.0	1.0	1.0
Worse perception of personal econ.	16425	1	0.4	0.5	0.0	0.0	1.0
Worse perception of country econ.	13455	19	0.4	0.5	0.0	0.0	1.0
Religious	13336	20	0.9	0.3	0.0	1.0	1.0
Incumbent vote	11124	33	0.5	0.5	0.0	1.0	1.0
Ideology score (0-10)	9222	45	5.4	2.5	1.0	5.0	10.0
Support of democracy	16099	3	0.6	0.5	0.0	1.0	1.0
Perception of corruption	10897	35	0.6	0.5	0.0	1.0	1.0
Tolerance to bribes	13268	20	0.2	0.4	0.0	0.0	1.0
Political pride score	14899	11	4.1	1.8	1.0	4.0	7.0
Trust in police score (0-7)	13589	19	4.0	1.8	1.0	4.0	7.0
Trust in local government (0-7)	15055	10	3.9	1.8	1.0	4.0	7.0
External efficacy	13310	20	3.6	1.9	1.0	4.0	7.0
Internal efficacy	13244	21	4.0	1.6	1.0	4.0	7.0

Note: Descriptive statistics for variables used in the empirical analysis. For categorical variables, the percent of observations in the category out of the total sample is presented. For numerical (either ordinal or continuous) variables, the mean, standard deviation, minimum and maximum are presented. For both, the number of observations and the percentage of missing values.

I include 1-7 scales for external and internal efficiency, trust in police, local government, political pride, and support for democracy where 0 represents no trust or support and 7 complete the opposite. Corruption perceptions are collected by the AB as a 1-4 scale, where 1 represents "corruption not generalized" and 4 "very generalized" (p. 22).[42] I dichotomize this variable taking values greater than 1 as perceiving corruption. Corruption tolerance is measured as tolerance to paying a bribe, where 0 is not justified, and 1 is justified. The empirical analysis

[42] LAPOP, "The AmericasBarometer by the Latin American Public Opinion Project (LAPOP) Ecuador 2004 - 2023 Merged File."

also includes gender, age, religiousness, ethnicity, civil status, education and labour market status. These last four variables are summarized in Table 2.

Table 2: Descriptive statistics for socieconomic categories in the matched dataset

		N	Missing (%)	Percent
Ethnicity	Mestizo	13077	100	78.4
	Blanca	1321	100	7.9
	Indígena	771	100	4.6
	Negra	487	100	2.9
	Mulata	564	100	3.4
	Otra	197	100	1.2
Civil status	Single	3910	100	23.4
	Married/Common Law	6964	100	41.8
	Divorced/Separated/Widowed	764	100	4.6
Education	Primary or none	3931	100	23.6
	Secondary	7610	100	45.6
	Superior	3441	100	20.6
Labour market status	Employed	7887	100	47.3
	Not in Labour Force	5559	100	33.3
	Unemployed	1577	100	9.5

Civil status includes single, married (lumped with common law), and divorced, separated and widowed, which are lumped in one category. The reference level is single. Self-reported ethnicity includes white, mestizo, indigenous, mulato and other ethnic groups, where the reference level is mestizo (the most common in the Highlands region, where the capital is located). Education is a categorical variable for highest educational degree attained, including levels for primary (lumped with no education), secondary, and higher education (college, university or higher are lumped together). The reference level is primary education. Labour market status includes three categories: employed, not in the labour force, and unemployed. The reference level is not in the labour force, includes those retired, students, homemakers, and those not

working.

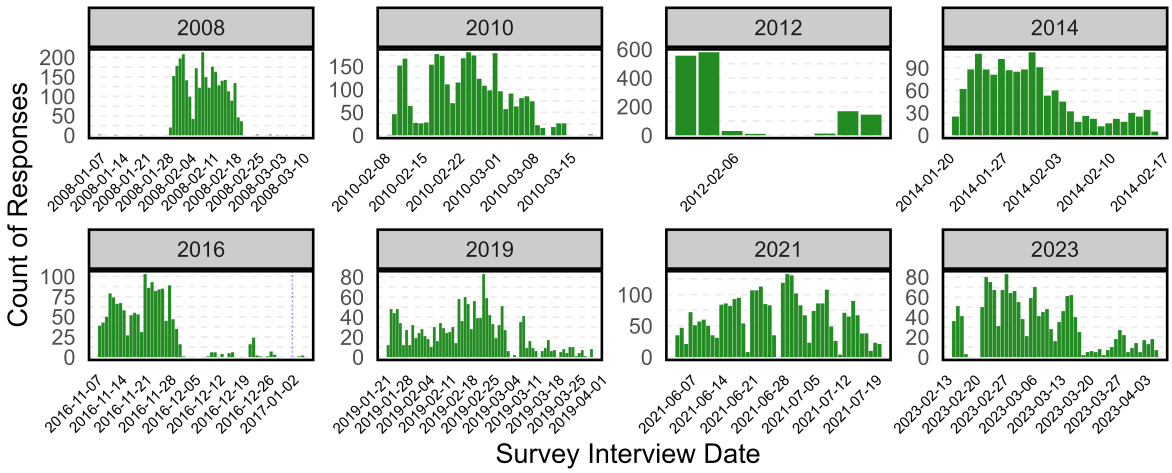
I extract daily minimum and maximum temperature and precipitation data from the CPC Global Unified Temperature datasets.[43] These data are prepared by the U.S. government National Oceanic and Atmospheric Administration (NOAA) and emerge from satellite imaging of the Earth surface. While daily weather data would typically be available from every country's meteorological authority[44], publicly available meteorological data from weather stations lacks the frequency and geospatial granularity required for this type of analysis.

I follow Quijano-Ruiz[45] and compute weighted mean minimum and maximum temperatures for each canton and day, weighting by the surface area of each canton. Replication code for this process is available in a GitHub repository. The surface area of each canton is obtained the Ecuadorian statistics authority (INEC, for its initials in Spanish) geoportal, along with the map shapefiles and political administrative divisions to match the canton names and codes to the AB data.[46] I then merge this data with the AB data based on interview dates and canton codes.

Figure 1 shows the distribution of respondents by interview date in the AmericasBarometer survey waves. As it can be seen, most stay in a relatively small time frame. The 2018 wave (sometimes referred as the 2018/19 wave) is the most spread out due to the survey being carried

[43] National Oceanic and Atmospheric Administration (NOAA) Physical Sciences Laboratory (PSL), "CPC Global Unified Temperature."
[44] In Ecuador, the relevant institution is the Instituto Nacional de Meteorología e Hidrología.
[45] "Assessing the reliability of self-rated health: the effects of transient weather fluctuations on perceived health."
[46] Instituto Nacional de Estadística y Censos, "Clasificador Geográfico Estadístico."

Figure 1: Survey dates of the Americas Barometer in Ecuador, 2008-2023



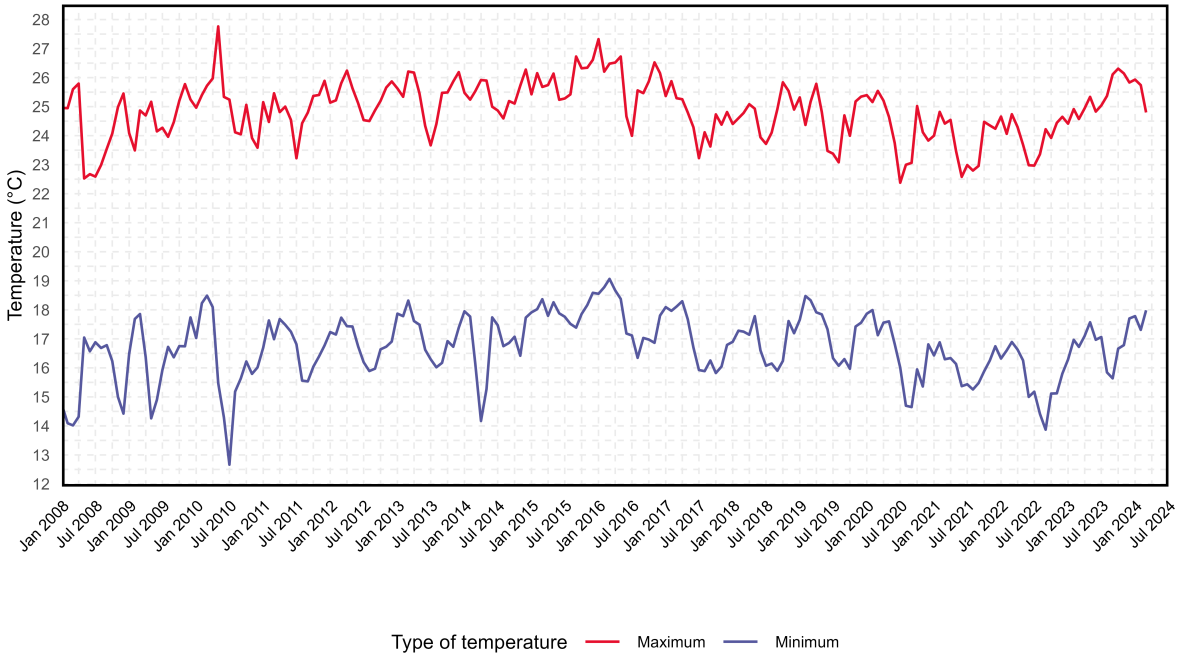
out between late 2018 and early 2019. Most waves are carried out January to April. These periods contain rich variation of temperature across cantons.

In Figure 2 I show mean monthly minimum and maximum temperatures from 2008 to 2023. The smallest average minimum temperature was 12.7, compared to the largest maximum temperature of 27.8. There are no notable upward or downward trends through time, with some periods showing higher temperatures. An important feature is that the spread between minimum and maximum temperatures is relatively stable, which will be important for the identification strategy, which I describe below.

3.2 Identification strategy

I exploit variation produced by a natural experiment: the transitory nature of daily temperature changes. I assume these changes are random and exogenous to variables related to political

Figure 2: Mean monthly temperatures, 2008-2023



mechanisms or other variables that can affect the performance of political leaders. By making this assumption, I can define a presidential popularity function as follows:

$$\text{approval}_{it} = \alpha + \tau_d + \theta_j + \beta\, \text{temp}_{jd} + \mathbb{X}'_{it}\gamma + u_{it} \tag{1}$$

where approval_{id} is presidential approval, τ_d and θ_j are vectors of interview date and canton fixed effects, temp_{jd} is daily temperature for canton j on day d, $\mathbb{X}'_{it}$ a vector of survey-wave and individual varying controls, γ the vector of associated control coefficients and u_{it} an error term. The parameter β is the coefficient of interest, which measures the effect of temperature on presidential approval. The assumption of randomness in daily temperature changes implies

that

$$\mathrm{E}[\mathrm{temp}_{jt} \times u_{it}] = 0 \tag{2}$$

which allows me to estimate β consistently.

A potential worry is that temperature, as measured by the CPC Global Unified Temperature data, suffers from measurement error, $\hat{\beta}$ can suffer from attenuation bias, which leads to underestimation of the true effect of temperature on presidential approval. Attenuation bias will exist if measurement error is more likely to be present in days with higher or lower temperatures, or for certain cantons. There is no reason to assume this is the case, but I address this possibility in the conclusion. If measurement error is present but not correlated with the error term, then $\hat{\beta}$ will still be consistently estimated, but with less precision.

Further, given that I only observe presidential approval in an ordinal or binary scale, I cannot directly estimate Equation 1. While it is possible to use a linear probability model, I choose to follow the literature and use logistic regression as the link function to estimate the probability of observing approval of the incumbent president. I cluster all standard errors at the canton level, to allow for spatially clustered correlation in the error term.

4 Results

4.1 Baseline specifications

Table 3 shows baseline results of the logit fixed effects estimation of Equation **??**, which are the baseline empirical models of the paper. These only include weather variables and canton and interview date fixed effects. The results from these specifications serve as a benchmark for the subsequent models that include additional control variables. Further, models without any type of political behaviour controls leverage a large sample size, as I do not lose any observations due to missing values. I later estimate models with controls to examine the robustness of the baseline results, as well as to improve the precision of the estimates.

Specification (1) considers only daily minimum temperature as a weather variable, which shows a positive logit coefficient (0.018) not statistically distinguishable from zero at conventional significance levels. Specification (2) only includes maximum daily temperature, which shows a negative logit coefficient (-0.044) that is statistically significant at $p < 0.01$. Specification (3) includes my measure of average temperature, again showing no statistically significant relationship between temperature and presidential approval.

Specification (4) considers the relationship between both minimum and maximum daily temperature variables, to account for the possibility that days with different spreads between minimum and maximum temperature have different effects on individuals. I also include a daily precipitation variable, to account for the possibility that a rainier day may have an additional

effect on approval ratings. It is shown that maximum temperature keeps its significance at $p < 0.01$ level, while other weather variables remain statistically insignificant at any conventional significance level. It is valuable to note that standard errors for all of my coefficients in this table are not notably large, which suggests that the lack of statistical significance may not be due to a lack of precision. The sign of the coefficients is evidence which supports the hypothesis that voters may commit attribution errors when evaluating politician's performance, and tend to evaluate the president worse in days with higher temperatures, as per my hypothesis of mood misattribution.

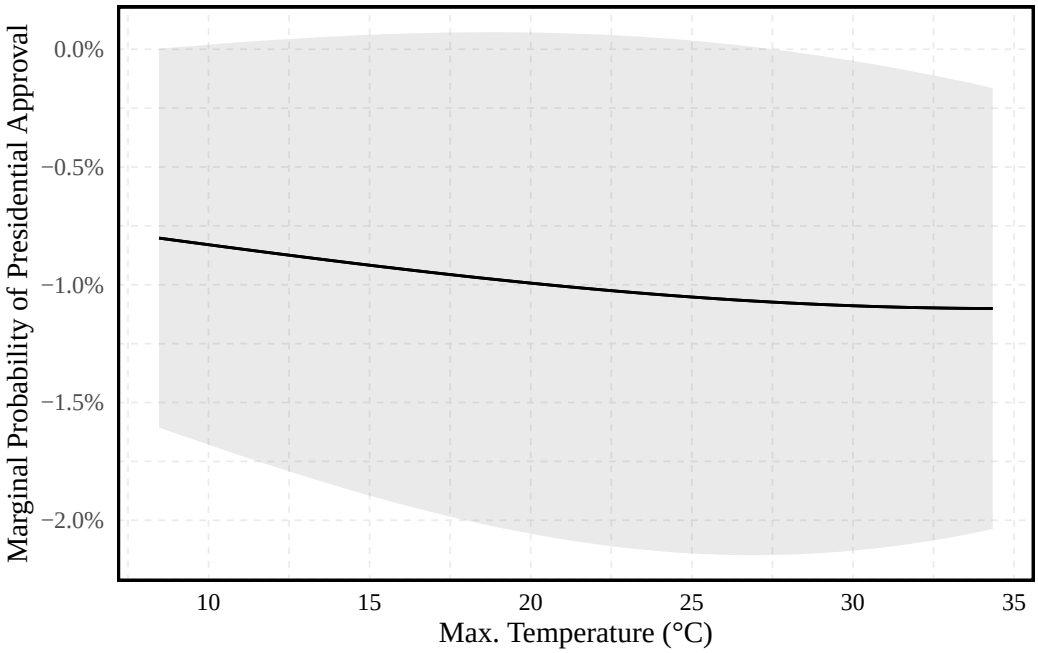
Figure 3 shows the marginal effects plot of maximum temperature on presidential approval from Specification (2). The plot shows that the marginal probability of presidential approval decreases as maximum temperature increases. At about 20°C of maximum daily temperatures, an additional degree makes survey respondents one percent point less likely to approve of the president. At the highest maximum temperature, which is about 34°C, an additional degree (a warmer day) makes survey respondents about 1.25 percent points less likely to approve of the president. These translate to an average marginal effect of -1.0%, as it can be seen in Table A.1 in the Appendix, which presents average marginal effects for all models presented in this section.

Table 3: Logit coefficients for baseline specifications

	(1)	(2)	(3)	(4)
Min. temperature (°C)	0.018			0.029
	(0.028)			(0.027)
Max. temperature (°C)		−0.044***		−0.051***
		(0.019)		(0.018)
Avg. temperature (°C)			−0.023	
			(0.035)	
N	14 118	14 118	14 118	14 118
AIC	18 302	18 297	18 302	18 297
RMSE	0.465	0.465	0.465	0.465
Canton fixed effects	X	X	X	X
Interview date fixed effects	X	X	X	X

Note: Baseline models explaining presidential approval through daily weather variables and canton and interview date fixed effects. Standard errors shown in parentheses are clustered by canton. ***p<0.01, **p<0.05

Figure 3: Marginal Effects of Max. Temperature on Presidential Approval



4.2 Controlling for political behaviour

Table 4: Logit coefficients for specifications with controls

	(1)	(2)	(3)	(4)
Min. temperature (°C)	0.003			0.003
	(0.059)			(0.060)
Max. temperature (°C)		−0.107***		−0.107***
		(0.048)		(0.048)
Avg. temperature (°C)			−0.117	
			(0.075)	
Precipitation (mm)				0.001
				(0.009)
Female	−0.242***	−0.246***	−0.248***	−0.246***
	(0.072)	(0.071)	(0.071)	(0.071)
Age	0.004	0.004	0.004	0.004
	(0.003)	(0.003)	(0.003)	(0.003)
White (ref. Mestizo)	−0.127	−0.116	−0.113	−0.116
	(0.155)	(0.153)	(0.154)	(0.152)
Indigenous	0.437	0.401	0.419	0.401
	(0.276)	(0.277)	(0.278)	(0.278)
Black	0.036	0.014	0.029	0.015
	(0.268)	(0.271)	(0.273)	(0.267)
Mulatto	−0.048	−0.028	−0.036	−0.028
	(0.308)	(0.310)	(0.310)	(0.308)
Other ethnicity	0.181	0.184	0.208	0.182
	(1.086)	(1.096)	(1.093)	(1.088)
Rural area	−0.075	−0.094	−0.086	−0.095
	(0.134)	(0.136)	(0.134)	(0.135)
Religious	0.094	0.086	0.097	0.087
	(0.162)	(0.163)	(0.163)	(0.162)
Married (ref. single)	0.011	0.011	0.015	0.011
	(0.095)	(0.095)	(0.094)	(0.094)
Divorced/Separated/Widowed	0.177	0.170	0.174	0.170
	(0.208)	(0.206)	(0.207)	(0.206)
Secondary education (ref. Primary)	0.140	0.136	0.136	0.136
	(0.112)	(0.113)	(0.113)	(0.113)
Higher education	0.054	0.047	0.049	0.047
	(0.124)	(0.125)	(0.125)	(0.125)
Not in labour force	0.135	0.141	0.144	0.141
	(0.091)	(0.091)	(0.091)	(0.091)
Unemployed	−0.201	−0.200	−0.204	−0.200
	(0.217)	(0.221)	(0.221)	(0.219)
Perceived worse personal economy	−0.383***	−0.382***	−0.384***	−0.382***

Table 4: Logit coefficients for specifications with controls *(continued)*

	(1)	(2)	(3)	(4)
	(0.103)	(0.105)	(0.104)	(0.104)
Perceived worse country economy	−0.603***	−0.599***	−0.601***	−0.599***
	(0.103)	(0.104)	(0.103)	(0.104)
Voted for incumbent	1.228***	1.226***	1.228***	1.226***
	(0.114)	(0.113)	(0.113)	(0.113)
Ideology score (0-10)	−0.062***	−0.062***	−0.062***	−0.062***
	(0.021)	(0.021)	(0.021)	(0.021)
Supports democracy	0.319***	0.317***	0.319***	0.317***
	(0.095)	(0.097)	(0.096)	(0.097)
Political pride score (0-7)	0.179***	0.179***	0.177***	0.179***
	(0.033)	(0.033)	(0.034)	(0.033)
External efficacy score (0-7)	0.182***	0.180***	0.180***	0.180***
	(0.024)	(0.024)	(0.024)	(0.025)
Internal efficacy score (0-7)	0.031	0.031	0.032	0.031
	(0.028)	(0.028)	(0.028)	(0.028)
Perceives corruption	0.185	0.192***	0.192***	0.192***
	(0.095)	(0.095)	(0.095)	(0.096)
Tolerates bribes	−0.209	−0.214	−0.215	−0.214
	(0.130)	(0.131)	(0.131)	(0.131)
Trust in police score (0-7)	0.118***	0.120***	0.120***	0.120***
	(0.030)	(0.031)	(0.031)	(0.031)
Trust in local gov. (0-7)	0.034	0.033	0.035	0.033
	(0.046)	(0.045)	(0.046)	(0.045)
N	3553	3553	3553	3553
AIC	4329	4324	4326	4328
RMSE	0.430	0.430	0.430	0.430
Canton fixed effects	X	X	X	X
Interview date fixed effects	X	X	X	X

Note: Models explaining presidential approval through daily weather variables and controls. Standard errors shown in parentheses are clustered by canton. ***p<0.01, **p<0.05.

Table 4 shows the results of the logit fixed effects estimation of Equation 1 with additional political behaviour controls. I control for sex, age, urban status, labour market status, education, ethnicity, and civil status. Personal perceptions of both personal and country economic situ-

ations are included too. The country's economic situation is particularly informative, given that it partials out the relationship of economic voting from the weather variables.

I also control for having voted for the incumbent and political ideology. Finally, I include variables for democracy support, political pride, corruption perceptions, corruption tolerance (bribes), efficiency and trust scores for police and local government. A disadvantage to these models is that lose a large amount of observations, since not all questions are asked consistently across survey rounds. I completely lose the 2021 wave due to a lack of the most fundamental controls, which were not asked due to the restricted survey design which was adopted to the COVID-19 pandemic.

Specifications (1) through (4) are the same as in Table 1, but with the addition of controls. Results show that the sign and significance of daily maximum temperature remain unchanged, showing that the relationship between temperature and presidential approval is robust to the inclusion of these controls. Further, I also find a negative and statistically significant relationship between presidential approval and my measure of average temperature in specification (3), which was not present in the baseline models.

With regard to the political behaviour controls, I find that the relationship between presidential approval and my controls is consistent with the literature. Those who perceive the country's economic situation as worse are less likely to approve of the president, as are those who perceive the country as more corrupt and those more tolerant to bribes. The former result is consistent with most of the literature on economic voting. Further, I find that support for democracy,

police, and political pride are positively related to presidential approval, while the opposite is true for those who are more right-wing and those who are unemployed. External efficiency is positively related to approval. Naturally, having voted for the incumbent greatly explains approval as well. No demographic or socioeconomic variables are statistically significant at any conventional significance level other than sex (female).

Figure 4: Marginal Effects of Max. Temperature on Presidential Approval with Controls

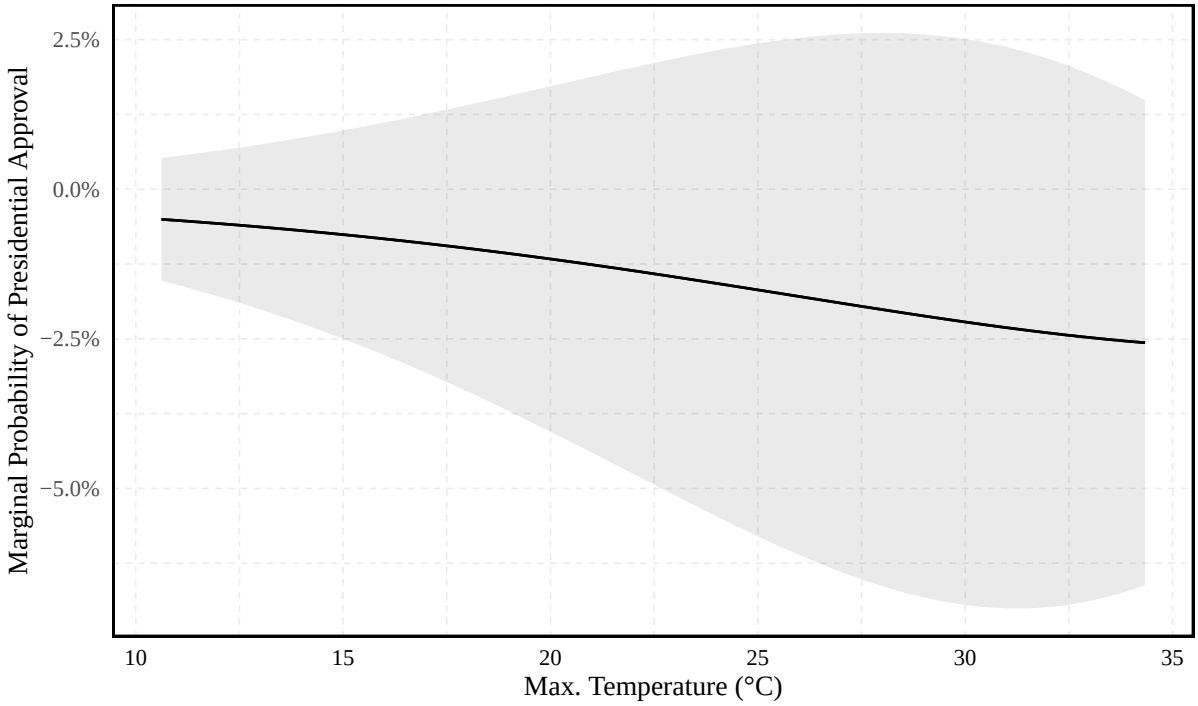


Figure 4 above shows the marginal effects plot of maximum temperature on presidential approval from Specification (4) with controls. Comparing to Figure 3, it is shown that the inclusion of controls does not change the decreasing marginal probability of presidential approval across maximum temperature. The relationship is in fact increased after controls are included. The average marginal effect of maximum temperature on presidential approval is -2.0%, as it

can be seen in Table A.2 in the Appendix.

In models not shown here, I tested for the inclusion of non-linearities in daily temperature effects. I find thatquadratic, cubic and quartic forms are not statistically significant, however, natural logarithm transformations of temperature are. This would suggest that the relationship between temperature and presidential approval is increasing, but at a decreasing rate. However, the inclusion of these transformations does not change the sign or significance of the coefficients of the other variables in the model.

5 Conclusion

This paper has shown that daily temperature has a significant negative effect on presidential approval in Ecuador. Survey respondents are about 1.0 to 2.0 percentage points less likely to approve of the president when maximum daily temperatures increase by one degree. This result is robust to the inclusion of socioeconomic and political behaviour controls, including variables which control for partisanship, trust in the police, democracy, personal ideology identification, evaluations of the economy, among others.

These results are consistent with some literature on retrospective voting and voter errors, which suggests that voters may commit attribution errors when evaluating politician's performance. I validate findings from Barrington-Leigh and Behzadnejad[47], Lignier et al.[48], and Quijano-

[47] "The Impact of Daily Weather Conditions on Life Satisfaction."
[48] "Does the Climate Impact Satisfaction with Life?"

Ruiz[49], who find that weather impacts behaviour.

I argue that the weather affects the mood of individuals negatively, and in turn individuals search externally for factors to validate their mood. This leads to a misattribution of mood to the president's performance, which results in lower approval ratings. The causal mechanism which explains these empirical findings rests on psychological theories of mood misattribution. These describe that individuals in a bad mood are more likely to report feelings of life dissatisfaction, and that they are more likely to attribute their mood to external factors.[50] I argue that warmer weather in Ecuador may lead to a negative moods, which in turn makes citizens direct their emotions towards the president's performance. This is consistent with the literature on the impact of weather across a range of outcomes, which finds that weather can have a significant impact on behaviour.[51]

In the same line as Quijano-Ruiz[52], who pioneers the use of CPC weather data in health services research, I introduce the use of this data for political behaviour studies, with promising results. CPC temperature data, though of lesser quality than weather station data, is of invaluable use for countries where weather station data is not available. There is a possibility that my temperature variables are subject to measurement error, which would cause attenuation bias. This would lead the true effect of temperature on presidential approval to be larger than

[49] "Assessing the reliability of self-rated health: the effects of transient weather fluctuations on perceived health."
[50] Schwarz and Clore, "Mood, Misattribution, and Judgments of Well-Being"; Bower, "Mood and Memory."
[51] Keller et al., "A Warm Heart and a Clear Head"; Barrington-Leigh and Behzadnejad, "The Impact of Daily Weather Conditions on Life Satisfaction"; Lignier et al., "Does the Climate Impact Satisfaction with Life?"; Quijano-Ruiz, "Assessing the reliability of self-rated health: the effects of transient weather fluctuations on perceived health"; Deller and Michels, "The Effect of Weather on Subjective Performance Evaluation."
[52] "Assessing the reliability of self-rated health: the effects of transient weather fluctuations on perceived health."

what I estimate in this paper. The fact that I am able to find statistically significant results in an observational setting suggests that the true effect of temperature on presidential approval is likely to be larger, and future research should aim to address this possibility by using more precise temperature data, and by using more sophisticated methods to address measurement error. Replicating this study in other countries where temperature data of higher quality is available would also be valuable, in order to validate these results and understand the precision of CPC weather data for political science research.

I find that daily temperature has an increasing effect on mood through a logarithmic transformation. This means that as daily temperature increases, the impact on presidential approval is larger, but a decreasing rate. This would be consistent with the theoretical argument that mood would be more affect at more extreme temperatures. However, future research should model this relationship with more sophisticated methods, such as ordered logistic regression, to more accurately understand the effect of weather on presidential approval. This would validate this paper's findings and provide a more nuanced understanding of the effect of weather on political behaviour.

Understanding how temperature and other weather-related variables affect political behaviour is important for extending the literature on attribution errors and retrospective voting. Further, doing so for understudied regions like Latin American furthers the discipline's understanding about the performance of classic models, and their applicability across regions and time frames. This paper is a first step in understanding the effect of weather on political behaviour in the

literature, which moves away from the focus on standard variables which have been proven to be influenced by factors not present in developed countries.

Democratic accountability is by far one of the most direct consequences of a poor system of retrospective voting. If voters truly punish politicians for factors outside of their control, they are provide poor incentives for politicians in the election times, which could explain the acceptance of populist politicians in the region across ideological lines such as Rafael Correa in Ecuador, Jair Bolsonaro in Brazil, Andrés Manuel López Obrador in Mexico, and others. Further research could focus on how irrelevant factors may lead to specific types of preferences for politicians, and how this may affect democratic instability.

6 References

Achen, Christopher H., and Larry M. Bartels. "Blind Retrospection: Electoral Responses to Droughts, Floods, and Shark Attacks." In *Democracy for Realists: Why Elections Do Not Produce Responsive Government*, REV - Revised. Princeton University Press, 2017. https://doi.org/10.2307/j.ctvc7770q.

Anderson, Christopher J. "The End of Economic Voting? Contingency Dilemmas and the Limits of Democratic Accountability." *Annual Review of Political Science* 10, no. 1 (2007): 271–96. https://doi.org/10.1146/annurev.polisci.10.050806.155344.

Barrington-Leigh, Christopher. "Weather as a Transient Influence on Survey-Reported Satis-

faction with Life." *MPRA Paper*, no. 25736 (2008).

Barrington-Leigh, Christopher, and Fatemeh Behzadnejad. "The Impact of Daily Weather Conditions on Life Satisfaction Evidence from Canadian Cross-Sectional and Panel Data." *Journal of Economic Psychology* 59 (April 2017): 145–63. https://doi.org/10.1016/j.joep.2017.01.003.

Bassi, Anna. "Weather, Risk, and Voting: An Experimental Analysis of the Effect of Weather on Vote Choice." *Journal of Experimental Political Science* 6, no. 1 (April 2019): 17–32. https://doi.org/10.1017/XPS.2018.13.

Bastos, Paulo, and Sebastian Miller. "Politics Under the Weather: Droughts, Parties and Electoral Outcomes." {{SSRN Scholarly Paper}}. Rochester, NY, October 2013. https://doi.org/10.2139/ssrn.2367702.

Beck, Nathaniel. "Does There Exist a Political Business Cycle: A Box-Tiao Analysis." *Public Choice*, 1982, 205–9.

Benton, Allyson Lucinda. "Dissatisfied Democrats or Retrospective Voters? Economic Hardship, Political Institutions, and Voting Behavior in Latin America." *Comparative Political Studies* 38, no. 4 (May 2005): 417–42. https://doi.org/10.1177/0010414004273856.

Berlemann, Michael, and Sören Enkelmann. "The Economic Determinants of U.S. Presidential Approval: A Survey." *European Journal of Political Economy* 36 (December 2014): 41–54. https://doi.org/10.1016/j.ejpoleco.2014.06.005.

Besley, Timothy. *Principled Agents?: The Political Economy of Good Government*. 1st ed. Oxford, NY: Oxford University Press, 2006.

Bower, Gordon H. "Mood and Memory." *American Psychologist* 36, no. 2 (1981): 129–48. https://doi.org/10.1037/0003-066X.36.2.129.

Broockman, David E., and Daniel M. Butler. "The Causal Effects of Elite Position-Taking on Voter Attitudes: Field Experiments with Elite Communication." *American Journal of Political Science* 61, no. 1 (2017): 208–21. https://doi.org/10.1111/ajps.12243.

Cerda, Rodrigo, and Rodrigo Vergara. "Economic Growth and Political Approval Ratings: Evidence from Latin America." *Political Behavior* 45, no. 4 (December 2023): 1735–58. https://doi.org/10.1007/s11109-022-09798-y.

Cohen, Alexander H. "Climate, Weather, and Political Behavior." Unpublished Doctoral Thesis, University of Iowa, 2011. https://doi.org/10.17077/etd.wsz8y8xo.

Connolly, Marie. "Some Like It Mild and Not Too Wet: The Influence of Weather on Subjective Well-Being." *Journal of Happiness Studies* 14, no. 2 (April 2013): 457–73. https://doi.org/10.1007/s10902-012-9338-2.

Deller, Carolyn, and Jeremy Michels. "The Effect of Weather on Subjective Performance Evaluation." {{SSRN Scholarly Paper}}. Rochester, NY, June 2022. https://doi.org/10.2139/ssrn.3780405.

Donovan, Kathleen, Paul M. Kellstedt, Ellen M. Key, and Matthew J. Lebo. "Motivated Reasoning, Public Opinion, and Presidential Approval." *Political Behavior* 42, no. 4 (December 2020): 1201–21. https://doi.org/10.1007/s11109-019-09539-8.

Feddersen, John, Robert Metcalfe, and Mark Wooden. "Subjective Wellbeing: Why Weather Matters." *Journal of the Royal Statistical Society Series A: Statistics in Society* 179, no. 1

(January 2016): 203–28. https://doi.org/10.1111/rssa.12118.

Ferejohn, John. "Incumbent Performance and Electoral Control." *Public Choice*, 1986, 5–25.

Frijters, Paul, Chitwan Lalji, and Debayan Pakrashi. "Daily Weather Only Has Small Effects on Wellbeing in the US." *Journal of Economic Behavior & Organization* 176 (August 2020): 747–62. https://doi.org/10.1016/j.jebo.2020.03.009.

"GitHub Copilot." Large Language Model. GitHub, Inc., n.d.

"GitHub Copilot." GitHub, Inc., n.d.

Gurney, Rachel M., Sisi Meng, Samantha Rumschlag, and Alan F. Hamlet. "The Influences of Political Affiliation and Weather-Related Impacts on Climate Change Adaptation in U.S. Cities." *Weather, Climate, and Society* 14, no. 3 (July 2022): 919–31. https://doi.org/10.1175/WCAS-D-21-0030.1.

Hart, Austin Ray, and J. Scott Matthews. *Quality Control: Experiments on the Microfoundations of Retrospective Voting*. Cambridge University Press, 2023.

Healy, Andrew J., Neil Malhotra, Cecilia Hyunjung Mo, and David Laitin. "Irrelevant Events Affect Voters' Evaluations of Government Performance." *Proceedings of the National Academy of Sciences of the United States of America* 107, no. 29 (2010): 12804–9. https://www.jstor.org/stable/25708619.

Healy, Andrew, and Gabriel S. Lenz. "Substituting the End for the Whole: Why Voters Respond Primarily to the Election-Year Economy." *American Journal of Political Science* 58, no. 1 (2014): 31–47. https://doi.org/10.1111/ajps.12053.

Healy, Andrew, and Neil Malhotra. "Myopic Voters and Natural Disaster Policy." *American*

Political Science Review 103, no. 3 (August 2009): 387–406. https://doi.org/10.1017/S0003055409990104.

———. "Random Events, Economic Losses, and Retrospective Voting: Implications for Democratic Competence." *Quarterly Journal of Political Science* 5, no. 2 (August 2010): 193–208. https://doi.org/10.1561/100.00009057.

———. "Retrospective Voting Reconsidered." *Annual Review of Political Science* 16, no. 1 (2013): 285–306. https://doi.org/10.1146/annurev-polisci-032211-212920.

Instituto Nacional de Estadística y Censos. "Clasificador Geográfico Estadístico." Map Shapefiles with Data Dictionaries. Geoportal INEC, n.d. Accessed January 23, 2024.

Jung, Ji Won, and Jinhwan Oh. "Determinants of Presidential Approval Ratings: Cross-Country Analyses with Reference to Latin America." *International Area Studies Review* 23, no. 3 (September 2020): 251–67. https://doi.org/10.1177/2233865919888373.

Kahneman, Daniel, and Amos Tversky. "On the Study of Statistical Intuitions." *Cognition* 11, no. 2 (1982): 123–41.

Kämpfer, Sylvia, and Michael Mutz. "On the Sunny Side of Life: Sunshine Effects on Life Satisfaction." *Social Indicators Research* 110, no. 2 (2013): 579–95. https://www.jstor.org/stable/24718723.

Keller, Matthew C., Barbara L. Fredrickson, Oscar Ybarra, Stéphane Côté, Kareem Johnson, Joe Mikels, Anne Conway, and Tor Wager. "A Warm Heart and a Clear Head: The Contingent Effects of Weather on Mood and Cognition." *Psychological Science* 16, no. 9 (September 2005): 724–31. https://doi.org/10.1111/j.1467-9280.2005.01602.x.

Key, Valdimer Orlando. *The Responsible Electorate: Rationality in Presidential Voting 1936–1960*. Cambridge, MA: Harvard University Press, 1960.

Kiewiet, D. Roderick, and Douglas Rivers. "A Retrospective on Retrospective Voting." *Political Behavior* 6, no. 4 (1984): 369–93. https://www.jstor.org/stable/586342.

Koubi, Vally. "Climate Change and Conflict." *Annual Review of Political Science* 22, no. Volume 22, 2019 (May 2019): 343–60. https://doi.org/10.1146/annurev-polisci-050317-070830.

Kramer, Gerald H. "Short-Term Fluctuations in US Voting Behavior, 1896–1964." *American Political Science Review* 65, no. 1 (1971): 131–43.

LAPOP. "The AmericasBarometer by the Latin American Public Opinion Project (LAPOP) Ecuador 2004 - 2023 Merged File." Dataset with Codebook. Vanderbilt University, n.d. Accessed February 11, 2024.

———. "The AmericasBarometer by the Latin American Public Opinion Project (LAPOP) Ecuador 2010 Individual Country File." Dataset with Codebook. Vanderbilt University, n.d. Accessed February 11, 2024.

———. "The AmericasBarometer by the Latin American Public Opinion Project (LAPOP) Ecuador 2021 Individual Country File." Dataset with Codebook. Vanderbilt University, n.d. Accessed February 11, 2024.

Layton, Matthew, Mariana Rodríguez, Mason Moseley, and Daniel Zizumbo-Colunga. "Chapter 3. Citizen Security, Evaluations of the State, and Policy Preferences." In *The Political Culture of Democracy in the Americas, 2014: Democractic Governance Across 10 Years*

of the AmericasBarometer, edited by Elizabeth J. Zechmeister, 3rd ed., 1:73–117. AmericasBarometer Regional Reports. Latin American Public Opinion Project, 2016.

Lee, Seonghui. "Party Responsiveness to the Collective Judgment of the Electorate: The Case of Presidential Popularity in Latin America." *Comparative Political Studies* 47, no. 14 (December 2014): 1973–99. https://doi.org/10.1177/0010414013520523.

Lewis-Beck, Michael S. "Does Economics Still Matter? Econometrics and the Vote." *The Journal of Politics* 68, no. 1 (2006): 208–12. https://doi.org/10.1111/j.1468-2508.2006.00381.x.

Lewis-Beck, Michael S., Richard Nadeau, and Angelo Elias. "Economics, Party, and the Vote: Causality Issues and Panel Data." *American Journal of Political Science* 52, no. 1 (2008): 84–95. https://www.jstor.org/stable/25193798.

Li, Mengyao, Susana Ferreira, and Travis A. Smith. "Temperature and Self-Reported Mental Health in the United States." *PLOS ONE* 15, no. 3 (March 2020): e0230316. https://doi.org/10.1371/journal.pone.0230316.

Li, Xiaoxiao, and Pankaj C. Patel. "Weather and High-Stakes Exam Performance: Evidence from Student-Level Administrative Data in Brazil." *Economics Letters* 199 (February 2021): 109698. https://doi.org/10.1016/j.econlet.2020.109698.

Liao, Yanjun, and Pablo Ruiz Junco. "Extreme Weather and the Politics of Climate Change: A Study of Campaign Finance and Elections." *Journal of Environmental Economics and Management* 111 (January 2022): 102550. https://doi.org/10.1016/j.jeem.2021.102550.

Lignier, Phil, Diane Jarvis, Daniel Grainger, and Taha Chaiechi. "Does the Climate Impact

Satisfaction with Life? An Australian Spatial Study." *Weather, Climate, and Society* 15, no. 1 (March 2023): 159–75. https://doi.org/10.1175/WCAS-D-22-0063.1.

Lucas, Richard E., and Nicole M. Lawless. "Does Life Seem Better on a Sunny Day? Examining the Association Between Daily Weather Conditions and Life Satisfaction Judgments." *Journal of Personality and Social Psychology* 104, no. 5 (May 2013): 872–84. https://doi.org/10.1037/a0032124.

Moncagatta, Paolo, and Ana Emilia Poveda. "The Politicization of Citizens and Ideological Polarization in Ecuador." In *The Political Culture of Democracy in Ecuador and in the Americas, 2018/19: Taking the Pulse of Democracy*, edited by Juan Carlos Donoso, Paolo Moncagatta, Arturo Moscoso, Simón Pachano, J. Daniel Montalvo, and Elizabeth J. Zechmeister, 1st ed., 1:73–88. AmericasBarometer Country Studies. Quito: Latin American Public Opinion Project, 2020.

Mullins, Jamie T., and Corey White. "Temperature and Mental Health: Evidence from the Spectrum of Mental Health Outcomes." *Journal of Health Economics* 68 (December 2019): 102240. https://doi.org/10.1016/j.jhealeco.2019.102240.

Murillo, María Victoria, Virginia Oliveros, and Milan Vaishnav. "Electoral Revolution or Democratic Alternation?" *Latin American Research Review* 45, no. 3 (2010): 87–114.

National Oceanic and Atmospheric Administration (NOAA) Physical Sciences Laboratory (PSL). "CPC Global Unified Temperature." Datasets. Boulder, Colorado, USA, 2024.

Persson, Torsten, and Guido Tabellini. *Political Economics: Explaining Economic Policy*. MIT press, 2002.

Quijano-Ruiz, Alonso. "Assessing the reliability of self-rated health: the effects of transient weather fluctuations on perceived health." Available on request, 2023.

Rowan, Sam. "Extreme Weather and Climate Policy." *Environmental Politics* 32, no. 4 (June 2023): 684–707. https://doi.org/10.1080/09644016.2022.2127478.

Schmiedeberg, Claudia, and Jette Schröder. "Does Weather Really Influence the Measurement of Life Satisfaction?" *Social Indicators Research* 117, no. 2 (2014): 387–99. https://www.jstor.org/stable/24720831.

Schwarz, Norbert, and Gerald L Clore. "Mood, Misattribution, and Judgments of Well-Being: Informative and Directive-Effects of Affective States." *Journal of Personality and Social Psychology* 45, no. 3 (1983): 513–23.

Shao, Wanyun. "Weather, Climate, Politics, or God? Determinants of American Public Opinions Toward Global Warming." *Environmental Politics* 26, no. 1 (January 2017): 71–96. https://doi.org/10.1080/09644016.2016.1223190.

Singer, Matthew, and Ryan E. Carlin. "Are Latin American Voters Ampesinos o Empresarios? Economic Perceptions and Government Support 1995-2008." {{SSRN Scholarly Paper}}. Rochester, NY, 2011.

Tilley, James, and Sara B Hobolt. "Is the Government to Blame? An Experimental Test of How Partisanship Shapes Perceptions of Performance and Responsibility." *The Journal of Politics* 73, no. 2 (2011): 316–30.

Valdini, Melody E., and Michael S. Lewis-Beck. "Economic Voting in Latin America: Rules and Responsibility." *American Journal of Political Science* 62, no. 2 (2018): 410–23.

https://doi.org/10.1111/ajps.12339.

Veiga, Luciana. "Economic Voting in an Age of Growth and Poverty Reduction: Electoral Response in Latin America (1995-2010)," June 2013.

Velez, Yamil, and David Martin. "Sandy the Rainmaker: The Electoral Impact of a Super Storm." *PS: Political Science & Politics* 46, no. 2 (April 2013): 313–23. https://doi.org/10.1017/S1049096513000139.

Visconti, Giancarlo. "After the Flood: Disasters, Ideological Voting and Electoral Choices in Chile." *Political Behavior* 44, no. 4 (December 2022): 1985–2004. https://doi.org/10.1007/s11109-022-09814-1.

Wiesehomeier, Nina, and David Doyle. "Discontent and the Left Turn in Latin America." *Political Science Research and Methods* 1, no. 2 (2013): 201–21.

Wlezien, Christopher, Mark Franklin, and Daniel Twiggs. "Economic Perceptions and Vote Choice: Disentangling the Endogeneity." *Political Behavior* 19, no. 1 (1997): 7–17. https://www.jstor.org/stable/586547.

Appendix: Average marginal effects

Table 6.4: Average partial effects for baseline models

	(1)	(2)	(3)	(4)
Min. temperature (°C)	0.004			0.006
	(0.006)			(0.006)
Max. temperature (°C)		−0.010***		−0.011***
		(0.004)		(0.004)
Avg. temperature (°C)			−0.005	
			(0.008)	
Precipitation (mm)				−0.001
				(0.001)
N	14 118	14 118	14 118	14 118
AIC	18 302	18 297	18 302	18 297
RMSE	0.465	0.465	0.465	0.465

Note: Average partial effects for baseline models explaining presidential approval through daily weather variables and canton and interview date fixed effects. Standard errors shown in parentheses are clustered by canton. ***p<0.01, **p<0.05, *p<0.1.

Table 6.4: Average partial effects for models with controls

	(1)	(2)	(3)	(4)
Min. temperature (°C)	0.001			0.001
	(0.011)			(0.011)
Max. temperature (°C)		−0.020***		−0.020***
		(0.010)		(0.010)
Avg. temperature (°C)			−0.022	
			(0.015)	
Precipitation (mm)				0.000
				(0.002)
Female	−0.045***	−0.045***	−0.046***	−0.045***
	(0.013)	(0.013)	(0.013)	(0.013)
Age	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
White (ref. Mestizo)	−0.023	−0.021	−0.021	−0.022
	(0.028)	(0.028)	(0.028)	(0.028)
Indigenous	0.080	0.073	0.076	0.073
	(0.050)	(0.052)	(0.051)	(0.052)
Mulatto	−0.009	−0.005	−0.007	−0.005
	(0.057)	(0.057)	(0.057)	(0.057)
Black	0.007	0.003	0.005	0.003
	(0.049)	(0.050)	(0.050)	(0.049)
Other	0.033	0.034	0.038	0.033
	(0.198)	(0.199)	(0.197)	(0.197)
Married (ref. Single)	0.002	0.002	0.003	0.002
	(0.017)	(0.017)	(0.017)	(0.017)
Divorced/Separated/Widowed	0.032	0.031	0.032	0.031
	(0.038)	(0.038)	(0.038)	(0.038)
Rural area	−0.014	−0.017	−0.016	−0.017
	(0.025)	(0.025)	(0.025)	(0.025)
Not in Labour Force	0.025	0.026	0.027	0.026
	(0.017)	(0.016)	(0.016)	(0.016)
Unemployed	−0.037	−0.037	−0.038	−0.037
	(0.041)	(0.041)	(0.041)	(0.041)
Perceived worse personal economy	−0.072***	−0.072***	−0.072***	−0.072***
	(0.019)	(0.020)	(0.019)	(0.020)
Perceived worse country economy	−0.115***	−0.114***	−0.115***	−0.114***
	(0.019)	(0.019)	(0.019)	(0.019)
Voted for incumbent	0.242***	0.241***	0.241***	0.241***

	(0.022)	(0.021)	(0.022)	(0.022)
Ideology score (0-10)	−0.011***	−0.011***	−0.011***	−0.011***
	(0.004)	(0.004)	(0.004)	(0.004)
Internal efficacy score (0-7)	0.006	0.006	0.006	0.006
	(0.005)	(0.005)	(0.005)	(0.005)
External efficacy score (0-7)	0.034***	0.033***	0.033***	0.033***
	(0.004)	(0.004)	(0.005)	(0.004)
Supports democracy	0.060***	0.059***	0.059***	0.059***
	(0.017)	(0.017)	(0.018)	(0.017)
Political pride score (0-7)	0.033***	0.033***	0.033***	0.033***
	(0.006)	(0.006)	(0.006)	(0.006)
Perceives corruption	0.034*	0.036***	0.036***	0.036***
	(0.018)	(0.017)	(0.018)	(0.018)
Tolerates bribes	−0.039	−0.040	−0.040	−0.040
	(0.024)	(0.024)	(0.024)	(0.024)
Trust in police score (0-7)	0.022***	0.022***	0.022***	0.022***
	(0.006)	(0.006)	(0.006)	(0.006)
Trust in local gov. (0-7)	0.006	0.006	0.006	0.006
	(0.009)	(0.009)	(0.009)	(0.008)
N	3553	3553	3553	3553
AIC	4329	4324	4326	4328
RMSE	0.430	0.430	0.430	0.430

Note: Average partial effects for models explaining presidential approval through daily weather variables, canton and interview date fixed effects, and political behaviour controls. Standard errors shown in parentheses are clustered by canton. ***p<0.01, **p<0.05, *p<0.1.