# Empirical Approach

## 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[[1]](#footnote-20). 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 survey waves carried out between 2008 to 2023[[2]](#footnote-21). 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: [[3]](#footnote-22) (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[[4]](#footnote-23) and has not been found to significantly deviate from other presidential popularity measures. I dichotomize the variable following LAPOP research reports[[5]](#footnote-24) 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[[6]](#footnote-25). Political ideology is represented in a 0-10 scale, where 0 represents the “extreme left” and 10 the “extreme right”. 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).[[7]](#footnote-26) 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 also includes gender, age, religiousness, ethnicity, civil status, education and labour market status. These last four variables are summarized in Table 2.

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.[[8]](#footnote-27) 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[[9]](#footnote-28), publicly available meteorological data from weather stations lacks the frequency and geospatial granularity required for this type of analysis.

I follow Quijano-Ruiz[[10]](#footnote-29) 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](https://github.com/laboratoriolide/ecuador-temperature-noaa). 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.[[11]](#footnote-31) I then merge this data with the AB data based on interview dates and canton codes.

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

[Figure 1](#fig-interviewdates) 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 out between late 2018 and early 2019. Most waves are carried out January to April. These periods contain rich variation of temperature across cantons.

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| Figure 2: Mean monthly temperatures, 2008-2023 |

In [Figure 2](#fig-temperature) 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.

## 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 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:

where is presidential approval, and are vectors of interview date and canton fixed effects, is daily temperature for canton on day , a vector of survey-wave and individual varying controls, the vector of associated control coefficients and an error term. The parameter is the coefficient of interest, which measures the effect of temperature on presidential approval. The assumption of randomness in daily temperature changes implies that

which allows me to estimate consistently.

A potential worry is that temperature, as measured by the CPC Global Unified Temperature data, suffers from measurement error, 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 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.

1. Cantons are the second level of the political-administrative division of the country, akin to municipalities or counties. [↑](#footnote-ref-20)
2. 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. [↑](#footnote-ref-21)
3. LAPOP, “The AmericasBarometer by the Latin American Public Opinion Project (LAPOP) Ecuador 2004 - 2023 Merged File.” [↑](#footnote-ref-22)
4. Berlemann and Enkelmann, “The Economic Determinants of U.S. Presidential Approval.” [↑](#footnote-ref-23)
5. Layton et al., “Chapter 3. Citizen Security, Evaluations of the State, and Policy Preferences.” [↑](#footnote-ref-24)
6. 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. [↑](#footnote-ref-25)
7. LAPOP, “The AmericasBarometer by the Latin American Public Opinion Project (LAPOP) Ecuador 2004 - 2023 Merged File.” [↑](#footnote-ref-26)
8. National Oceanic and Atmospheric Administration (NOAA) Physical Sciences Laboratory (PSL), “CPC Global Unified Temperature.” [↑](#footnote-ref-27)
9. In Ecuador, the relevant institution is the Instituto Nacional de Meteorología e Hidrología. [↑](#footnote-ref-28)
10. “Assessing the reliability of self-rated health: the effects of transient weather fluctuations on perceived health.” [↑](#footnote-ref-29)
11. Instituto Nacional de Estadística y Censos, “Clasificador Geográfico Estadístico.” [↑](#footnote-ref-31)