Extreme cold and Evaluation of Democracy: Evidence from Peruvian Highlands

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Introduction

- With climate change, extreme temperatures are becoming more common
  - Studies show that developing country households are most affected by extreme weather (Mirza, 2003; Schlenker and Lobell, 2010, Dell et al., 2014)

We study the effect of extreme cold temperature shocks on individuals' beliefs of whether democracy functions in a developing country context: the Peruvian highlands.

- Extreme temperatures might affect support for democracy through a number of channels. For example:
  - Extreme cold is harmful for many crops and thus can lower agricultural incomes
  - Extreme cold may increase the incidence of illness (Sanchez, 2018)
  - Extreme temperatures can increase conflict (Hsiang et al.,2013)

Data

- **Peruvian Annual Household Survey (ENAHO):** Repeated cross-section of households, 2007-2018.
- **Temperature data**: Household-level hourly information on temperature extracted from ERA5, 2006-2018; latest reanalysis dataset provided by ECMWF.
- **Rainfall data**: Daily rainfall data from CHIRPS at HH level, 2006-2018
- Sample: individuals/households in the Peruvian Highlands

Measure of Extreme Cold (Frost) Shocks

$$degreehour(dh) = \begin{cases} |h_t - (-\lambda)|, & if\ h_t < -\lambda \\ 0, & if\ h_t \geq -\lambda \end{cases}$$

h_t: hourly daily temperature; λ: harmful temperature threshold

Our primary measure of extreme temperature shocks ($FrostShock$) is the **cumulative** degree hours below an extreme temperature threshold over the most recent 12 months (based on the household's survey date).

$$FrostShock_i = \sum_{m=1}^{12} \sum_{d} \sum_{t=1}^{24} dh_{i,t,d,m}$$

Methods

$$Y_{idt} = \alpha_0 + \beta_1 FrostShock_{idt} + \beta_2 Avg.Temp_{idt} + \beta_3 Avg.Rain_{dt} + Z_{idt}\beta_4 + \mu_{idt} + \tau_d + \sigma_t + \varepsilon_{idt}$$

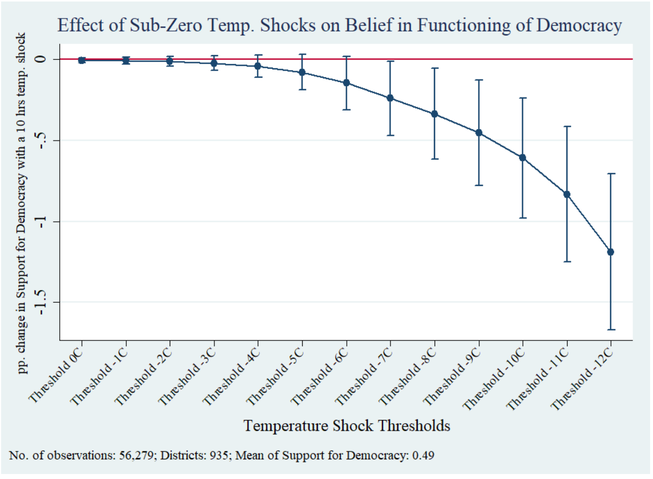
4 primary outcomes (at the individual/household level), Y_{idt}:

1. Belief in functioning of democracy (dummy variable): In Peru, does democracy work well?
2. Child illness (dummy variable): child (age ≤ 5) was ill in last 4 weeks
3. Log of annual agricultural income
4. Log of annual total income

- Z_{idt} is a vector of control variables at household level
- μ_{idt}, τ_d, and σ_t are fixed effects for month of interview, district, and survey year

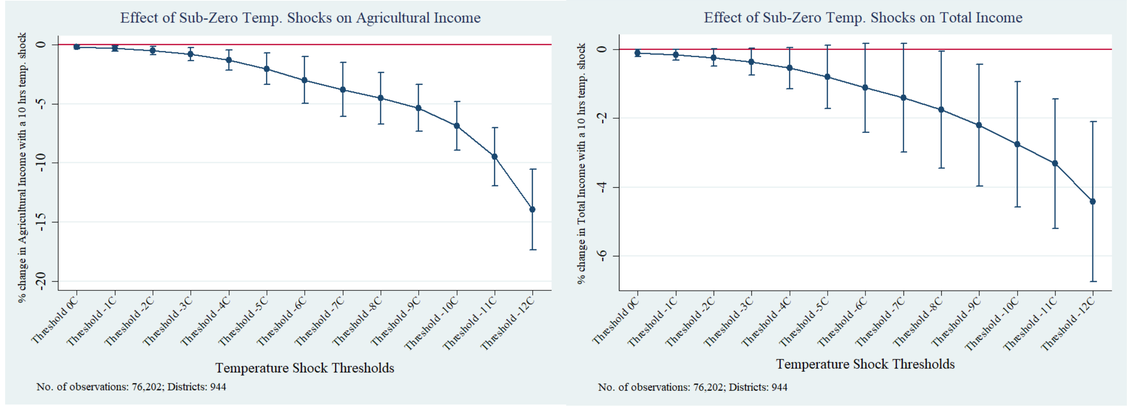
Main Finding

Main finding: Extreme cold reduces the belief that democracy functions well in Peru.

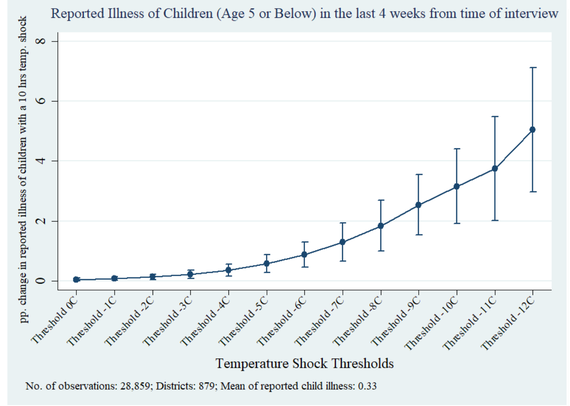


Notes: Sample is made up of one randomly selected adult from each household. Controls: respondent sex, age, education level, marital status, mother tongue, relation to the household head, HH-level ownership of assets (TV & cell phone), dwelling characteristics (floor, ceiling type, toilet access), HH size, share of income earners in the household, and town size. Standard errors are clustered at the district level.

Results: Potential Mechanisms



Notes: Controls include characteristics of the household head (sex, age, age squared, education level fixed effects), share of irrigated land, log of total land (owned+ rented), HH Size. SEs are clustered at the district level



Notes: Controls include characteristics of the household head (sex, age, age squared, education level fixed effects), HH-level ownership of assets (TV & cell phone), dwelling characteristics (floor, ceiling type, toilet and water access), HH Size, and child sex and age. Standard errors are clustered at the district level

10 degree hours below -9° C over the previous year reduces the belief that democracy functions well by 0.5 pp.

The same shock leads to a 5.3% reduction in agricultural income (2.2% decline in total income) and a 2.5 pp. increase in reported child illness.

Additional findings:

- Extreme cold shock increases child hospitalization and livestock deaths and reduces total and food expenditure.
- It also increases the likelihood that individuals report lack of support for agriculture, lack of employment, and domestic violence as main problems in Peru.

Next steps:

- Explore other outcomes in the ENAHO (such as trust in government) as well as other health and conflict outcomes (such as respiratory illness and domestic violence) in the Peru Demographic and Health Surveys (DHS).
- Investigate whether changes in evaluation of democracy translates into electoral outcomes.

References

Ananyev, M., and Sergei G. (2018): “Effect of Income on Trust: Evidence from the 2009 Economic Crisis in Russia”, Economic Journal, 129(619), 1082-1118.

Autor, D., Dorn, D., Hanson, G., and Majlesi, K., (2020): “Importing Political Polarization? The Electoral Consequences of Rising Trade Exposure”, American Economic Review, Vol 110, No. 10, 3139-83

Foster, C., and Frieden, J., (2017): “Crisis of Trust: Socio-economic determinants of Europeans’ confidence in government”, Mimeo Harvard University.

Guiso, L., Herrera, H., Morelli, M., Sonno, T. (2020): “Economic Insecurity and the Demand of Populism in Europe”, Working Paper.

Hsiang, S.M., Burke, M., Miguel, E. (2013): “Quantifying the Influence of Climate on Human Conflict”, Science 341, 1235367

Schlenker, W., and Lobell, D.B., (2010): "Robust negative impacts of climate change on African agriculture." Environmental Research Letters 5(1): 014010

Sanchez, A., (2018): “Early Life Exposure to Weather Shocks and Human Capital Accumulation: Evidence from Peruvian Highlands” Working Paper 178, Young Lives.

“Climate Risk Management for Agriculture in Peru: Focus on the Junin and Piura Regions”, UNDP Report (2013). Retrieved from: https://www.iisd.org/sites/default/files/publications/crm_peru_es.pdf

“Gaining Momentum in Peruvian Agriculture: Opportunities to Increase Productivity and Enhance Competitiveness”, World Bank Report (2017).

“Analysis of the impact of the cold events (Friaje) of 2008 in the high Andean agriculture and livestock in Peru”, FAO Report (2008).