Temperature, Trust, and Political Instability in Africa

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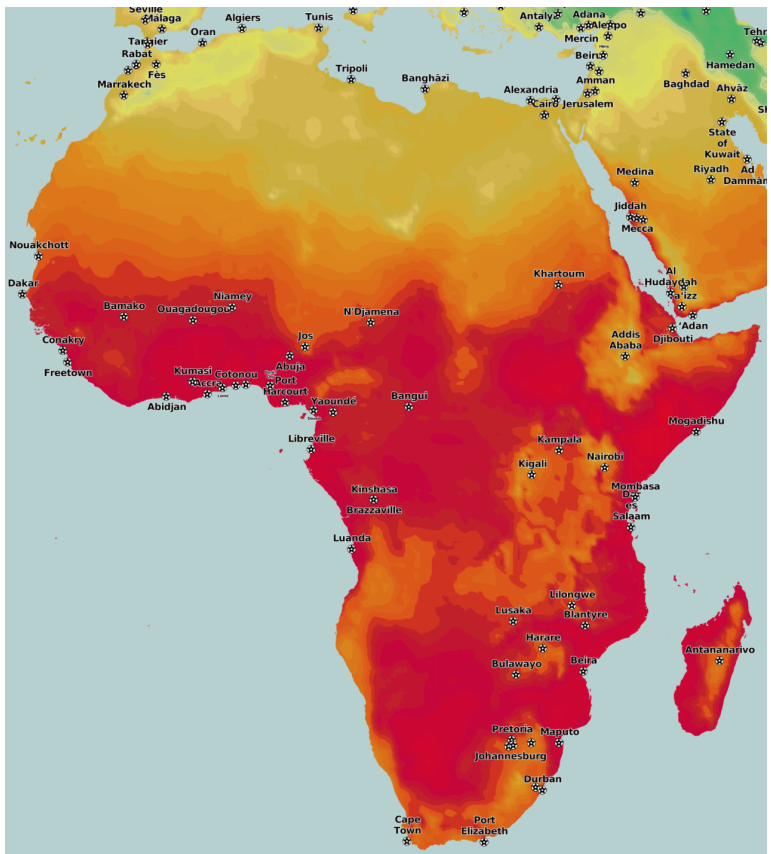
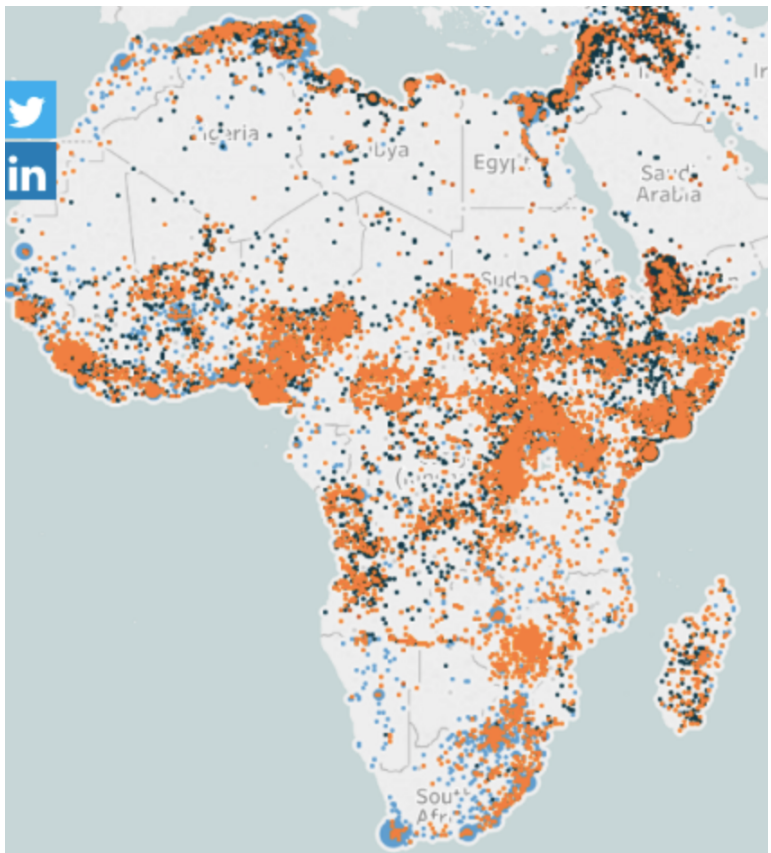
Motivation

Hotter places experience more conflict

(a) Average Temperatures



(b) Incidences of Conflict



Climate and Conflict

- Agricultural income as pathway of impact: Miguel et al, (JPE, 2004), Bruckener and Ciccone (Econometrica, 2011), Dube and Vargas (REStud, 2013), Harari and La Ferrara (REStat, 2018)

$$\text{climate shocks} \rightarrow \text{agricultural income shocks} \rightarrow \text{conflict}$$

However: evidence of direct physiological/psychological effect of temperature

- When it is hotter, individuals are more aggressive:
  - Retaliation in economic games, road rage, gun use in training, baseball
  - Show different levels of neuro-transmitters (e.g. serotonion)

Miguel's TED talk: great non-technical summary

What we do

In this paper

Document **direct effect of temperature** (independently of income) on 3 determinants of instability and unrest: political trust, protests, and voting behaviour.

Research design:

- Merge high-frequency climatic data with exact GPS coordinates of individuals, regions, and countries in Africa
- Measure temperature via heat index (temperature and humidity)
- Estimate effect of daily/monthly deviation from long term means (also defined as anomalies)

1st part: attitudes

1. **Temperature decreases trust in government**
   - 1^{o}C anomaly **on exact day and precise location of interview:**
     - $\uparrow$ mistrust in government by $\approx$ 0.5pp
     - $\downarrow$ intentions to vote for government by $\approx$ 0.8pp
     - $\uparrow$ aggression (as perceived by interview administrator)

Key policy finding

Temperature by itself does not cause distrust. **Rather,** temperature exacerbates existing mistrust (in line with findings from psychological literature)

- Temperature **only** affects trust:
  - In poor countries (where dissatisfactions are likely to be widespread)
  - Within countries for dissatisfied individuals (identified via ML)

$\rightarrow$ Important distributional consequences

2nd part: actions

2. Temperature increases protests and decreases votes for government

- Protests and riots: 1°C monthly temperature anomaly
  - ↑ incidence of riots/protests by ≈ 0.3 pp
  - Mechanisms: effect unlikely to be driven by agricultural income:

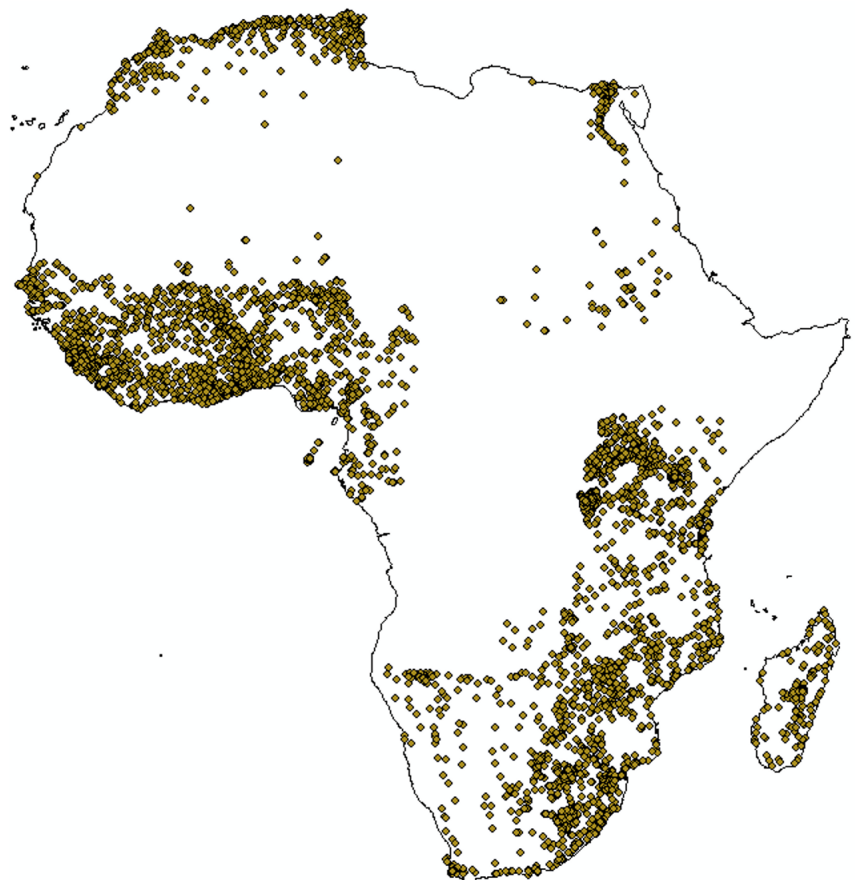
- Voting: a 1°C temperature anomaly on day of election
  - ↓ votes for incumbent party by ≈ 4pp
  - ↑ voter turnout by ≈ 3pp
  - **Not large effects:** in only 6% of election does incumbent lose by less than 6.5% (= 1 SD change in temperature)

Background: Heat index and Data

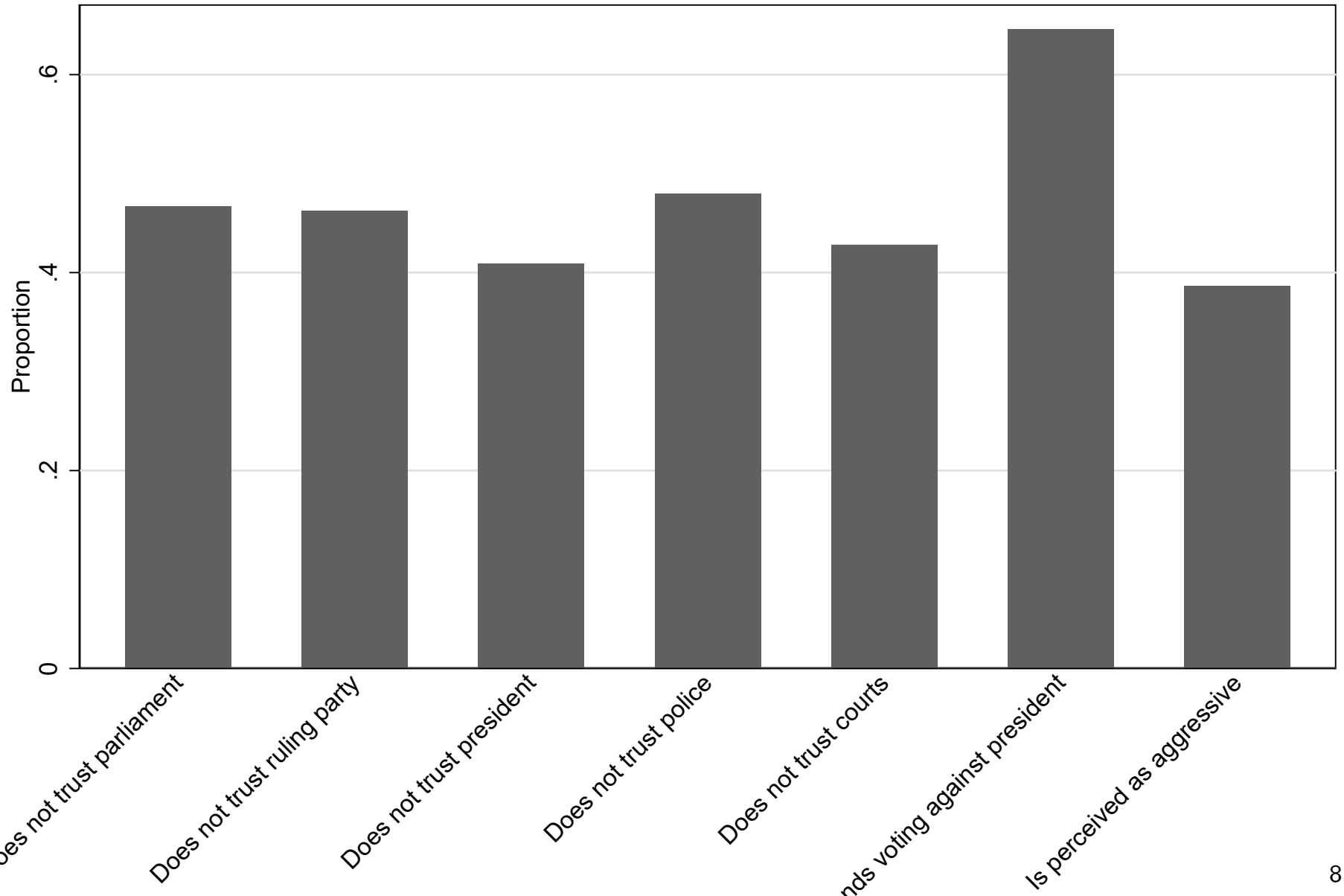
Feeling hot: when body temperature deviates from 37, the body perceives this as "feeling" hot. The body regulates temperature by perspiration. Effectiveness depends on 2 main factors ($heat\ index = 0.89 \times T + 3.82 \times P_a - 2.56$)

1. Air temperature
2. Humidity

- **Climate data:** ERA5 dataset: high quality **hourly** data
- **Attitudinal data:** Afrobarometer collects self-reported attitudes for 36 countries, representative of around 76% of the African population. Implemented in 2014/15



Background: Measures for trust

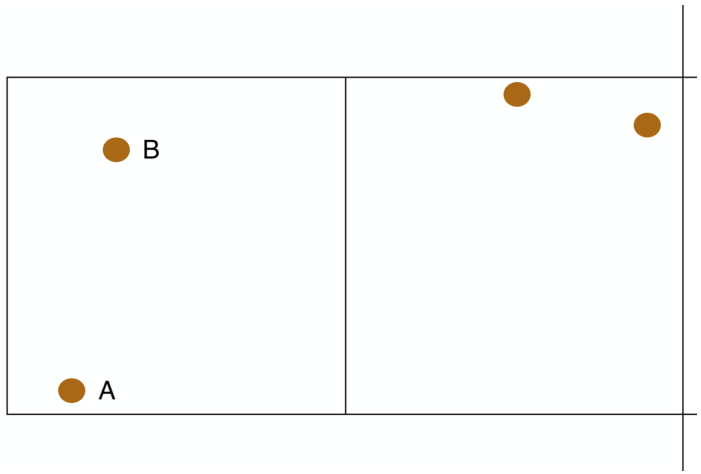


Research design: intuition

Problem: temperature can be related to institutions (Colder countries tend to have more efficient institutions)

Solution: deviation from long term mean:

- We use GPS coordinate of respondents
- Calculate temperature on day of interview
- Calculate difference between daily temperature and long run temperature average in month of interview 1×1 lat/long cell



Example:

- Average temperature in Helsinki in May: 14°C
- Temperature in Helsinki today: 11°C
- Fact that in May it's usually 14°C is related to institutions
- Deviation from average (14°C-11°C=-3°C) **is random**

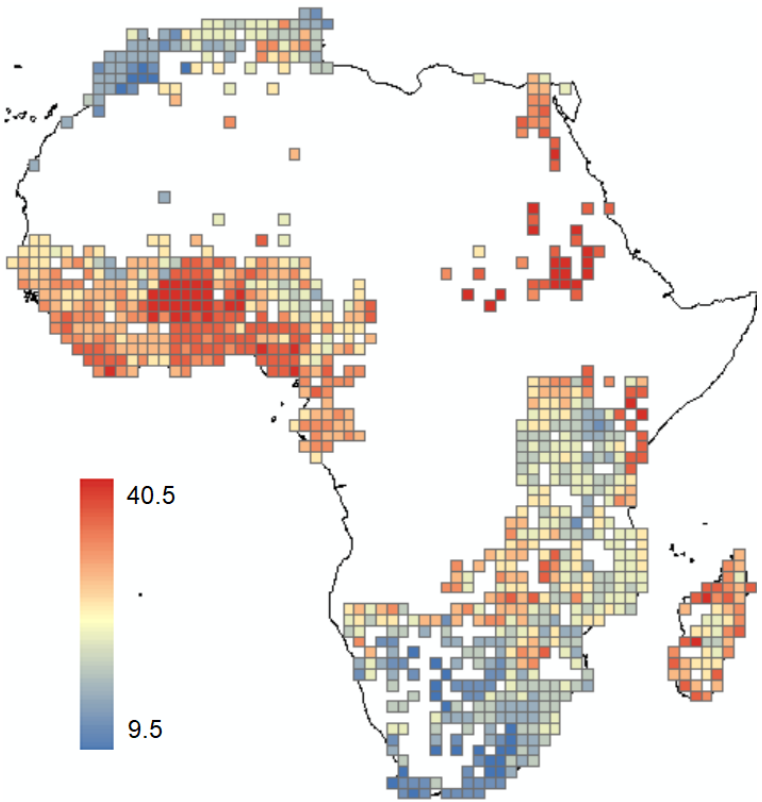
Estimating equation

$$attitude_{ictmd} = \alpha_1 H_{itmd} + \mathbf{X}'_{itmd}\gamma + \overline{\mathbf{C}}_{\mathbf{cm}} + \eta_c + \psi_{tmd} + \epsilon_{ictmd} \quad (1)$$

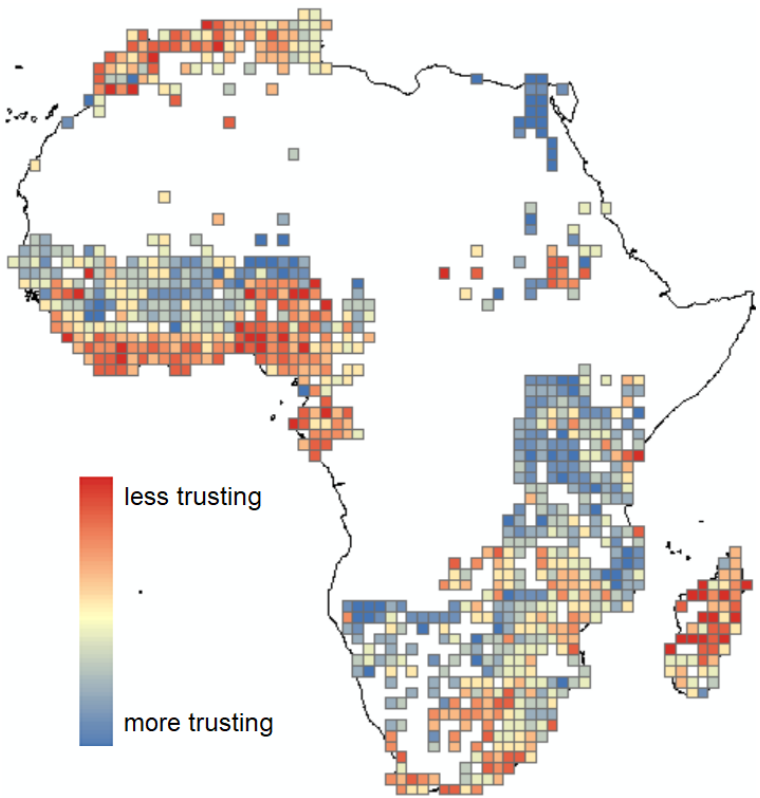
- $attitude_{ictmd}$: self-reported attitude (trust, voting intentions and aggression) for individual i in cell c in year t, month m and day d.
- H_{idtmd} is heat index at exact location of individual i in cell c in year t, month m and day d
- η_c and ψ_{tmd} are fixed effects for each cell and the *exact date of interview*
- $\overline{\mathbf{C}}_{\mathbf{cm}}$ is the long term average in H_{idtmd} and P_{idtmd} for cell c in month m
  - Because we control for $\overline{\mathbf{C}}_{\mathbf{cm}}$, we can interpret H_{itmd} as **anomalies** (deviations from long term means) in heat index $\rightarrow$ plausibly exogenous

Climate and Trust: Descriptive evidence

Heat index



Self-reported trust in govt

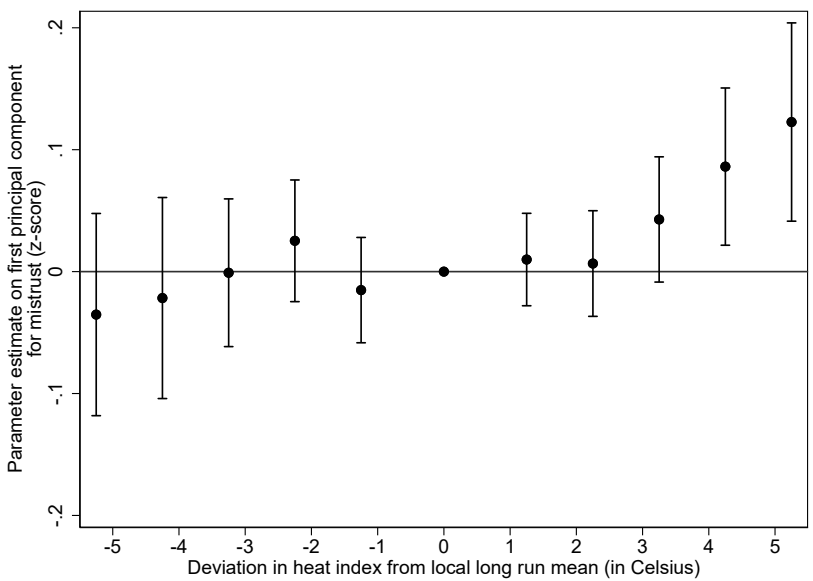


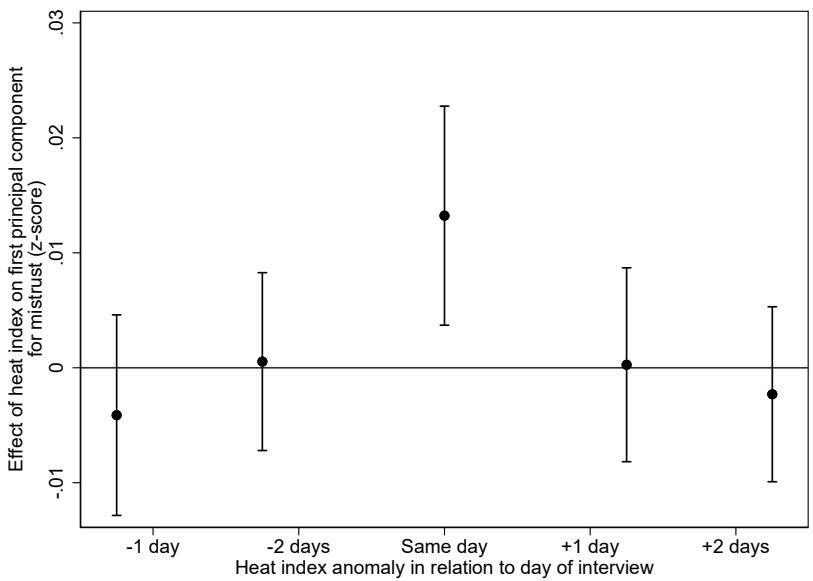
Climate and Trust: Regression Results

	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Effect of temperature on day of interview					
Dependent variable:	=100 if respondent does not trust					Mistrust
	parliament	ruling	president	police	courts	index
Heat index anomaly	0.540	0.603	0.377	0.364	0.302	0.012
(on day of interview)	(0.166)	(0.179)	(0.179)	(0.161)	(0.163)	(0.004)
Observations	50,018	50,012	50,022	50,012	50,010	49,984
Cell & Date fixed effects	yes	yes	yes	yes	yes	yes
Long-Run climate average	yes	yes	yes	yes	yes	yes

Functional form and timing

1. Effects are driven by large and **positive** anomalies
   - Difference has to be large enough to be perceived
   - Fits with mechanisms below
2. Anomalies on 2 days before and 2 days after, do not matter.
   - Suggestive of causal effect (unobserved heterogeneity would likely show up on other days, too)



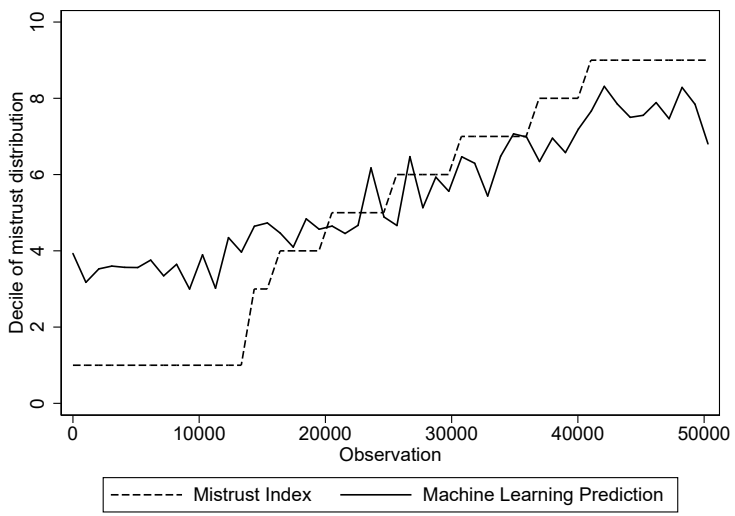


Mechanism: heat exacerbates and does not create fears

Psychological literature: temperature itself does not cause aggression or mistrust. Rather, **heat magnifies** reactions to external triggers.

- Effect is **stronger for dissatisfied and marginalised**:

1. **Poverty:** poor vs rich countries
2. **Identify dissatisfied individuals using machine learning:** 179 predictors:
   - Historical slave trade: taken from Nunn and Wantchekon (AER, 2011)
   - Attitudes: e.g. whether respondent believes politicians to be corrupt
   - Past experiences: e.g. whether respondent has ever complained
   - Characteristics: e.g. missing meals



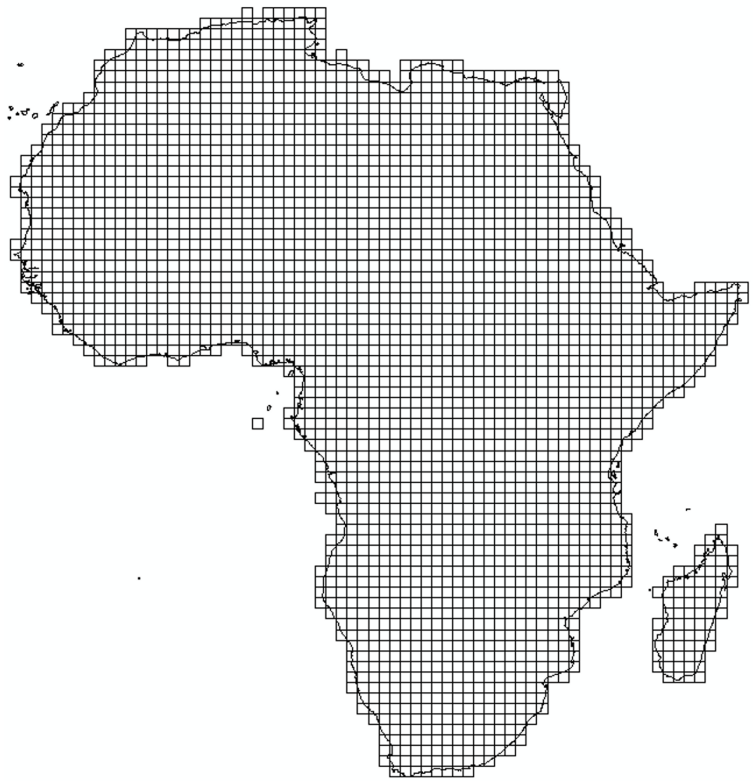
Mechanism: heat exacerbates and does not create fears

	(1)	(2)	(3)	(4)	(5)	(6)
	Panel B: Mechanisms and intentions to act					
Dependent variable:	Mistrust index	Mistrust index	Mistrust index	Experiences index (placebo)	=100 if resp. is aggressive	=100 if resp. will vote vs. govt.
Heat index anomaly (on day of interview)	0.004 (0.004)	0.006 (0.003)		0.002 (0.003)	0.307 (0.164)	0.528 (0.156)
Heat index anomaly × poor	0.033 (0.011)					
Marginalized dummy		0.560 (0.062)				
Heat index anomaly × marginalized		0.006 (0.002)				
Temperature anomaly (on day of interview)			0.050 (0.019)			
Humidity anomaly (on day of interview)			0.066 (0.024)			
Observations	49,984	49,984	49,984	46,401	49,889	48,828
Cell & Date fixed effects	yes	yes	yes	yes	yes	yes
Long-Run climate average	yes	yes	yes	yes	yes	yes

Temperature and protests: research design

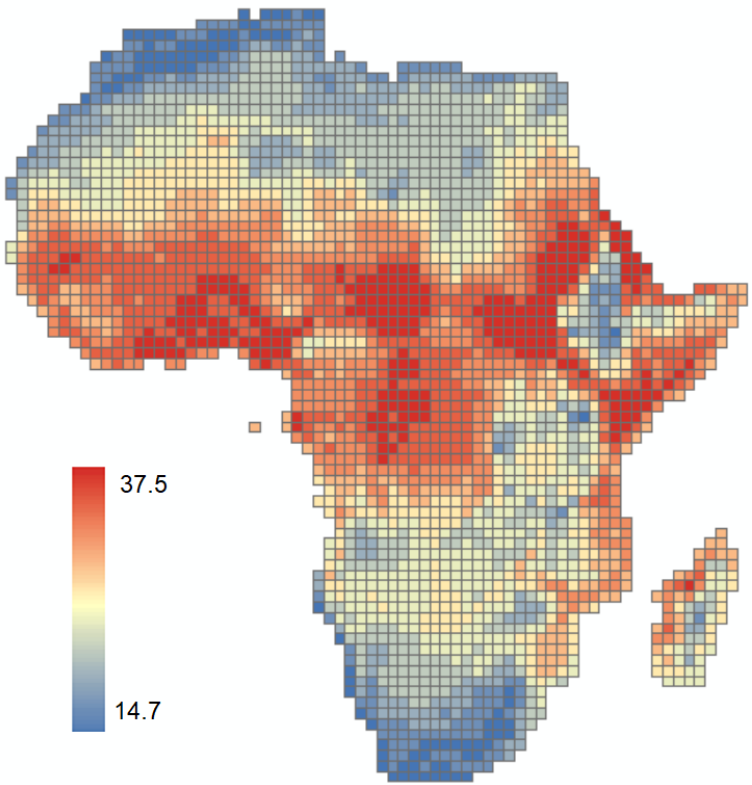
Same research design: Effect of temperature anomalies (heat index) on

- Protests and riots
  - Divide Africa into 2,757 cells (on right)
  - Count incidence of protests and riots per cell per month (from ACLED)
  - Estimate effect of monthly anomalies

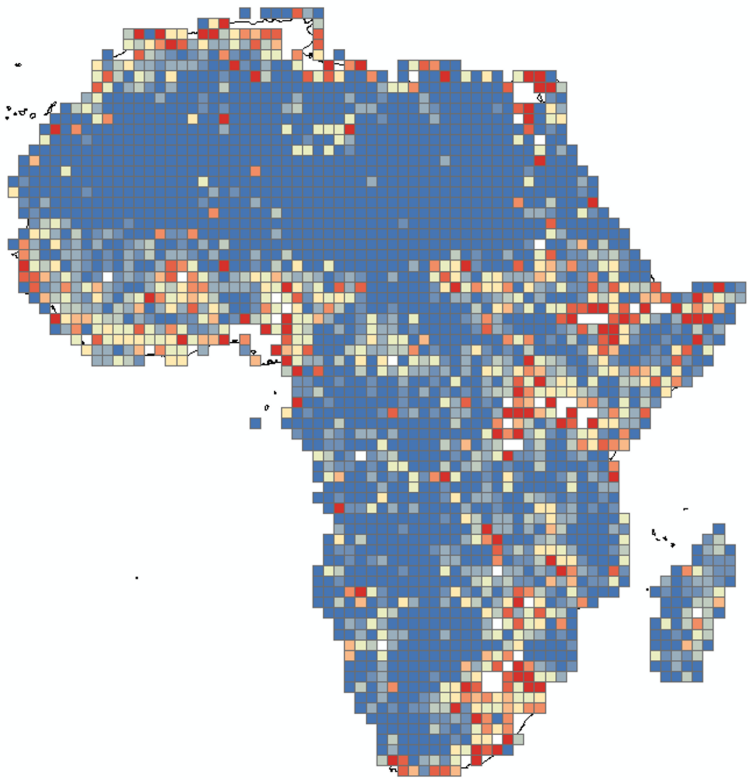


Temperature and protests: descriptive evidence

Heat index



Protests and riots



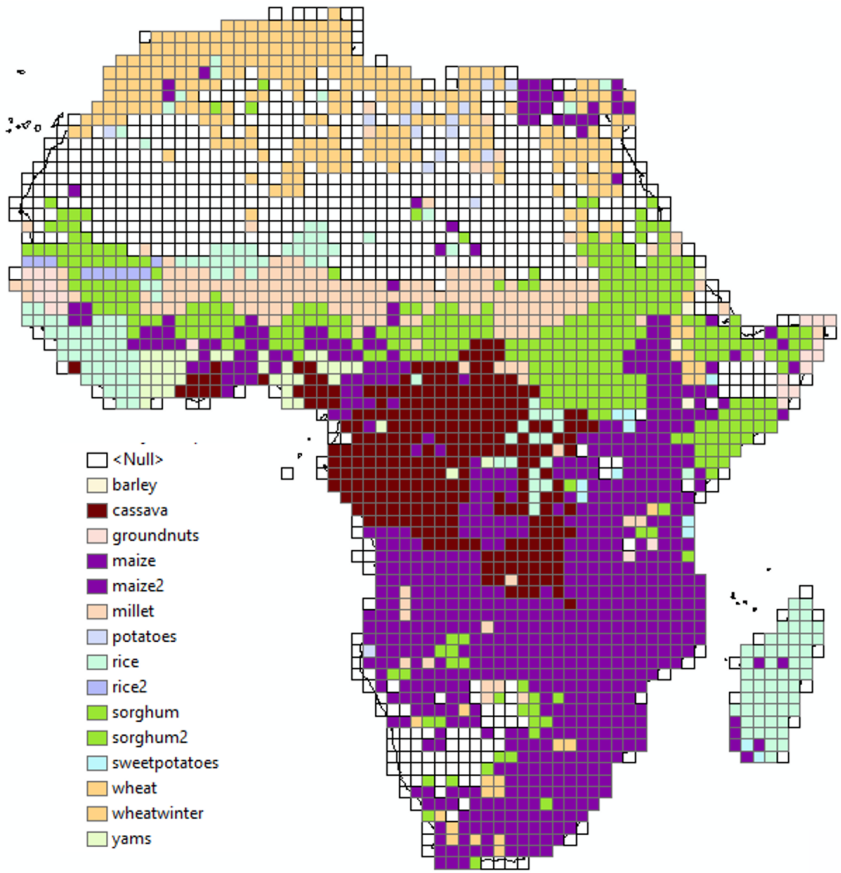
Temperature and protests: regression results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	= 100 if cell c in month m experiences at least one					Log agricultural GVA per worker	Votes cast for president	Voter turnout
	Riot or protest	Strategic violence	Riot or protest	Riot or protest	Riot or protest			
Heat index anomaly	0.123	0.028	0.120	0.200			−3.835	2.558
	(0.033)	(0.020)	(0.035)	(0.052)			(1.826)	(1.570)
Heat index anomaly × poor country			0.084					
			(0.035)					
Average temperature inside growing season				0.374				
				(0.097)				
Average temperature out of growing season				0.084				
				(0.107)				
Air temperature					0.485	−0.025		
					(0.170)	(0.021)		
Humidity					0.889	0.005		
					(0.236)	(0.011)		
Observations	330,840	330,840	330,840	298,200	242,547	349	96	96
Cell, Year & Month FE	yes	yes	yes	yes	yes			
Long-Run climate	yes	yes	yes	yes	yes	yes	yes	yes
Country trends	no	yes	yes	yes	yes			
Lagged dep var	yes	yes	yes	yes	yes			
Country FE						yes		
Country-by-month FE							yes	yes
Data source	ACLED	ACLED	ACLED	ACLED	ACLED	World Bank	Elections	Elections

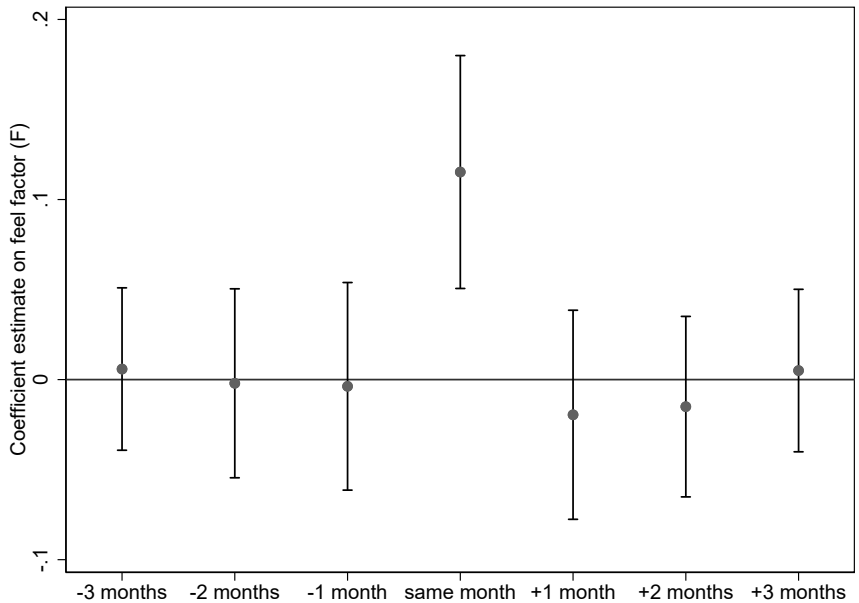
Mechanism: income channel unlikely

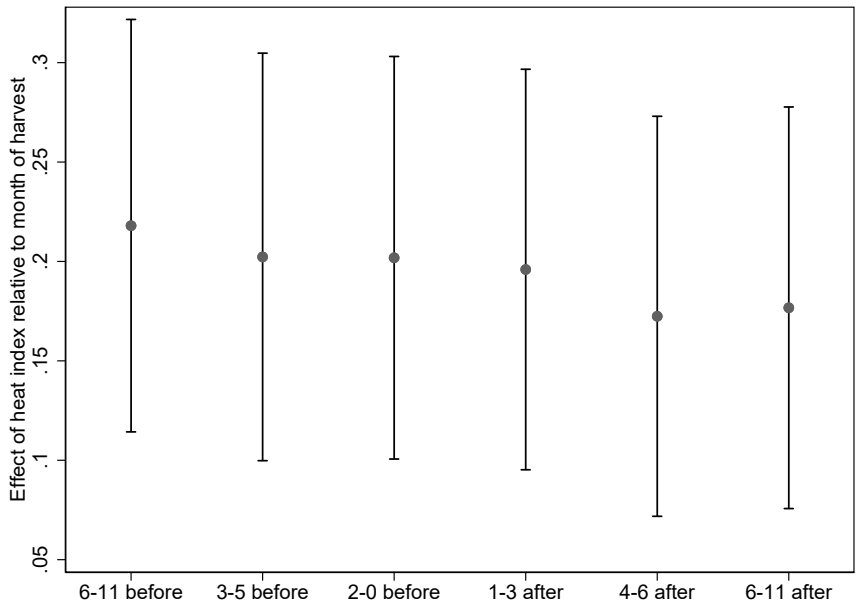
4 pieces of evidence in paper but only 2 here:

1. Leads and lags of temperature
2. We distinguish between growing and non-growing seasons (weather matters only during growing seasons). Goldman Sachs: around 60% of workers in Africa rely on agriculture
   - **For each cell** we find the most important crop (see map)
   - For each most important crop we identify the growing season (when crop is in the ground)
   - **Interpretation of magnitudes:** compare our findings to literature



Timing of effect and crop calendar





Interpretation of magnitudes

Our effect: about half the size of effect operating via income (and well-documented in literature)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
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Heat index anomaly			0.084					
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Average temperature				0.374				
inside growing season				(0.097)				
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Cell, Year & Month FE	yes	yes	yes	yes	yes			
Long-Run climate	yes	yes	yes	yes	yes	yes	yes	yes
Country trends	no	yes	yes	yes	yes			
Lagged dep var	yes	yes	yes	yes	yes			
Country FE						yes		
Country-by-month FE							yes	yes
Data source	ACLED	ACLED	ACLED	ACLED	ACLED	World Bank	Elections	Elections

Temperature and Voting: research design

Same research design:

- We digitised data for all sub-Saharan African presidential elections 1985-2019
- Overlay GPS coordinates of country and calculate temperature **on election day**
- Select only countries that were classified as either *free* or *partly free* at time of election by Freedom House
- Sample: 96 elections
- Estimate effect of daily anomaly on votes cast for government.

Voting

	(1)	(2)
Dependent variable:	% of votes cast for incumbent	Electoral turnout
Heat index on day of election	−3.835	2.558
	(1.826)	(1.570)
Observations	96	96
Month-by-country FE	yes	yes
Long-run average temperature	yes	yes

Interpretation:

- 1 SD (0.9 degrees) $\rightarrow$ 6.5pp
- **Not large for in our sample**
  - 76% of incumbents are re-elected
  - In only 6% of elections did government lose by less than 6.5%

Conclusion

First study to show: higher temperature erodes trust, increases protests and even affects electoral votes cast.

- Attitudes: at higher temperature individuals are less trusting of their government, less likely to vote for their government and more aggressive.
- Actions: at higher temperatures there are more riots and protests and votes for incumbent governments decrease

Policy importance:

- For rich countries and satisfied individuals: temperature does not matter
- For poor countries and dissatisfied individuals: temperature increases mistrust and social unrest

  $\rightarrow$ **Climate change:** will have disproportionate effect on disadvantaged societies