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Stefano Carattini and Marcella Veronesi

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Trust, Temperature Fluctuations, and Asylum Applications*

Stefano Carattini[1] and Marcella Veronesi[2]

[1] Georgia State University, CESifo, LSE, and University of St. Gallen
[2] University of Verona and ETH Zurich

Abstract

This paper studies the relationship between generalized trust, temperature fluctuations during the maize growing season, and international migration by asylum seekers. A priori generalized trust can be expected to have an ambiguous effect on migration. On the one hand, countries with higher trust may exhibit higher adaptive capacity to temperature fluctuations and so lower climate-induced migration. On the other hand, trust may also facilitate migration by increasing the likelihood that communities invest in risk sharing through migration and enjoy reliable networks supporting migrants. Hence, it is an empirical question whether trust mitigates or increases the impact of climate change on migration. Our findings are consistent with an ambivalent effect of trust on migration. We find that for moderate temperature fluctuations, trust mitigates the impact of weather on migration. This effect is driven by the role of trust in increasing adaptive capacity. However, for severe temperature fluctuations, communities with higher trust experience more migration. Overall, the former effect dominates the latter, so that the net effect is that trust mitigates migration. Our findings point to important policy implications concerning the role of trust in fostering adaptation by facilitating collective action, and the need for targeted interventions to support adaptation and increase resilience in low-trust societies in which collective action may be harder to achieve.

Keywords
Migration; climate change; trust; adaptation

JEL codes:
O15; Q54; Z13

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1. Introduction

Climate change is expected to increase both the likelihood and severity of extreme weather events, including strong temperature fluctuations, droughts, and heat waves (IPCC 2018). Such extreme events will challenge the ability of communities to survive in their current form. Severe changes in the abundance of basic resources such as food may force many people, including entire villages, to migrate domestically and internationally, as a direct effect of scarcity or due to the conflicts that scarcity produces. In particular, migration from most affected areas such as Sub-Saharan Africa and Latin America towards Europe and the United States is predicted to increase significantly because of climate change (International Organization for Migration 2014).

Recent evidence suggests that flows of asylum seekers from developing countries to the European Union respond considerably to temperature fluctuations in the country of origin, following the growing literature showing crop yields' responsiveness to temperature increases (Missirian and Schlenker 2017). Therefore, it is of crucial importance to understand how to foster the resilience of a country to climate change, that is, to strengthen its ability to cope with climatic stress and mitigate the need to migrate, often in desperate conditions. In this paper, we investigate the role of generalized trust, that is, trust in other members of society, in potentially mitigating the effect of temperature fluctuations on asylum applications to the European Union by facilitating collective action in adaptation.

The resilience of a country depends on the country's vulnerability and its adaptive capacity. Vulnerability and the adaptive capacity of a country depend not only on the availability of human and physical capital but also on its formal and informal institutions (Berkes, Folke, and Colding 2000; Folke 2006). Substantial heterogeneity exists in how resilient countries are to climate change, even within the same country. In this respect, informal institutions, such as trust, are expected to play a major role in increasing the resilience of a country by fostering adaptation. Indeed, adaptation represents, to a large extent, a local social dilemma.

A large literature, culminating with the Nobel prize in economics awarded to Elinor Ostrom in 2009, has emerged over the last three decades showing that communities with stronger generalized trust are more likely than others to succeed in engaging in collective action and managing local social dilemmas such as common pool resources without external oversight or privatization (e.g. Ostrom 1990; Poteete, Janssen, and Ostrom 2010; Kocher et al. 2015). Hence, these communities may establish sustainable norms for the use of common pool resources and so escape the "tragedy of the commons" predicted by earlier research (Hardin 1968). Further, generalized trust has also been shown to foster prosperity and economic development, especially in presence of incomplete contracts and imperfect information (Putnam, Leonardi, and Nanetti 1994; Fukuyama 1995; Algan and Cahuc 2013).

In the very same way that villages with higher trust may fare better in preserving current collective resources, in this paper we posit that countries with higher trust may be more likely to mobilize collective efforts and invest in adaptation to climate change. Such collective efforts in adaptation require a non-negligible degree of trust in others. In contrast, countries with lower trust may be less likely to adapt, and so more likely to suffer from weather fluctuations and depopulate faster through migration. If adaptation, or lack thereof, was the only channel through which trust may affect migration flows, we may expect countries with higher trust to experience, on average, lower migration rates, for a given temperature fluctuation.

We cannot, however, expect the effect of trust on climate-induced migration to be univocally negative. Trust may also facilitate the process of climate-induced migration (Tilly 2007). Standard models of migration theorize that communities with higher trust may diversify risks by sending some members to large city centers in the same country as well as to foreign countries (Lucas and Stark 1985; Massey et al. 1993; Collier, Piracha, and Randazzo 2018). Migrants are expected to return part of the money earned in the new location to their community through remittances, to pay back for the initial investment by the community (Joseph, Nyarko, and Wang 2018). Communities with higher trust may also face lower costs and risks of movement if they can count on their members in destination countries to help recent migrants (Massey et al. 1993). Hence, the role played by trust on the relationship between temperature fluctuations and migration is a priori ambiguous. It is an open empirical question whether trust mitigates or increases the impact of temperature fluctuations on migration. To the best of our knowledge, this is the first study to explore the relationship between trust, temperature fluctuations, and migration.

We combine several country-level datasets, including data on asylum applications to the European Union from the United Nations High Commissioner on Refugees, temperature and precipitation during the maize growing season in the source country from the University of Delaware (Matsuura and Willmott 2012a; 2012b), trust from the World Values Surveys (Inglehart et al. 2014), a measure of the capacity of a society to adapt to the negative effects of climate change compiled by the Notre Dame Global Adaptation Initiative (Chen et al. 2015), and a rich set of country-specific covariates controlling for economic conditions and institutional factors such as conflicts, corruption, political stability, and quality of institutions. Our identification strategy relies on source country fixed effects and random and exogenous year-to-year variations in temperature. Hence, our identification strategy relies on temperature anomalies. Our specifications also include year fixed effects to adjust for common shocks.

We find that for moderate temperature fluctuations (25-28°C), trust mitigates the impact of temperature shocks on migration. Trust, indeed, is shown to facilitate local investments in adaptive capacity. However, for more severe temperature increases (above 28°C), which are extremely detrimental for agriculture, countries with higher trust experience more migration. Overall, the former effect dominates the latter, so that the net effect is that trust mitigates climate-induced migration. Our findings are robust to several sensitivity checks. Our results point to important policy implications concerning the role of trust in increasing countries' adaptive capacity and their resilience to climate change. In particular, they point to an untapped potential of policies facilitating collective action, especially when it is harder to achieve, to increase resilience, improve livelihoods, and decrease the need to migrate, often in desperate conditions, as a result of extreme weather events.

The remainder of the paper is organized as follows. Section 2 describes our data and empirical strategy. Section 3 presents our main findings and related robustness checks. Section 4 concludes.

2. Data and empirical approach

2.1. Data and descriptive statistics

This paper uses six different sets of data: (i) weather; (ii) asylum applications; (iii) trust; (iv) adaptive capacity; (v) mortality; and (vi) source countries' characteristics. A first dataset, coming from Missirian and Schlenker (2017), combines weather and asylum applications.[1] Data on asylum applications were collected from the United Nations High Commissioner on Refugees.[2] The data provide yearly information on both the source and the destination country between year 2000 and year 2014. The focus of Missirian and Schlenker (2017), as of our paper, is on all applications from non-OECD source countries that have a country in the European Union as destination and had non-zero applications in each of the 15 years.

[1] We thank Wolfram Schlenker for kindly sharing the data.
[2] Asylum application data from the United Nations High Commissioner on Refugees can be retrieved from http://popstats.unhcr.org/en/asylum_seekers (last accessed, January 2020).

In Missirian and Schlenker (2017), information on temperature fluctuations from the mean in the source country and season-total precipitation for non-OECD source countries come from the University of Delaware.[3] High-resolution gridded monthly weather data are aggregated at the country level in Missirian and Schlenker (2017), averaging out all grid cells. Temperature fluctuations and season-total precipitation are then measured for the maize growing season, which determines an important share of household incomes in the countries covered by the datasets. As noted in Missirian and Schlenker (2017), a large share of the population in our source countries works in the agricultural sector and maize, the staple commodity responsible for the largest share of caloric intake among human beings (Roberts and Schlenker 2013), plays an important role in all of them. In case of multiple growing seasons in the same year, the dataset is restricted to the first season. Average temperature at the grid cell level is then averaged out at the country level, with each grid cell receiving a weight that corresponds to the maize growing area in that specific cell.

Further, this paper uses data on generalized trust, collected from the World Values Surveys between year 2000 and year 2014.[4] The following question is used to measure generalized trust: “Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?”. Our measure of trust is the proportion of respondents in a given country and a given year who answers, “Most

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[3] University of Delaware weather data are publicly available at https://psl.noaa.gov/data/gridded/data.UDel_AirT_Precip.html (last accessed, January 2020).
[4] World Values Surveys data are publicly available at http://www.worldvaluessurvey.org/WVSDocumentationWVL.jsp (last accessed, January 2020).

people can be trusted". This is a widely used measure for generalized trust and is supported by numerous field and lab experiments, including in developing countries (see Algan and Cahuc 2013 for a review of the literature; Knack and Keefer 1997 and Tannenbaum et al. 2020 for cross-country evidence from the field). This information is available for 52 non-OECD source countries that applied for asylum in the European Union.

We then match our data on trust with the data from Missirian and Schlenker (2017) and obtain a final sample of 780 country-year observations from 52 countries and 15 years, covering a total of 3,378,271 refugee applications. While Missirian and Schlenker (2017) use 1,545 observations over 103 countries for the same time period, we show in Table A1 in the Appendix that our sample virtually perfectly replicates their main finding: the temperature variables are jointly significant at the 1 percent level (p-value = 0.000) with a minimum temperature of 21°C after which asylum applications increase.

Next, this paper uses data on adaptive capacity in the source countries from the Notre Dame Global Adaptation Initiative, also known as ND-GAIN.[5] Adaptive capacity is an index measuring the "Availability of social resources for sector-specific adaptation. In some cases, these capacities reflect sustainable adaptation solutions. In other cases, they reflect capacities to put newer, more sustainable adaptations into place" (Chen et al. 2015). The sectors included are food, water, health, ecosystem services, human habitat, and infrastructure.

[5] These data are publicly available at https://gain.nd.edu/our-work/country-index/download-data/ (last accessed, January 2020).

Fourth, this paper uses data on age-standardized death rates per 100,000 at the country level from the World Health Organization (WHO), which is available for many of the countries in our study over the years 2000-2014.[6] The age-standardized death rate is a weighted average of the age-specific death rates per 100,000 persons, where the proportions of persons in the corresponding age groups of the WHO standard population represent the weights. Fifth, this paper uses data on a set of covariates for the source countries, such as the number of minor and major conflicts a country is involved in from the Uppsala Conflict Data Program, and the fatalities from political violence in thousands from the Armed Conflict Location and Event Data Project. We also use information on the quality of political institutions measured by the polity index from the Polity IV database. A higher level indicates more democratic institutions. The polity scale ranges from +10 (strongly democratic) to -10 (strongly autocratic).

In addition, we use data on control of corruption, political stability, and regulatory quality from the Worldwide Governance Indicators. Control of corruption reflects perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Political stability measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism. Regulatory quality reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. We also use data on real gross domestic product (real GDP) per capita expressed in 2011 US dollars from the

[6] These data are publicly available at https://apps.who.int/healthinfo/statistics/mortality/whodpms/ (last accessed, January 2020).

Maddison database.[7] Descriptive statistics on weather, asylum applications, trust, adaptive capacity, and source country characteristics are provided in Table 1.

2.2 Empirical strategy and econometric model

We apply econometric models for longitudinal data to analyze how temperature fluctuations affect asylum applications and the role of trust in the temperature-asylum relationship. To this end, we proceed as follows. First, we follow Missirian and Schlenker (2017) and estimate the following equation to elicit the effect of temperature fluctuations on asylum applications:

$$(1) \qquad \log(A_{ct}) = \sum_{i=1}^{2} \alpha_i T_{ct}^i + \sum_{i=1}^{2} \beta_i R_{ct}^i + \gamma_c + \delta_t + \varepsilon_{ct},$$

where $\log(A_{ct})$ is the logarithm of asylum applications from source country *c* to any member of the European Union in year *t*; T_{ct}^i $(i = 1, 2)$ represents average temperature and average temperature squared over the maize growing season in source country *c* and year *t*; and R_{ct}^i $(i = 1, 2)$ represents season-total precipitation and precipitation squared over the maize growing season in source country *c* and year *t*. In addition, in equation (1) we include source country fixed effects (γ_c) to account for country differences in baseline characteristics (e.g., different

[7] Data from the Uppsala Conflict Data Program are publicly available at https://ucdp.uu.se. Data on the Armed Conflict Location and Event Data Project are publicly available at https://www.prio.org/Data/Armed-Conflict/Armed-Conflict-Location-and-Event-Data/. Data from Polity IV are publicly available at http://www.systemicpeace.org/inscrdata.html. Data from the Worldwide Governance Indicators are publicly available at http://info.worldbank.org/governance/wgi/#home. Data from the CIA World Factbook are publicly available at https://www.cia.gov/library/publications. Data from the Maddison database are publicly available at https://www.rug.nl/ggdc/historicaldevelopment/maddison/releases/maddison-project-database-2018. All data sources were last accessed in January 2020.

institutions and economic development), year fixed effects (δ_t) to account for common shocks, and an idiosyncratic error term (ε_{ct}).

After exploring the relationship between temperature fluctuations and asylum applications, we investigate the effect of trust on the temperature-asylum relationship. This model extends equation (1) by adding trust and its interaction with temperature. In particular, we estimate the following equation:

$$(2) \qquad \log(A_{ct}) = \sum_{i=1}^{2} \alpha_i' T_{ct}^i + \sum_{i=1}^{2} \lambda_i T_{ct}^i \times Z_{ct} + \theta Z_{ct} + \sum_{i=1}^{2} \beta_i' R_{ct}^i + \gamma_c' + \delta_t' + \mu_{ct},$$

where the prime superscript distinguishes this equation from equation (1) and all variables are defined as in equation (1) except for Z_{ct} representing our measure of generalized trust in source country *c* and year *t*. Our main parameters of interest are λ_1 and λ_2, that is the coefficients of the interaction terms between trust (Z_{ct}) and the temperature variables ($T_{ct}^i, i = 1, 2$). Our identification strategy relies on source country fixed effects and the random and exogenous year-to-year variation in temperature, which leads to an unbiased estimate of λ, the coefficient of the interaction term between trust and temperature, even if trust itself happened to be endogenous (Nizalova and Murtazashvili 2014).

3. Empirical results

3.1 Main results

We first estimate the effect of temperature fluctuations on migration as in Missirian and Schlenker (2017) and then explore the role of generalized trust on the temperature-migration relationship. Our main variables of interest are the interaction terms between trust and the temperature variables, which describe the relationship between generalized trust, temperature fluctuation, and international migration by asylum seekers. All variables are measured with respect to the source country: number of asylum seekers per year per source country, temperature fluctuations in the source country, and generalized trust in the source country. The model controls for a quadratic function of total season precipitation, source country, and year fixed effects. Hence, it exploits random and exogenous year-to-year variation in weather (temperature anomalies) in each country while controlling for global trends.

Table 2 presents our main results. Column 1 shows the effect of temperature fluctuations on asylum applications, i.e. equation (1). Figure 1 illustrates graphically the results for the temperature-asylum relationship. As in Missirian and Schlenker (2017), we find a strong and significant U-shaped effect: asylum applications decrease with temperature up to 21°C and then, when higher temperatures start to be detrimental for agriculture, they significantly increase. We also do not find a significant effect of total season precipitation. Coefficients for total season precipitation are displayed in Table A2 in the Appendix.

Column 2 of Table 2 shows the role of trust on the temperature-migration relationship, i.e. equation (2). The estimates of the interaction terms between trust and temperature, and trust and temperature squared, are strongly statistically significant, both individually and jointly (p-value = 0.0001). This implies that the strength of the relationship between temperature and asylum applications is affected by trust.

In Figure 2, we show the predicted relationship between asylum applications and trust at three different levels of trust: low, medium, and high. Low trust corresponds to one standard deviation below average trust, high trust corresponds to one standard deviation above average trust, and medium trust is equal to the average level of trust observed in the data. Figure 2 shows that until 28°C, the lower the trust, the higher the extent to which people migrate. For relatively high temperatures, i.e. above 28°C, the opposite is true. Several studies find that crop yields, crop productivity or rents decrease significantly as temperature reaches high levels, and even more so at 28°C and beyond, limiting the potential for adaptative strategies to succeed (Schlenker and Roberts 2009; Schlenker and Lobell 2010; Blanc and Schlenker 2017; Gammans, Mérel, and Ortiz-Bobea 2017; Hendricks 2018; Ortiz-Bobea 2020).

Notably, Figure 2 shows that the line for medium trust lies systematically in between the lines for low and high trust. For temperatures below 28°C, when trust is medium, migration is higher than when trust is high, but lower than when trust is low. For temperatures above 28°C, when trust is medium, migration is lower than when trust is high, but higher than when trust is low. Figure 2 also shows that most of the action in terms of the temperature-migration relationship comes from medium and high trust contexts, where trust can facilitate collective action to deal with moderate temperatures (25-28°C) and where trust offers an escape valve in the form of international migration when temperatures are especially high. These findings are entirely consistent with our main set of hypotheses.

Following from Figure 2, another way to address our main research question consists in interacting trust with two dummy variables: one for moderate temperature fluctuations (25-28°C) and one for more severe temperature fluctuations (above 28°C). Recall that 28°C represents our pivotal point in Figure 2 and is the temperature after which agriculture tends to be very severely affected by temperature fluctuations (Schlenker and Roberts 2009; Schlenker and Lobell 2010; Blanc and Schlenker 2017; Gammans, Mérel, and Ortiz-Bobea 2017; Hendricks 2018; Ortiz-Bobea 2020), potentially beyond what collective action in adaptation can prevent. In column 3 of Table 2, we show that for relatively moderate temperature fluctuations, trust mitigates migration (the coefficient of the interaction term between temperature 25-28°C and trust is negative and strongly significant). However, for more severe temperature fluctuations (above 28°C), the coefficient of the interaction term becomes positive, which implies that trust increases migration. This result is entirely consistent with column 2.

As shown in Figure A1 in the Appendix, since moderate temperature fluctuations are more likely than severe temperature fluctuations (32 percent versus 4 percent of cases in our sample), and the absolute value of the magnitude of the coefficients for moderate and severe temperature fluctuations is not different, everything else equal, the main effect of trust is that it mitigates climate-induced migration.

3.2 Sensitivity analysis

We conduct several sensitivity checks in Table 3 to exclude potential confounding effects and to ensure that our results are not capturing some spurious correlations. Column 1 presents our baseline specification, which corresponds to column 2 in Table 2. In column 2, we investigate whether our results change if we consider only first instances of asylum applications rather than all instances, including appeals. Our main findings are unchanged. In column 3, we obtain the same results when we consider only applications to the 14 richest European Union countries, which account for most of the applications. Our results are also robust to the inclusion as covariates of several country characteristics that may affect asylum seeking: the number of minor and major conflicts a country is involved in as well as a quadratic in the fatalities from political violence in thousands (column 4), the quality of political institutions (column 5), corruption control (column 6), political stability (column 7), regulatory quality (column 8), and real gross domestic product per capita (column 9). Our results remain unchanged if we include these variables one at the time or all at the same time (column 10). Coefficients for all control variables are displayed in Table A3 in the Appendix. In addition, our results are robust to the exclusion of one country at the time (Table A4 in the Appendix).

3.3 Underlying channel: trust and adaptive capacity

We interpret the role of trust on the temperature-migration relationship as follows. First, as shown, trust helps at mitigating migration flows when temperature fluctuations are not extreme (25-28°C), which is the case most of the time (about 32 percent of the observations, versus 4 percent with average temperature above 28°C). We posit, and test, that the mechanism for this effect is the higher ability of countries with higher trust to adapt and increase resilience, which allows them to weather out moderate temperature fluctuations with less need to depopulate and send part of their members out of the country.

Crop and animal diversification, investments in machinery, irrigation, and water delivery systems are all strategies known to protect yields as long as temperature increases remain manageable, and all potentially requiring collective action. It is much harder, however, to prepare for severe temperature fluctuations (Schlenker and Roberts 2009; Schlenker and Lobell 2010; Blanc and Schlenker 2017; Gammans, Mérel, and Ortiz-Bobea 2017; Hendricks 2018; Ortiz-Bobea 2020). In this case, the need to depopulate may be much stronger and countries with higher trust are more likely to leverage their networks and help their members migrating. In the latter case, the effect of trust on migration through adaptation is dominated by the effect of trust on migration through collective investment in migrants and the use of trust networks to help them migrate. Hence, countries with higher trust engage in more migration for severe temperature fluctuations.

As described, we expect the channel pushing for a negative relationship between trust and migration to relate with collective action around the provision of adaptation as a local public good. We test this channel in Table 4 by estimating in column 1 the relationship between trust and the adaptive capacity of a country, that is, the ability of a society and its supporting sectors to adjust and respond to reduce the negative consequences of climatic events. We find that trust is strongly and positively correlated with adaptative capacity at the 1 percent level. Higher trust is associated with higher capacity to adapt to the negative effects of climate change.

In our estimation, we also include year fixed effects to account for shocks common to all countries and control for several factors that could affect the adaptive capacity of a country such as the quality of political institutions (column 2), corruption control (column 3), political stability (column 4), regulatory quality (column 5), and real GDP (column 6). If we control for these variables one at the time (columns 2-6) or all together (column 7), we confirm our main finding that the higher the level of trust in a country, the more adaptive capacity that country exhibits. Coefficients for all control variables are displayed in Table A5 in the Appendix.

4. Conclusions

Climate change is expected to increase the likelihood and severity of temperature fluctuations. Informed by previous literature showing a positive causal relationship between temperature fluctuations in non-OECD source countries and asylum seeking in the European Union, in this study we investigate potential solutions beyond mitigating climate change. We posit that adaptation represents to a large extent a local social dilemma and analyze the role of generalized trust, a key ingredient for collective action, in mitigating the effect of temperature fluctuations on migration flows. We show that countries with higher generalized trust present higher adaptive capacity and experience lower migration with moderate temperature fluctuations.

However, trust can also facilitate migration. Villagers help migrants leave the country, trusting them to send back remittances. Stronger trust networks also facilitate the process of migration and integration in the destination country, thus decreasing the risk of migration and increasing its potential returns. We find that with severe temperature fluctuations, for which agriculture is very harshly harmed and it is harder to adapt, this second effect dominates. This effect is very much in line with a growing literature showing strong negative effects of high temperatures on crop yields, especially above 28°C. In this context, countries with higher trust are more likely to experience migration for severe temperature fluctuations. The overall effect, however, is such that trust largely mitigates migration, given that moderate temperature fluctuations occur with higher frequency. Hence, this paper contributes to a growing literature on the social benefits of informal institutions such as social capital, and in particular trust.

This paper paves the way to additional studies investigating the role of trust in affecting migration. Further, it also highlights the need for further research considering other possible implications of temperature fluctuations. For instance, preliminary analyses using mortality data from the World Health Organization point to a strong negative relationship between generalized trust and temperature-induced mortality rates (see Table A6 in the Appendix). In low-trust societies, in which adaptation to climate change is lacking, we find that migration is an option only for some, while others encounter death.

Two main recommendations to policymakers and practitioners also follow from our results. First, we join other researchers in their call for supporting the creation of pro-social preferences in society (Dixit and Levin 2017). Such initiatives may be especially promising in areas vulnerable to climate change and are likely to generate benefits well beyond increased adaptive capacity. Second, we consider essential that governments, international organizations, and non-governmental organizations invest in facilitating adaptation, and providing insurance mechanisms, in contexts in which trust among members of the same community may be insufficient to support effective collective action. Cultural traits tend, indeed, to be relatively persistent over time and change may only occur across generations. Adaptation to climate change, however, is needed now.

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Figures and tables

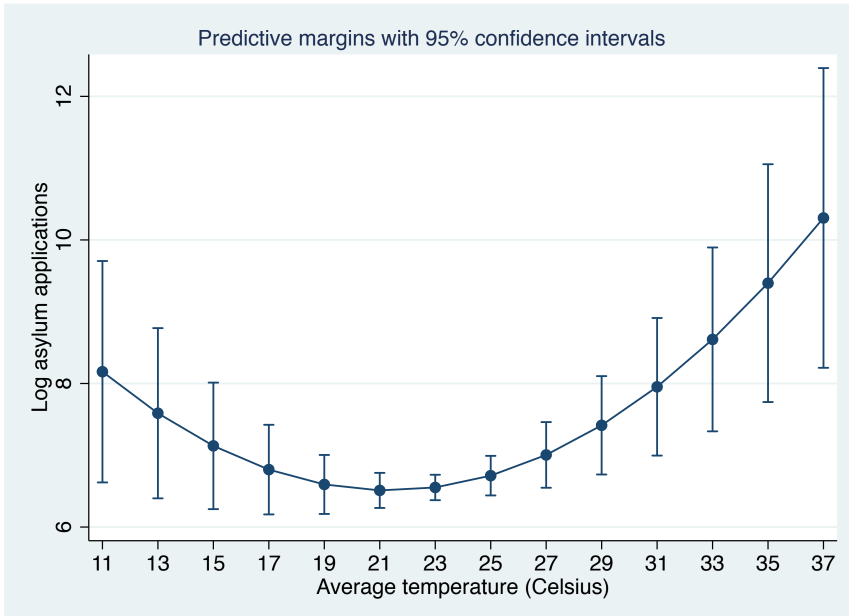

Figure 1. Temperature fluctuation and asylum applications
Note: The model controls for a quadratic function in total season precipitation, source country and year fixed effects.

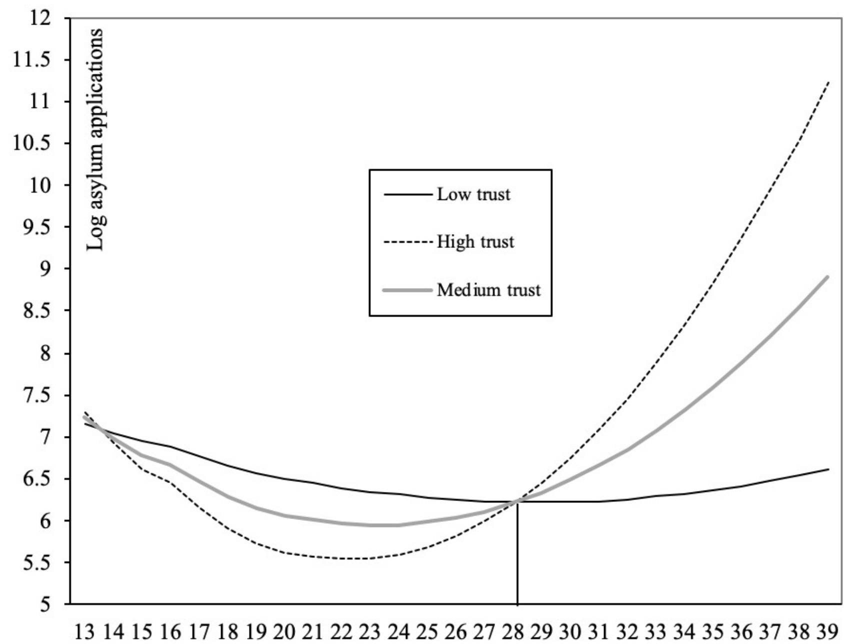

Figure 2. Trust and the temperature-asylum relationship

Notes: "Low" and "High trust" are equal to one standard deviation above or below the mean of trust, which corresponds to "Medium trust". The model controls for a quadratic function in total season precipitation, generalized trust, source country, and year fixed effects.

Table 1. Summary statistics

Variables	N	Mean	Std. Dev.	Minimum	Maximum
Asylum applications	780	4,331.117	7,686.797	3	73,929
Adaptive capacity	765	-0.514	0.117	-0.807	-0.338
Average temperature	780	22.760	4.763	12.665	38.588
Precipitation (mm)	780	0.515	0.433	0.000	2.291
Trust	780	0.214	0.135	0.028	0.653
Political institutional quality	759	-1.789	16.370	-88.000	9.000
Corruption control	714	-0.597	0.459	-1.560	1.010
Political stability	714	-0.716	0.747	-3.180	0.830
Regulatory quality	714	-0.423	0.599	-2.240	0.930
Real GDP	780	10,256.060	12,595.760	703	95,645
Population	780	97,200,000	250,000,000	2,096,015	1,370,000,000
Minor conflicts	780	0.338	0.797	0.000	6.000
Major conflicts	780	0.058	0.254	0.000	3.000
Fatalities	780	0.124	0.631	0.000	11.539

Notes: Data refer to the period 2000-2014. The sample size is smaller for some variables because there are no data on adaptive capacity for Palestinian Territory Occupied, because of missing data on the quality of political institutions for Palestinian Territory Occupied and Serbia, and for year 2001 in the Worldwide Governance Indicator.

Table 2. Trust and the temperature-asylum relationship

Dependent variable: Log asylum applications	(1)	(2)	(3)
Temperature	-0.644***	-0.019	
	(0.190)	(0.212)	
Temperature squared	0.015***	-0.001	
	(0.004)	(0.005)	
Trust × temperature		-2.537***	
		(0.698)	
Trust × temperature squared		0.061***	
		(0.015)	
Trust		23.149***	0.262
		(7.821)	(0.709)
Temperature 25-28°C			0.770**
			(0.322)
Temperature > 28°C			-1.435***
			(0.347)
Trust × temperature 25-28°C			-4.823**
			(2.245)
Trust × temperature > 28°C			3.998***
			(1.164)
Number of observations	780	780	780
Number of countries	52	52	52
Year fixed effects	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes

Notes: Heteroskedasticity-consistent standard errors are presented in parentheses. Data refer to the period 2000-2014. The models control for a quadratic function in total season precipitation, source country, and year fixed effects. The coefficients and standard errors of the precipitation variables are presented in Table S1 of the SI. ***, ** indicate significance at the 1% and 5% level, respectively.

Table 3. Trust and the temperature-asylum relationship: robustness checks

Dependent variable: Log asylum applications	(1) Baseline	(2) First instances of applications	(3) Richest EU	(4) Conflicts	(5) Political institutions' quality	(6) Corruption control	(7) Political stability	(8) Regulatory quality	(9) Real GDP	(10) All
Temperature	-0.019	-0.077	-0.082	-0.011	-0.076	0.015	-0.037	0.029	-0.019	-0.061
	(0.212)	(0.245)	(0.175)	(0.216)	(0.213)	(0.203)	(0.195)	(0.199)	(0.212)	(0.209)
Temperature squared	-0.001	-0.000	0.001	-0.001	0.001	-0.001	-0.000	-0.002	-0.001	0.001
	(0.005)	(0.006)	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
Trust × temperature	-2.537***	-2.627***	-2.478***	-2.571***	-2.339***	-2.112***	-2.187***	-2.255***	-2.540***	-2.128***
	(0.698)	(0.803)	(0.484)	(0.712)	(0.714)	(0.642)	(0.592)	(0.645)	(0.723)	(0.650)
Trust × temperature squared	0.061***	0.065***	0.061***	0.062***	0.056***	0.051***	0.053***	0.054***	0.061***	0.051***
	(0.015)	(0.017)	(0.010)	(0.015)	(0.015)	(0.014)	(0.013)	(0.014)	(0.015)	(0.014)
Trust	23.149***	22.643**	22.062***	23.671***	21.346***	19.239***	20.093***	20.706***	23.186***	19.886***
	(7.821)	(8.728)	(5.218)	(8.044)	(7.910)	(7.084)	(6.539)	(7.049)	(8.077)	(7.127)
Additional covariate(s)				[0.0002]	-0.004	-0.333*	-0.317***	-0.273	0.000	[0.007]
					(0.002)	(0.186)	(0.093)	(0.250)	(0.000)	
Number of observations	780	780	780	780	759	714	714	714	780	709
Number of countries	52	52	52	52	51	51	51	51	52	51
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Column 1 presents the baseline specification from equation (1). Column 2 considers first instances of asylum applications. Column 3 considers applications to the 14 richest EU member countries. All columns control for a quadratic function in total season precipitation, generalized trust, source-country, and year fixed effects. Column 4 also controls for the number of minor and major conflicts a country is involved in as well as a quadratic in the fatalities from political violence in thousands. Column 5 controls for the quality of political institutions, column 6 for corruption control, column 7 for political stability, column 8 for regulatory quality, column 9 for real gross domestic product per capita, and column 10 for all the aforementioned covariates at the same time. In square brackets the *p*-value of a joint test of significance of the conflict covariates in column 4, and all additional covariates in column 10. The coefficients and standard errors of the additional covariates are presented in Table S2 of the SI. The sample size is smaller in columns 5 and 10 because of missing data on the quality of political institutions for Palestinian Territory Occupied and Serbia, and in columns 6-8 and 10 because of missing data for year 2001 in the Worldwide Governance Indicator. Heteroskedasticity-consistent standard errors are presented in parentheses. Data refer to the period 2000-2014. ***, ** indicate significance at the 1% and 5% level, respectively.

Table 4. Trust and adaptive capacity

Dependent variable: Adaptive capacity	(1) Trust	(2) Political institutions' quality	(3) Corruption control	(4) Political stability	(5) Regulatory quality	(6) Real GDP	(7) All
Trust	0.146***	0.141***	0.150***	0.147***	0.152***	0.072***	0.061**
	(0.025)	(0.025)	(0.026)	(0.025)	(0.026)	(0.026)	(0.026)
Additional covariate(s)		-0.000**	0.020**	0.032***	0.025***	0.000***	[0.000]
		(0.000)	(0.009)	(0.006)	(0.007)	(0.000)	
Number of observations	765	759	714	714	714	765	709
Number of countries	51	51	51	51	51	51	51

Notes: All specifications include generalized trust and year fixed effects. Column 2 also controls for the quality of political institutions, column 3 for corruption control, column 4 for political stability, column 5 for regulatory quality, column 6 for real gross domestic product per capita, and column 7 for these additional covariates all together. In square brackets the *p*-value of a joint test of significance of all additional covariates in column 7. The coefficients and standard errors of the additional covariates are presented in Table S4 of the SI. The sample size is smaller because there are no data on adaptive capacity for Palestinian Territory Occupied, and because of missing data on the quality of political institutions for Palestinian Territory Occupied and Serbia, and for year 2001 in the Worldwide Governance Indicator. Heteroskedasticity-consistent standard errors are presented in parentheses. Data refer to the period 2000-2014. ***, ** indicate significance at the 1% and 5% level, respectively.

A. Appendix

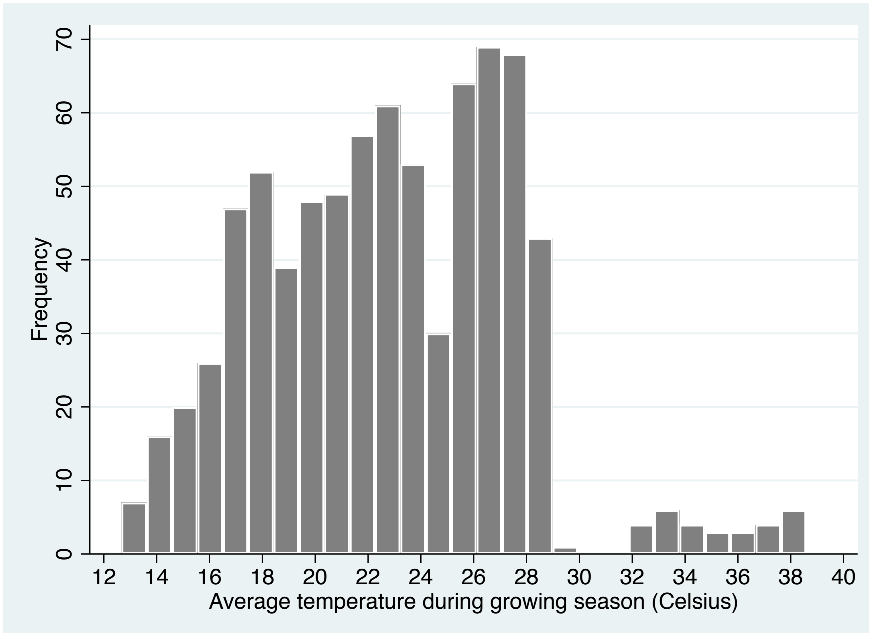

Figure A1. Average temperature distribution during the maize growing season (Celsius)

Table A1. Replication of Missirian and Schlenker (2017) with our sample

Dependent variable: Log asylum applications	(1) Missirian and Schlenker (2017)	(2) Our sample
Average temperature	-0.539***	-0.644***
	(0.187)	(0.190)
Average temperature squared	0.013***	0.015***
	(0.004)	(0.004)
Precipitation	0.244	-0.132
	(0.530)	(0.535)
Precipitation squared	0.104	0.089
	(0.177)	(0.159)
Observations	1,545	780
Number of countries	103	52
Year fixed effects	Yes	Yes
Country fixed effects	Yes	Yes

Notes: Heteroskedasticity-consistent standard errors are presented in parentheses. Data refer to the period 2000-2014. *** indicates significance at the 1% level.

Table A2. Trust and the temperature-asylum relationship

Dependent variable: Log asylum applications	(1)	(2)	(3)
Temperature	-0.644***	-0.019	
	(0.190)	(0.212)	
Temperature squared	0.015***	-0.001	
	(0.004)	(0.005)	
Trust × temperature		-2.537***	
		(0.698)	
Trust × temperature squared		0.061***	
		(0.015)	
Trust		23.149***	0.262
		(7.821)	(0.709)
Temperature 25-28°C			0.770**
			(0.322)
Temperature > 28°C			-1.435***
			(0.347)
Trust × temperature 25-28°C			-4.823**
			(2.245)
Trust × temperature > 28°C			3.998***
			(1.164)
Precipitation	-0.132	-0.176	-0.036
	(0.535)	(0.546)	(0.461)
Precipitation squared	0.089	0.096	0.038
	(0.159)	(0.160)	(0.132)
Constant	13.166***	7.608***	6.879***
	(2.384)	(2.579)	(0.230)
Number of observations	780	780	780
Number of countries	52	52	52
Year fixed effects	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes

Notes: Heteroskedasticity-consistent standard errors are presented in parentheses. Data refer to the period 2000-2014. ***, ** indicate significance at the 1% and 5% level, respectively.

Table A3. Trust and the temperature-asylum relationship: robustness checks displaying coefficients for control variables

Dependent variable: Log asylum applications	(1) Baseline	(2) First instances of applications	(3) Richest EU	(4) Conflicts	(5) Political institutions' quality	(6) Corruption control	(7) Political stability	(8) Regulatory quality	(9) Real GDP	(10) All
Temperature	-0.019	-0.077	-0.082	-0.011	-0.076	0.015	-0.037	0.029	-0.019	-0.061
	(0.212)	(0.245)	(0.175)	(0.216)	(0.213)	(0.203)	(0.195)	(0.199)	(0.212)	(0.209)
Temperature squared	-0.001	-0.000	0.001	-0.001	0.001	-0.001	-0.000	-0.002	-0.001	0.001
	(0.005)	(0.006)	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
Trust × temperature	-2.537***	-2.627***	-2.478***	-2.571***	-2.339***	-2.112***	-2.187***	-2.255***	-2.540***	-2.128***
	(0.698)	(0.803)	(0.484)	(0.712)	(0.714)	(0.642)	(0.592)	(0.645)	(0.723)	(0.650)
Trust × temperature squared	0.061***	0.065***	0.061***	0.062***	0.056***	0.051***	0.053***	0.054***	0.061***	0.051***
	(0.015)	(0.017)	(0.010)	(0.015)	(0.015)	(0.014)	(0.013)	(0.014)	(0.015)	(0.014)
Trust	23.149***	22.643**	22.062***	23.671***	21.346***	19.239***	20.093***	20.706***	23.186***	19.886***
	(7.821)	(8.728)	(5.218)	(8.044)	(7.910)	(7.084)	(6.539)	(7.049)	(8.077)	(7.127)
Precipitation	-0.176	-0.553	-0.414	-0.162	-0.090	0.018	-0.071	0.047	-0.176	0.101
	(0.546)	(0.573)	(0.553)	(0.528)	(0.561)	(0.573)	(0.598)	(0.560)	(0.546)	(0.596)
Precipitation squared	0.096	0.168	0.161	0.106	0.069	0.047	0.053	0.027	0.096	0.021
	(0.160)	(0.171)	(0.155)	(0.158)	(0.163)	(0.156)	(0.158)	(0.158)	(0.161)	(0.168)

Table A3. (Continued)

Dependent variable: Log asylum applications	(1) Baseline	(2) First instances of applications	(3) Richest EU	(4) Conflicts	(5) Political institutions' quality	(6) Corruption control	(7) Political stability	(8) Regulatory quality	(9) Real GDP	(10) All
Minor conflicts				0.158**						0.097
				(0.067)						(0.078)
Major conflicts				0.311						0.225
				(0.194)						(0.182)
Fatalities				0.218						0.148
				(0.140)						(0.121)
Fatalities squared				-0.016						-0.010
				(0.012)						(0.010)
Political institutions' quality					-0.004					-0.001
					(0.002)					(0.002)
Corruption control						-0.333*				-0.048
						(0.186)				(0.271)
Political stability							-0.317***			-0.216*
							(0.093)			(0.118)
Regulatory quality								-0.273		-0.151
								(0.250)		(0.357)
Real GDP									0.000	0.000
									(0.000)	(0.000)
Constant	7.608***	8.635***	8.277***	7.318***	8.057***	6.993***	7.558***	6.892***	7.602***	7.276***
	(2.579)	(2.780)	(2.264)	(2.597)	(2.561)	(2.540)	(2.441)	(2.460)	(2.568)	(2.420)
Number of observations	780	780	780	780	759	714	714	714	780	709
Number of countries	52	52	52	52	51	51	51	51	52	51
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Column 1 presents the baseline specification from equation (1). Column 2 considers first instances of asylum applications. Column 3 considers applications to the 14 richest EU member countries. All columns include source country, and year fixed effects. Column 4 also controls for the number of minor and major conflicts a country is involved in as well as a quadratic in the fatalities from political violence in thousands. Column 5 controls for the quality of political institutions, column 6 for corruption control, column 7 for political stability, column 8 for regulatory quality, column 9 for real gross domestic product per capita, and column 10 for all the aforementioned covariates at the same time. The sample size is smaller in columns 5 and 10 because of missing data on the quality of political institutions for Palestinian Territory Occupied and Serbia, and in columns 6-8 and 10 because of missing data for year 2001 in the Worldwide Governance Indicator. Heteroskedasticity-consistent standard errors are presented in parentheses. Data refer to the period 2000-2014. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

Table A4. Trust and the temperature-asylum relationship: excluding one country at the time

Country excluded	Trust × temperature		Trust × temperature squared	
	Coefficient	Std. Error	Coefficient	Std. Error
Albania	-2.564***	0.707	0.062***	0.015
Algeria	-2.452***	0.711	0.059***	0.015
Azerbaijan	-2.522***	0.700	0.061***	0.015
Bangladesh	-2.534***	0.695	0.061***	0.014
Armenia	-2.501***	0.689	0.061***	0.014
Bosnia and Herzegovina	-2.551***	0.702	0.062***	0.015
Brazil	-2.542***	0.693	0.061***	0.014
Belarus	-2.558***	0.727	0.062***	0.015
China	-2.454***	0.728	0.059***	0.015
Colombia	-2.601***	0.752	0.062***	0.016
Ecuador	-2.478***	0.716	0.060***	0.015
Ethiopia	-2.535***	0.699	0.061***	0.015
Georgia	-2.532***	0.705	0.061***	0.015
Occupied Palestinian Territory	-2.547***	0.700	0.061***	0.015
Ghana	-2.556***	0.694	0.062***	0.014
Guatemala	-2.560***	0.699	0.062***	0.015
India	-2.542***	0.749	0.061***	0.016
Indonesia	-2.470***	0.688	0.060***	0.014
Islamic Republic of Iran	-2.850***	0.626	0.069***	0.014
Iraq	-2.274**	1.052	0.054*	0.028
Kazakhstan	-2.570***	0.722	0.062***	0.015
Jordan	-2.734***	0.805	0.066***	0.017
Kuwait	-2.442***	0.710	0.059***	0.015
Kyrgyzstan	-4.692***	1.422	0.103***	0.027
Lebanon	-2.535***	0.701	0.061***	0.015
Libya	-2.550***	0.696	0.061***	0.015
Malaysia	-2.552***	0.694	0.061***	0.015
Mali	-2.513***	0.692	0.061***	0.014
Moldova	-2.474***	0.760	0.060***	0.016
Morocco	-2.388***	0.739	0.057***	0.015
Nigeria	-2.545***	0.716	0.061***	0.015
Pakistan	-2.632***	0.667	0.064***	0.014
Peru	-2.498***	0.692	0.061***	0.014
Philippines	-2.401***	0.627	0.059***	0.013
Russian Federation	-2.558***	0.714	0.062***	0.015
Rwanda	-2.419***	0.737	0.058***	0.016

Table A4. (Continued)

Country excluded	Trust × temperature Coefficient	Std. Error	Trust × temperature squared Coefficient	Std. Error
Saudi Arabia	-2.504***	0.691	0.060***	0.015
Serbia	-2.535***	0.697	0.061***	0.015
Vietnam	-2.454***	0.659	0.061***	0.014
South Africa	-2.538***	0.691	0.062***	0.015
Zimbabwe	-2.608***	0.714	0.063***	0.015
Thailand	-2.558***	0.674	0.062***	0.014
Uganda	-2.538***	0.699	0.061***	0.015
Ukraine	-2.528***	0.642	0.062***	0.013
Republic of Macedonia	-2.486***	0.670	0.060***	0.014
Egypt	-2.244***	0.513	0.057***	0.011
United Republic of Tanzania	-2.522***	0.698	0.061***	0.015
Burkina Faso	-2.535***	0.694	0.061***	0.015
Uzbekistan	-2.526***	0.703	0.061***	0.015
Venezuela	-2.620***	0.701	0.063***	0.015
Yemen	-2.592***	0.691	0.062***	0.014
Zambia	-2.548***	0.700	0.061***	0.015

Notes: Heteroskedasticity-consistent standard errors are presented next to the coefficients. Data refer to the period 2000-2014. ***, ** indicate significance at the 1% and 5% level, respectively.

Table A5. Trust and adaptive capacity displaying coefficients for control variables

Dependent variable: Adaptive capacity	(1) Trust	(2) Political institutions' quality	(3) Corruption control	(4) Political stability	(5) Regulatory quality	(6) Real GDP	(7) All
Trust	0.146***	0.141***	0.150***	0.147***	0.152***	0.072***	0.061**
	(0.025)	(0.025)	(0.026)	(0.025)	(0.026)	(0.026)	(0.026)
Political institutions' quality		-0.000**					-0.000**
		(0.000)					(0.000)
Corruption control			0.020**				-0.063***
			(0.009)				(0.012)
Political stability				0.032***			0.027***
				(0.006)			(0.006)
Regulatory quality					0.025***		0.036***
					(0.007)		(0.009)
Real GDP						0.000***	0.000***
						(0.000)	(0.000)
Constant	-0.565***	-0.566***	-0.553***	-0.545***	-0.555***	-0.576***	-0.582***
	(0.018)	(0.018)	(0.019)	(0.018)	(0.018)	(0.017)	(0.019)
Number of observations	765	759	714	714	714	765	709
Number of countries	51	51	51	51	51	51	51

Notes: All specifications include year fixed effects. Column 2 also controls for the quality of political institutions, column 3 for corruption control, column 4 for political stability, column 5 for regulatory quality, column 6 for real gross domestic product per capita, and column 7 for these additional covariates all together. The sample size is smaller because there are no data on adaptive capacity for Palestinian Territory Occupied, and because of missing data on the quality of political institutions for Palestinian Territory Occupied and Serbia, and for year 2001 in the Worldwide Governance Indicator. Heteroskedasticity-consistent standard errors are presented in parentheses. Data refer to the period 2000-2014. ***, ** indicate significance at the 1% and 5% level, respectively.

Table A6. Trust, temperature, and mortality

	Dependent variable: Log age-standardized death rates per 100,000 people
Temperature 25-28°C	0.285***
	(0.056)
Trust × temperature 25-28°C	-1.726***
	(0.357)
Trust	0.064
	(0.280)
Constant	6.739***
	(0.065)
Number of observations	284
Number of countries	23
Year fixed effects	Yes
Country fixed effects	Yes

Notes: Heteroskedasticity-consistent standard errors are presented in parentheses. Data refer to the period 2000-2014. *** indicates significance at the 1% level.