Climate induced international migration and conflicts

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1. Motivation

Human responses to environmental stress induce indirect effects that could be as substantial as the direct ones

One such indirect effect could be the existence of a link between environmentally induced migration and conflicts

- The direct link between temperature/precipitation change and emigration have been researched
- As well as the connection between climate and violent conflicts
- The connection between climate, migration and conflict has been envisaged and discussed, but not adequately tested

1. Motivation

Migration is one the pathways of linking environmental degradation and conflict because of:

- Competition over resources
- Ethnic tensions
- Distrust between the area of origin and the host area
- Demolition of social capital
- Exacerbation of socio-economic fault lines

Reuveny (2007): in 19 out of 38 cases climate induced migration causes conflicts

- the causal link has not been tested (case-studies only)

Ghimire et al. (2015): flood-induced displacement does not cause new conflicts but it fuels existing ones

- not considered the effect of the outflows of displaced persons on conflict in third destination countries

1.

Motivation

Why should we care about the effect environmentally induced migrants? Why should they behave differently with respect to ordinary migrants?

- Environmental change may speed up and intensify the process of out-migration for those with sufficient resources, so that large waves of migrants are not smoothly absorbed in destination countries

1. Motivation

- On the other hand, if lower available resources (due to climate change) may constrain the outflows of people, adverse environmental change may in turn deprive a country of an important safety valve (outflows)

2. Existing Literature: Weather/climate change and Migration

Micro-level studies: drought, flood, high temperature, low precipitation both increase and decrease emigration in different countries

- Henry et al., 2004; Dillon et al., 2011; Gray and Mueller, 2012; Bohra-Mishra et al., 2014; Mueller et al., 2014; Kelley et al., 2015)

Macro-level analyses: generally positive (or null) increase in internal and international migration due to weather change

- Barrios et al., 2006; Marchiori et al., 2011; Cai et al., 2014; Beine and Parsons, 2015)

Macro-level analysis- Cattaneo and Peri (2015): the effect of warming on internal and international migration varies depending on the income level of the origin countries

- Higher temperatures increased emigration rates in middle income countries
- Higher temperatures generate a poverty trap, that lowers the probability to emigrate in poor countries

2. Existing Literature: Weather/climate change and Conflict

Macro level analyses: different statistical assumptions have yielded different results

- Burke et al. (2009), Burke et al. (2010a, b): strong historical linkages between warming temperature and civil war in Africa
- Hsiang et al. (2011): conflicts in tropical regions are more likely during hot and dry El Nino years
- Harari and La Ferrara (2014): negative climate shocks increase conflict incidence
- Buhaug, 2010 and Couttenier and Soubeyran (2013) no effect of climate/weather on civil war

Meta-analysis on quantitative studies: Strong evidence linking climatic events and various conflict outcomes

- Burke et al., 2015; Hsiang and Burke, 2014; Hsiang et al, 2013

Micro-level analyses: statistical significant relationship between weather variables and insurgencies, violence, peasant revolts or political protest

- Dell (2012), Vanden Eynde (2011), Jia (2014), Maddestam et al. (2013)

3. Methodology

Objective: estimate the effect of climate-induced migration on civil conflicts world-wide

- Extremely difficult to identify migrants that have left their homelands soley due to environmental stressors
- Auxiliary first step regression to predict the total emigration flows originated from country *c* due to temperature and precipitation only
- We build a predicted measure of the climate-induced migration flows using the estimated parameters of temperature and precipitation (Peri, 2005 REStat; Burke et al., 2015, Nature)
- We allocate the emigration flows due to climate change to the different possible destinations *j* using observed shares and sum over all the available destinations *j*

3. Methodology

Once the outflows of climate-induced migrants is computed, we include this variable in a conflict equation:

$$C_{j,t} = \mathrm{f}\left(X_{j,t}, G_j, \widehat{Mig}_{j,t}\right)$$

$C_{j,t}$ is a dummy variable equal to one if at least one civil conflict occurred (incidence) or started (onset) in the decade beginning with year t in country j

Conflict= battles with at least 25 deaths in a given year

$X_{j,t}$ is a matrix of time-variant determinants of conflicts

G_j is a matrix of time-invariant determinants of conflicts

$\widehat{Mig}_{j,t}$ is the generated flows of climate-induced migrants

3. Methodology

Drawing from Fearon and Latin (2003), Miguel et al. (2004) and Morelli and Rohner (2015)

$X_{j,t}$ = GDP per capita, population, natural resource abundance, whether a state was recently created, institutional quality

G_j = ethnic fractionalization, non-contiguous state, mountainous terrain

We run pooled cross-country regressions without controlling for fixed effects

- Ethnic fractionalization is not time-varying
- We average controls over ten years
- To address unobserved etherogeneity we cluster standard errors by country and we include regional-fixed effects or region-decade fixed effects (Montalvo and Reynal-Querol, 2008, Esteban et al., 2015)

3. Methodology

Endogeneity concerns because of omitted variables and reverse causality of the variable of interest $\widehat{Mig}_{j,t}$ and

- Correlation between the error term and the flow variable is ≠ 0

2SLS technique

- We compute, as an instrument, bilateral migration flows estimating a gravity model using only geographic characteristics (Frankel and Romer, 1999; Rodriguez and Rodrik, 2001; Rodrik 2004; Peri and Ortega, 2014 and Alesina et al., 2015)
  - very small subset of bilateral geography controls
  - we control for the main pathways between geography and conflicts (geography, disease and institution) as relative bilateral geography variables may be correlated with absolute (unilateral) geography characteristics

4. Data

Temperature and precipitation data are taken from Dell et al. (2012):

- (terrestrial) monthly mean temperature and precipitation data at 0.5X0.5 degree resolution from weather stations, aggregated using **pupulation weights**

Migration data are taken from Ozden et al. (2011)

- bilateral migrant stocks between all countries of the word in the last five available censuses (from 1960 to 2000)

Conflict data are taken from the UCDP/PRIO Armed Conflict Dataset

- Focus on civil conflicts only

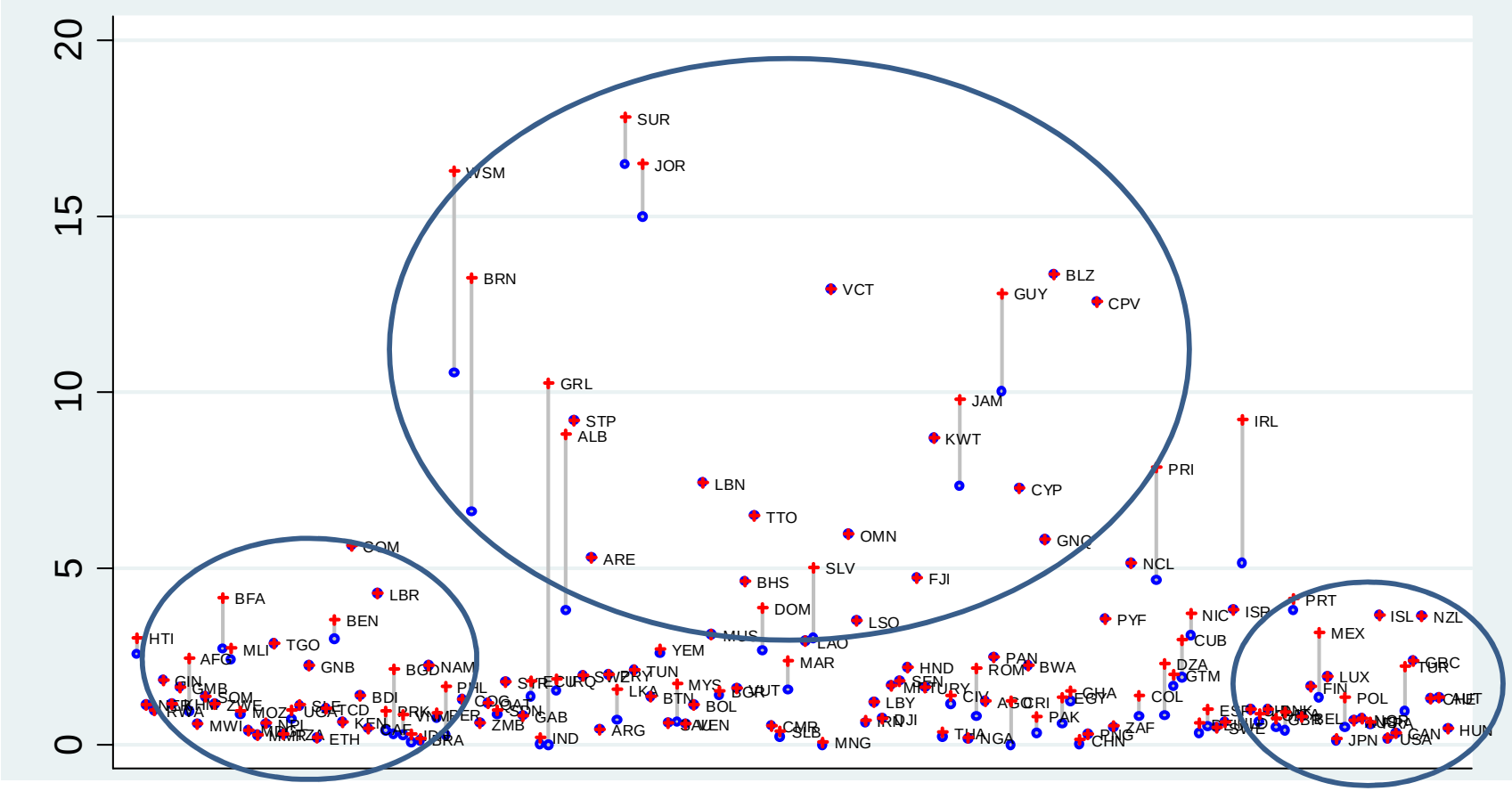
5.

Empirical Results: emigration flows

	(1)	(2)	(3)
	Emigration flows		
Temp*middle income dummy	22.288**	23.018**	30.291**
	(8.752)	(8.864)	(13.448)
Temp squared*middle income dummy	-0.716**	-0.747**	-0.919**
	(0.322)	(0.325)	(0.417)
Temp * poor country dummy	-3.961	-2.967	17.494
	(29.845)	(29.993)	(24.053)
Temp squared* poor country dummy	0.163	0.125	-0.325
	(0.874)	(0.879)	(0.719)
Temp *OECD dummy	-57.044	-59.865	-70.112
	(95.144)	(95.705)	(100.520)
Temp squared* OECD dummy	4.692	4.804	5.159
	(5.740)	(5.755)	(5.878)
Decade FE	No	Yes	No
Decade X Region effects	No	No	Yes
Observations	614	614	614
R-squared	0.097	0.109	0.171

5.

Empirical Results: outflows of climate-migrants



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5. Empirical Results: linear prob model, conflict incidence

	(1)	(2)	(3)	(4)
	Decade FE	Decade, Region FE	Decade X Region	Decade X Region, bootstrap
Climate	0.006	-0.003	0.004	0.004
Migrants	[0.017]	[0.016]	[0.017]	[0.014]
Ethnic diversity	0.275**	0.385***	0.363***	0.363***
	[0.121]	[0.136]	[0.124]	[0.101]
Democracy	0.014	0.071	0.054	0.054
	[0.058]	[0.064]	[0.061]	[0.042]
Anocracy	0.073	0.066	0.069	0.069
	[0.064]	[0.062]	[0.063]	[0.050]
Oil Exporter	0.190**	0.038	0.098	0.098
	[0.073]	[0.081]	[0.075]	[0.068]
New State	-0.137*	-0.134	-0.168	-0.168*
	[0.081]	[0.086]	[0.103]	[0.093]
Non-contiguity	0.08	0.196**	0.146*	0.146**
	[0.087]	[0.091]	[0.087]	[0.065]
Ln(Population)	0.045*	0.060**	0.053**	0.053***
	[0.026]	[0.024]	[0.025]	[0.019]
Ln(GDP)	-0.113***	-0.108***	-0.133***	-0.133***
	[0.036]	[0.040]	[0.038]	[0.026]
Mountain	0.106	0.101	0.081	0.081
	[0.125]	[0.117]	[0.115]	[0.103]
Observations	406	406	406	406

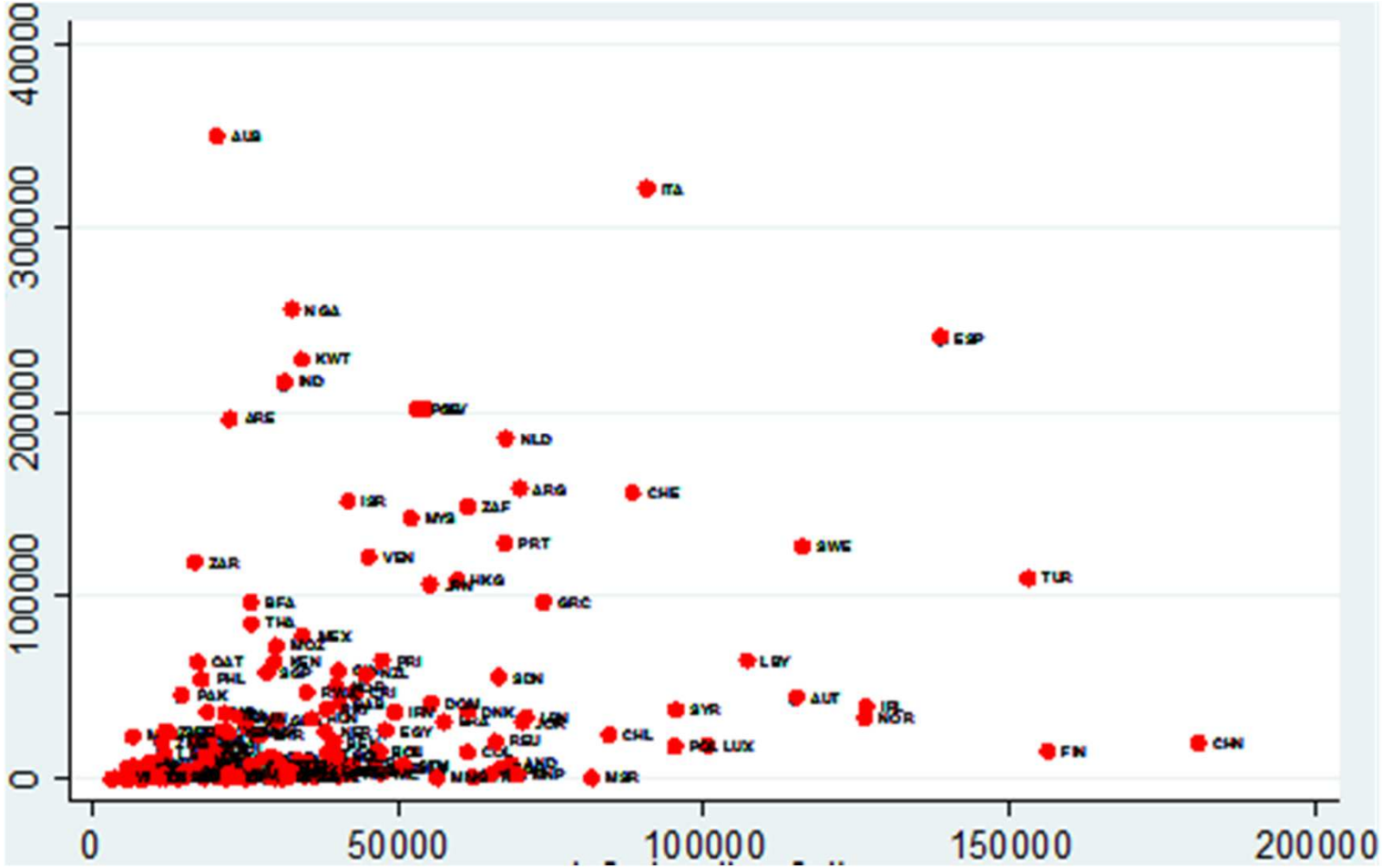
7. Empirical Results: linear prob model, conflict onset

	(1)	(2)	(3)	(4)
	Decade FE	Decade, Region FE	Decade X Region	Decade X Region, bootstrap
Climate	0.017	0.004	0.014	0.014
Migrants	[0.013]	[0.015]	[0.015]	[0.014]
Ethnic diversity	0.284***	0.336***	0.329***	0.329***
	[0.086]	[0.099]	[0.094]	[0.090]
Democracy	0.008	0.07	0.045	0.045
	[0.050]	[0.050]	[0.050]	[0.049]
Anocracy	0.049	0.053	0.052	0.052
	[0.050]	[0.050]	[0.050]	[0.056]
Oil Exporter	0.200***	0.084	0.133**	0.133*
	[0.063]	[0.066]	[0.064]	[0.068]
New State	-0.157**	-0.171**	-0.202***	-0.202**
	[0.062]	[0.067]	[0.071]	[0.084]
Non-contiguity	0.05	0.146**	0.109*	0.109**
	[0.061]	[0.060]	[0.059]	[0.045]
Ln(Population)	0.027	0.043**	0.035*	0.035**
	[0.020]	[0.018]	[0.019]	[0.016]
Ln(GDP)	-0.079***	-0.056**	-0.085***	-0.085**
	[0.028]	[0.028]	[0.027]	[0.034]
Mountain	0.13	0.15	0.123	0.123
	[0.108]	[0.092]	[0.095]	[0.085]
Observations	406	406	406	406

7. Empirical Results: gravity model for climate-induced migration flows

	(1)	(2)	(3)	(4)
	Climate mig		Total mig	
	OLS	PPML	OLS	PPML
ln 1960 pop at destination	0.410***	0.582***	0.391***	0.569***
	(0.014)	(0.040)	(0.010)	(0.045)
Ln distance	-0.952***	-0.856***	-0.921***	-0.948***
	(0.028)	(0.065)	(0.023)	(0.059)
Common Border	-2.692*	-3.505	-2.843**	-5.003**
	(1.521)	(2.935)	(1.270)	(2.439)
Common official language	0.965***	0.718***	0.941***	0.785***
	(0.058)	(0.144)	(0.052)	(0.163)
Colonial Ties	2.336***	1.472***	2.486***	1.504***
	(0.184)	(0.245)	(0.170)	(0.248)
Border* (ln distance)	0.449**	0.959***	0.297	1.220***
	(0.200)	(0.228)	(0.186)	(0.278)
Border* (ln 1960 pop dest)	-0.032	-0.255***	-0.011	-0.057
	(0.100)	(0.088)	(0.089)	(0.162)
Border* landlocked	-0.365*	-0.434*	-0.146	-0.549*
	(0.218)	(0.240)	(0.196)	(0.294)
Border * (ln area origin)	0.015	-0.140	0.083	-0.253
	(0.115)	(0.089)	(0.088)	(0.157)
Border * (ln area destination)	0.179**	0.209	0.185**	0.163
	(0.084)	(0.144)	(0.080)	(0.137)
Agro Ecological Zone difference	0.125***	0.146***	0.127***	0.148***
	(0.005)	(0.014)	(0.004)	(0.022)
Observations	39,908	129,078	50,559	182,328

7. Actual versus predicted inflows of climate-induced migrants



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7. Empirical Results: 2SLS, conflict incidence

	(1)	(2)	(3)	(4)
	Decade FE	Decade, Region FE	Decade X Region FE	Decade X Region, bootstrap
Climate	-0.043	-0.032	-0.028	-0.028
Migrants	[0.055]	[0.074]	[0.065]	[0.094]
Ethnic diversity	0.348**	0.413***	0.399***	0.399***
	[0.139]	[0.142]	[0.133]	[0.149]
Democracy	0.012	0.080	0.057	0.057
	[0.060]	[0.070]	[0.062]	[0.066]
Anocracy	0.076	0.077	0.080	0.080
	[0.064]	[0.068]	[0.066]	[0.069]
Oil Exporter	0.183**	0.030	0.089	0.089
	[0.073]	[0.081]	[0.074]	[0.095]
New State	-0.120	-0.130	-0.161	-0.161
	[0.080]	[0.085]	[0.101]	[0.119]
Non-contiguity	0.088	0.199**	0.151*	0.151*
	[0.087]	[0.089]	[0.085]	[0.088]
Ln(Population)	0.072**	0.076*	0.070*	0.070
	[0.034]	[0.044]	[0.038]	[0.056]
Ln(GDP)	-0.067	-0.083	-0.105*	-0.105
	[0.062]	[0.070]	[0.063]	[0.090]
Mountain	0.064	0.086	0.063	0.063
	[0.137]	[0.124]	[0.120]	[0.150]
F-stat	11.95	7.398	9.777	9.768
Observations	406	406	406	406

7. Empirical Results: 2SLS, conflict onset

	(5)	(6)	(7)	(8)
	Decade FE	Decade, Region FE	Decade X Region FE	Decade X Region, bootstrap
Climate	-0.039	-0.049	-0.026	-0.026
Migrants	[0.043]	[0.063]	[0.052]	[0.068]
Ethnic diversity	0.367***	0.388***	0.373***	0.373***
	[0.102]	[0.107]	[0.101]	[0.126]
Democracy	0.005	0.087	0.048	0.048
	[0.054]	[0.058]	[0.051]	[0.051]
Anocracy	0.052	0.074	0.065	0.065
	[0.052]	[0.054]	[0.052]	[0.057]
Oil Exporter	0.192***	0.070	0.122**	0.122
	[0.061]	[0.064]	[0.061]	[0.076]
New State	-0.138**	-0.164**	-0.194***	-0.194**
	[0.061]	[0.066]	[0.070]	[0.085]
Non-contiguity	0.058	0.152**	0.116**	0.116*
	[0.064]	[0.063]	[0.059]	[0.060]
Ln(Population)	0.057**	0.073**	0.056*	0.056
	[0.027]	[0.037]	[0.031]	[0.041]
Ln(GDP)	-0.026	-0.011	-0.051	-0.051
	[0.045]	[0.056]	[0.046]	[0.064]
Mountain	0.083	0.123	0.101	0.101
	[0.115]	[0.093]	[0.092]	[0.093]
F-stat	12.01	7.362	9.768	9.768
Observations	406	406	406	406

8. Robustness checks: Civil War (battles with at least 1000 deaths in a given year

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Incidence				Onset			
	Decade FE	Decade, Region FE	Decade X Region FE	Decade X Region, bootstrap	Decade FE	Decade, Region FE	Decade X Region FE	Decade X Region, bootstrap
Climate Migrants	-0.032	-0.010	-0.034	-0.034	-0.021	-0.025	-0.027	-0.027
	[0.048]	[0.067]	[0.058]	[0.083]	[0.028]	[0.043]	[0.036]	[0.085]
F-stat	12.01	7.362	9.768	9.768	12.01	7.362	9.768	9.768
Observations	406	406	406	406	406	406	406	406

8. Robustness checks: Civil conflict and Polarization

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Incidence				Onset			
	Decade FE	Decade, Region FE	Decade X Region FE	Decade X Region, bootstrap	Decade FE	Decade, Region FE	Decade X Region FE	Decade X Region, bootstrap
Climate	-0.052	-0.076	-0.050	-0.050	-0.044	-0.088	-0.030	-0.030
Migrants	[0.085]	[0.141]	[0.109]	[0.147]	[0.068]	[0.125]	[0.091]	[0.196]
Ethnic	0.114	0.026	0.069	0.069	0.023	-0.002	0.009	0.009
Polarization	[0.208]	[0.205]	[0.195]	[0.230]	[0.147]	[0.155]	[0.137]	[0.163]
Ethnic	0.273	0.419*	0.371*	0.371	0.330**	0.392**	0.355**	0.355
diversity	[0.216]	[0.229]	[0.219]	[0.277]	[0.156]	[0.175]	[0.161]	[0.236]
F-stat	10.27	4.127	6.548	6.548	10.27	4.127	6.548	6.548
Observations	372	372	372	372	372	372	372	372

8. Robustness checks: Civil conflict and Total migrants

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Incidence				Onset			
	Decade FE	Decade, Region FE	Decade X Region FE	Decade X Region, bootstrap	Decade FE	Decade, Region FE	Decade X Region FE	Decade X Region, bootstrap
Climate Migrants	-0.037 [0.043]	-0.027 [0.052]	-0.034 [0.048]	-0.037 [0.043]	-0.036 [0.035]	-0.037 [0.044]	-0.031 [0.040]	-0.036 [0.035]
F-stat	17.69	12.69	18.12	17.69	17.69	12.69	18.12	17.69
Observations	406	406	406	406	406	406	406	406

8. Robustness checks: geographical-disease controls (Rodriguez and Rodrik (2001)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Incidence				Onset			
	Decade FE	Decade, Region FE	Decade X Region FE	Decade X Region, bootstrap	Decade FE	Decade, Region FE	Decade X Region FE	Decade X Region, bootstrap
Climate	0.038	0.046	0.062	0.062	-0.009	-0.002	0.018	0.018
Migrants	[0.059]	[0.063]	[0.063]	[0.079]	[0.053]	[0.055]	[0.056]	[0.080]
F-stat	10.91	12.86	13.44	13.44	10.91	12.86	13.44	13.44
Observations	392	392	392	392	392	392	392	392

8. Robustness checks: probit

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Incidence				Onset			
	Decade FE	Decade, Region FE	Decade X Region FE	Decade X Region, bootstrap	Decade FE	Decade, Region FE	Decade X Region FE	Decade X Region, bootstrap
Climate Migrants	-0.140 [0.174]	-0.146 [0.250]	-0.131 [0.222]	-0.131 [0.265]	-0.105 [0.159]	-0.173 [0.230]	-0.093 [0.229]	-0.093 [0.309]
Observations	406	406	405	405	406	406	400	400

8. Robustness checks: country fixed effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Incidence				Onset			
	Decade FE	Decade, Region FE	Decade X Region FE	Decade X Region, bootstrap	Decade FE	Decade, Region FE	Decade X Region FE	Decade X Region, bootstrap
Climate Migrants	0.041 [0.052]	0.041 [0.085]	0.009 [0.070]	0.009 [0.097]	0.033 [0.088]	0.033 [0.111]	-0.009 [0.086]	-0.009 [0.129]
F-stat	15.99	35.41	15.99	35.41	15.99	35.41	15.99	35.41
# of countries	117	117	117	117	117	117	117	117
Observations	402	412	402	412	402	412	402	412

9. Conclusions and future research

We find that neither climate-induced migration nor the total flows of conventional migrants influence the incidence or the onset of civil conflicts and wars.

Emigration represents an important opportunity to increase economic well-being and facilitate adaptation to the detrimental consequence of climate change

Emigration should be facilitated through the removal of barriers that hinder this investment rather than constrained

More work is needed to test additional implications of climate-induced migration (i.e. effect on inequality)

More work is needed to understand if the lower ability to emigrate due to liquidity constraint may increase internal risk of conflicts

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