Climate change, international migration and conflicts

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Abstract

Climate change may cause the displacement of many people from the areas affected. The objective of this paper is to empirically estimate the linkages among climate, migration and the risk of civil conflicts in migrant-receiving areas. Using data from 1970 to 2000 and applying a 2SLS approach, we show that climate-induced migrants are not an additional determinant of civil conflicts and civil wars in receiving areas. Conversely we find that lower available resources, due to adverse climate, constrain the outflows of people. By depriving a poor country of an important safety valve (namely the outflows of migrants) this mechanism translates into higher chance of local conflicts.

Key Words: Conflict, Global Warming, Emigration

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1 Introduction

Human migration has been identified as an important response to climate-induced environmental stress. By worsening the living conditions in certain places or even making habitation impossible, environmental stress makes individuals move from one place to another. Migration represents an important factor of adaptation to climate change. However, climate-induced migration may induce indirect effects on resources and populations, generating ripple mechanisms that affect regions located at a great distance from the ones directly hit. Migration might cause new sources of stress in the receiving countries and might become a driver of social unrest. By reducing the availability or intensifying an uneven distribution of water, food and arable land, migration could trigger new conflicts or fuel existing ones. Moreover, ethnic tensions, distrust, demolition of social capital or fault lines are possible channels through which migration might cause conflicts (Reuveny, 2007).

The direct link between climate change and emigration, on the one hand, and between climate change and violent conflicts, on the other, have been both been researched individually. As far as the direct link between climate change and emigration is concerned, Barrios et al. (2006) find that rain shortages increase internal migration from rural to urban areas in Sub-Saharan countries. Marchiori et al (2011) report that temperature and rainfall anomalies affect both internal and international migration in sub-Saharan countries. They also predict that weather anomalies will produce an annual displacement of 11.8 million people by the end of the 21st century. Beine and Parsons (2015) find no statistical significant effect of climate-related factors such as extreme weather events, deviations and anomalies from the long-run averages, on bilateral international migration. Cai et al. (2014) report a positive effect of yearly temperatures on bilateral migration flows directed to OECD countries, while Cattaneo and Peri (2016) find that the positive effect of raising temperature on emigration rates to urban areas and to other countries features only in middle income economies. In very poor countries, instead, higher temperatures reduced the probability of emigration to cities or to other countries, consistently with the presence of liquidity constraints.

Regarding the second nexus, namely between climate and violent conflicts, Miguel et al (2004) is the first paper that includes rainfall-driven economic shocks in a conflict estimation for sub-Saharan countries. Ciccone (2011) and Ciccone (2013) have reconsidered the link between rainfall and conflict, in that the mean reverting properties of rainfall have been taken into account. Different statistical assumptions have yielded different results: Burke et al. (2009) and Burke et al. (2010a, b) find a strong link between civil war and temperature in Africa if one controls for country fixed effects and country-specific time trends only. Hsiang et al. (2011) report that conflicts are more likely during hot and dry El Nino years than during cooler La Nina years. Harari and La Ferrara (2014) find that climate shocks increase conflicts in a geographically disaggregated analysis. The units of observations in this analysis are 110 X 110 km subnational cells. On the contrary, Buhaug (2010) finds that in African countries climate variability is poorly related to armed conflict, whereas African civil wars is explained by ethno-political exclusion and low GDP. Couttenier and Soubeyran (2013) report that if one accounts for yearly common world-wide changes by including year fixed effect, the link between climate and civil war vanishes. Conducting a meta-analysis on quantitative studies Hsiang et al (2013) conclude that warming is associated with an increase in both the rate of interpersonal conflict and the rate of intergroup conflict.

The possibility that climate, migration and conflict are connected to one another has been envisaged and discussed, but only with a qualitative approach and the causal link has not been adequately tested (Withagen, 2014). Some of the above statistical studies find that natural disasters bring higher conflicts, but don't explore the specific channels through which this relationship emerges. A sudden and mass influx of displaced people can be one of these channels, in particular when poor economic conditions and weak institutions characterize the receiving regions. Ghimire et al. (2015) is the only paper that analyses the link between climate human displacement and civil conflict. The authors find that the displacement of people consequently to floods is not a cause of new conflicts, rather it fuels existing ones. The paper however only focuses on flood-induced displacement. It is well known however that other events, such as gradual changes in temperature, droughts, changing patterns of precipitations or extreme hits can influence migration and consequently conflicts. Moreover, the paper considers only internally displaced people and does not consider the effect of the outflows of displaced persons on conflict in third destination countries.

All migration flows, regardless of their drivers, could present some risks to security. Competition over resources, ethnic tensions and distrust are sources of tension due to both environmentally induced migration and ordinary migration. However, the scope and speed of the two types of migration could differ. Environmental change may speed up and intensify the process of out-migration. Larger and faster waves of migrants might be generated and not smoothly absorbed in destination countries, making conflicts more likely.

An opposite mechanism could be in place as well. The migration strategy is not available to all individuals affected by climate change. Changes in temperature and precipitation may have a depressing effect on the emigration chances of some groups of people, for example the poorest. Given that lower available resources may constrain the outflows of the poorest people, environmental shocks may in turn deprive a country of an important safety valve (outflows) and this could translate into local conflicts.

This paper estimates the linkages among climate, migration and the risk of civil conflicts using a macro-level empirical approach. The objective of the paper is two-fold.

First it analyses whether variations in temperature and precipitation have an impact on conflicts in migrant-receiving areas, through the migration channel. Second, the paper also tests if the lack of emigration resulting from lower resources due to climate change increases the risks of civil conflicts in poor countries of origin. The rest of the paper is organized as follows. Section 2 describes the methodology. Section 3 presents a description of the data and variables. Section 4 presents the main empirical specifications and the main estimates of the effects. Section 5 shows the results when we deal with "climate-induced lack of emigration" . Section 6 concludes the paper.

2 Methodology

The aim of the paper is to estimate the indirect impacts of climate stress on conflicts through migration. In order to test this relationship, namely the link between climate-induced migration and conflicts in destination countries, we need a measure for climate migrants. This data is however not available, as the reasons for migrating are not generally collected in censuses, which are the sources of the migration data. It is extremely difficult to identify migrants that have left their homelands solely due to environmental stressors. To address this type of nexus and given the potential endogeneity of the migration flow variable in an OLS estimate, we exploit the statistical property of an instrumental variable approach. The endogeneity of migration flows could arise because of reverse causality. Countries experiencing a civil conflict or a civil war are less attractive as a destination for migration. To address this concern, we employ a 2SLS. As pointed out in Angrist and Pischke (2009), and summarized in Wooldridge (2010), the 2SLS estimator consistently estimates a local average treatment effect (LATE), which is the average effects for the sub-population that is affected by the instrument. This sub-population is defined as compliers. We are therefore able to identify the average effects on conflicts for those immigrants that are induced by temperature and precipitation change.

To construct an instrument for the migration flows we draw from the trade literature. Frankel and Romer (1999) and subsequently Rodriguez and Rodrik (2001) and Rodrik (2004), compute an instrument for trade/migration flows by estimating a bilateral trade/migration model using only geographic and climatic characteristics as controls. This method is now standard also in the migration literature (Peri and Ortega, 2014; Alesina et al. 2015; Docquier et al., 2016). To mitigate a possible violation of the exclusion restriction that could arise, two strategies have been employed. First, the gravity model for migration flows from country i to destination j is estimated using only a very small subset of controls. Only (geography and climate) bilateral controls are added. In particular, we estimate the bilateral gravity equation adding bilateral distance, common border, common official language, common colonial history. We also add bilateral climatic variables, such as temperature and precipitation differences between origin country i and destination country j.

Second, following Peri and Ortega (2014), we take seriously the criticism raised by Rodriguez and Rodrik (2001) in the context of international trade in that relative bilateral variables may be correlated with absolute (unilateral) characteristics, invalidating the exclusion restriction. For this reason we include in the second stage specification a set of variables that should control for the main pathways between geography-climate and conflicts. Once we have estimated the gravity migration regression, we construct the instrument for migration flows by aggregating the predicted flows from the bilateral migration equation across destination j as in Frankel and Romer (1999).

3 Data and Summary statistics

The migration data are taken from Ozden et al. (2011), which give bilateral migration stocks between 226 origin and destination countries for the last five censuses rounds, 1960-2000. Drawing from the bilateral data, we compute net emigration flows as differences between stocks in two consecutive Censuses.

Temperature and precipitation data are taken from Dell et al. (2012). The authors aggregate worldwide (terrestrial) monthly mean temperature and precipitation data at 0.5 X 0.5 degree resolution obtained from weather stations (Terrestrial Air Temperature and Precipitation: 1900–2006 Gridded Monthly Time Series, Version 1.01, Matsuura and Willmott 2007) using as weights 1990 population at 30 arc second resolution from the Global Rural-Urban Mapping Project (Balk et al. 2004).

As far as conflict is concerned, we take the data from the UCDP/PRIO Armed Conflict Dataset, which is the most widely used source of conflict data at the country level. The dataset offers a yearly binary indicator of the existence of a conflict in a specific country, based on the number of deaths per year. This variable focuses only on civil conflicts, which are coded under the categories 3 and 4 of the PRIO database.

4 Empirical specification and results

We estimate the following empirical specification over the period 1970-2000:

$$C_{jt} = \alpha + \theta lnMig_{jt} + \mathbf{X}'_{\mathbf{jt}}\beta + \mathbf{G}'_{j}\gamma + \phi_{rt} + \pi_t + \varepsilon_{jt} \quad (1)$$

Given that the flows of migrants are available on at decade level, C_{jt} is a dummy variable, equal to one if at least one civil conflict occurred in the decade beginning with decade $t = (1970, 1980, 1990)$ and recipient country j, and zero otherwise. This variable captures the incidence of a civil conflict. Alternatively, it is equal to one if at least one civil conflict started in the decade t in country j. In this case the variable measures the onset of a civil conflict. The onset specification answers to the question of what makes a "fresh" episode of violence breaks out, while the incidence specification captures the total intensity of a conflict. In our baseline specification, civil conflicts refer to battles with at least 25 deaths in a given year. In a robustness check we will use the alternative threshold based on 1000 or more deaths per year. In this case, the dependent variable measures civil wars.

$lnMig_{jt}$ is the natural logarithm of the total inflows of migrants in country j, computed summing all net bilateral flows for the same destination countries. Alternatively we compute immigration rates, as the ratio between the aggregate net flows of immigrants in the decade, relative to the destination country population at the beginning of the decade.

Drawing from Cederman and Girardin (2007), Collier and Hoeffler (2004), Collier and Rohner (2008), Esteban et al. (2012), Fearon and Laitin (2003), Montalvo and Reynal-Querol (2005) and Morelli and Rohner (2015), we use a standard battery of controls, which are time variant (X_{jt}) and time-invariant (G_j). The former include the natural logarithm of GDP per capita, the natural logarithm of population and natural resource abundance, which identifies countries where fuel exports exceed one third of merchandise exports. We control for whether a state was recently created, marking countries in the first ten years of independence and for non-contiguous states. We add a control for peace duration and agriculture value added share. We also control for institutional quality, using the Polity-2 score from the Polity IV database. The score, which ranges from -10 to +10, has been converted to capture democratic regimes. These are situations where score is above 6. Among time-invariant variables we add an index of ethnic fractionalization, a control for mountainous terrain, which measures the percentage of territory covered by mountains. We add a control for the presence of yellow fever, absolute latitude, percent of land in the tropics, percent of population from within 100 km from ice-free coast and percent of population with malaria. We include region-decade fixed effects (ϕ_{rt}), decade fixed effects (π_t) and cluster standard errors by country.

All controls are averaged over a time period of 10 years of the decade t. In an alternative specification, we measure the controls in the year starting decade t.[1]

The existing empirical literature mainly runs pooled panel without controlling for country fixed effects (among others Esteban et al., 2015, Montalvo and Reynal-Querol). This is done because an important determinant of civil conflicts, namely ethnic fractionalization, is not a time-varying measure. For comparability with most papers in the existing literature, in some specifications we follow the same approach and estimate a pooled cross-section as in 1. In alternative specifications we fully exploit the panel dimension of the data and add country fixed effects:

[1]Esteban et al. (2012) estimate a similar sub-period specification using 5-year intervals. Controls are measured in the first year of each period.

$$C_{jt} = \theta lnMig_{jt} + \mathbf{X}_{\mathbf{jt}}^{'}\beta + \phi_{rt} + \nu_j + \pi_t + \varepsilon_{jt} \tag{2}$$

This is done to address concerns of unobserved heterogeneity between countries leading to over-stated significance levels.

Our measure of civil war is a binary variable. We run a linear probability model, in alternative to a probit or a logit model, because the linear probability model is a convenient approximation to the underlying response probability (Woldridge, 2002) and it allows for clustered standard errors in the presence of country fixed effects. Moreover, as discussed above, to consistently estimate equation1, we need to apply an instrumental variable approach because of potential endogeneity of the migration flow variable. In this respect, the use of a linear probability model with instrumental variable (2SLS) is typically preferred to a non-linear instrumental variable procedure, even in case of dichotomous dependent variable in the second stage, because of strong specification assumptions required in the non-linear estimation (Angrist and Kreuger, 2001; Wooldridge, XXX). The linear probability model with instrumental variable provides a good estimate of the average effect.

Following Frankel and Romer (1999) and Feyrer (2009) in a panel context, we compute as instrument for the inflows of migrants, a predictor for bilateral migration estimating the following bilateral gravity equation:

$$lnM_{cjt} = \delta lnD_{cj} + \gamma B_{cj} + \psi L_{cj} + \theta C_{cj} + \vartheta dTEMP_{cjt} + \xi dRAIN_{cjt} + \pi_t + \omega_c + \chi_{ct} + \varepsilon_{cjt} \tag{3}$$

In agreement with the migration bilateral literature (Anderson, 2011; Beine et al., 2015; Beine et al., 2011; Bertoli and Fernández-Huertas Moraga, 2013) the dependent variable lnM_{cjt} is the natural logarithm of the flows of migrants from country c to destination j in decade beginning with year $t = (1970, 1980, 1990)$. As controls we take only a small subset of bilateral controls to avoid a violation of the exclusion restriction in the instrumental variable model. We use the natural logarithm of bilateral (geodesic) distance (D_{cj}), common border (B_{cj}), common official language (L_{cj}), common colonial history (C_{cj}). We also add time-varying bilateral climatic variables, such as temperature ($dTEMP_{cjt}$) and precipitation ($dRAIN_{cjt}$) differences between origin country c and destination country j. Temperature and precipitation are averaged over the 10 years of the decade t.

We add a vector of origin-time fixed effects (χ_{ct}) to account for multilateral resistance (Anderson and Van Wincoop, 2003; Ortega and Peri, 2013) that arises from time varying common origin shocks to migration which influence migrants' locations decisions. Decade effects (π_t) and origin fixed effects (θ_c) are also included.

Once we have estimated the gravity migration regression, we construct the instrument for the inflows of migrants by aggregating the predicted flows from the bilateral migration equation across destination j.

Standard errors are clustered by origin-destination country pairs. We run both a OLS and a Poisson regression by pseudo-maximum likelihood estimator (PPML). PPML addresses important heteroskedasticity and selection bias issues due to the large number of zeroes in bilateral migration flows (Santos Silva and Tenreyro, 2006).

Table 2 reports the estimated parameters of a OLS (column 1) and PPML (column 2) gravity models. The point estimates are qualitatively comparable across the PPML and OLS models and have the expected signs. Bilateral distance has a strong and negative statistically significant coefficient, while sharing a common border, a common language and a common colonial past are associated with larger migration flows. Differences in temperature between origin and destination boost emigration, indicating that migrants select on average destinations with lower temperature than the origin. In the PPML specification however, the coefficient turns no statistically significant if the origin country is a poor economy. Differences in precipitation as well increase emigration, but only if the origin country is a middle income or poor country.

We obtain the instruments for migration using the predicted bilateral flows of migrants from our gravity models and by aggregating over destinations. Figure 1 and 2 display the relationship between actual flows and predicted climate-migrants in a scatter plot. Both plots show a quite large correlation between the two figures. We use this gravity-based predicted immigration flows to instrument the endogenous inflow of migrants in our first stage regression.

The validity of the 2SLS estimations rests on the assumption that the relative bilateral controls employed in the gravity equation are not correlated with the error term ε in the conflict equations 1and 2.This instrumental variable approach could be criticized if bilateral geography/climate variables are correlated with absolute (unilateral) variables. Unilateral geography/climate variables influence conflicts through other channels than migration, thus invalidating the exclusion restriction. To address this concern, Rodriguez and Rodrik (2001) suggest to add into the second-stage baseline model a very broad set of variables that should capture the main pathways between geography-climate and the variable of interest.

One potential pathway between climate and conflict is represented by agriculture. For this reason the share of agriculture value added is added. Another possible pathway is represented by the type of a country institution, as far as geography influences the quality of an institution and this strongly influences the probability that a conflict occurs. We account for this channel adding the democracy variable. Finally we add controls for the presence of yellow fever, absolute latitude, mean elevation above the sea level, average distance to the coast, percent of land in the tropics, percent of population from within 100 km from ice-free coast, percent of population with malaria in 1994 and a landlocked dummy to capture potential pathways between geography and conflict. Given that proxies for deep geography characteristics and disease environment are time-invariant, the use of country fixed effects in some specification allows us to bypass these controls and limit the scope for omitted variable bias.

Table 3 shows the first-stage of the endogenous variable on the included instrument and the set of controls of the second stage. Column (1) uses the gravity-based immigration flows predicted by a OLS model, while column (2) uses the inflows predicted by the PPML model. The model which uses as instrument the flows predicted by the OLS performs better than the one predicted through PPML, as indicated by the tests for weak instruments. In column (1) the statistic exceeds the Stock and Yogo (2005) critical value, while in column (2) the statistic is well below. For this reason, we will employ as instrument the inflows predicted by the OLS model.

Table 4 provides the 2SLS estimated coefficients of equation 1 for the incidence of conflicts. In this specification with test the drivers of the intensity of a conflict, represented by battles with less than 25 deaths. Column (1) displays results of a specification which includes the variable of interest, which is the inflows of migrants and restricts to the standard controls for conflicts. Column (2) adds agriculture valued added. From column (3) and (7) we follow the literature on the geographical determinants of conflict and add sequentially controls for geography characteristics and disease environment. Column (8) add all additional controls jointly. With this approach we aim to test the stability of our main coefficient of interest to the inclusion of geography/climate conflicts.

We run a pooled 2SLS with decade fixed effects and interaction between decade and region fixed effects to control for regional factors of variation in economic conditions over time are added.

The estimated parameters of the total inflows of migrants are not statistically different from zero, indicating that those people migrating for climate-related reasons, do not represent a driver of conflict in destination countries. This null effect is robust to the different specifications, as all subsequent model expansions do not substantially affect our coefficient estimates.

The coefficients of the other controls are in agreement with the main findings of the existing literature. GDP per capita has a negative effect on conflict, though the coefficient is statistically significant in few specifications. More economically developed countries have lower rates of conflicts, because of cultural reasons, because of rural societies more penetrated by central administrations, and because these states have greater financial, administrative and military capabilities. Moreover, for poor people the opportunity costs of joining a guerrilla is lower. Larger population should make it more difficult to control who is doing what at the local level and increases the number of potential rebels that can be recruited by the insurgents. The present analysis does not confirm this hypothesis, as the coefficient of population is not statistically significant, albeit positive. The persistence of peace decreases the risk of civil conflict as indicated by the negative and statistically significant coefficient of the number of years since last civil conflict incidence. An additional year of peace increases the risk of civil conflict incidence by 3 percentage points, on average and *ceteris paribus*.

The coefficient of new state is negative and statistically significant. Being a state that recently gained independence reduces the incidence of civil conflict incidence. We find support to the hypothesis that the existence of natural obstacles, like water, a frontier or long distances between the territorial base and the state's centre, favours the insurgence of a conflict. Being a non-contiguous state increases the risks of civil conflict by up to 11 percentage points.

Collier and Hoeffler (2002) point out that natural resource abundance provides an opportunity for rebellion since these resources can be used to finance the war and increase the payoff in case of victory. Moreover, oil producers tend to have a weaker state apparatuses. The present data does not support these hypothesis as the coefficient is statistically not significant.

The coefficient of mountainous terrain is positive and statistically significant, indicating that countries with a large percentage of territory covered by mountains have higher chances to have an ongoing conflict. Mountains represents an opportunity for the insurgence of a conflict, since this terrain can favour the rebels.

Countries with larger shares in agriculture value added are more at risk of civil conflict, providing support to the existence of a link between climate and conflicts.

As far as the controls related to geography and disease environment are concerned, only the variables yellow fever and coastal population exert a significant effect on conflict.

Table 5 presents the estimated parameters for conflict onset. This specification shows what makes a "fresh" episode of violence start. The coefficients are almost invariant with respect to the conflict incidence specification and the variable climate-induced migrants has a non-statistically significant coefficient also in the onset specification. The coefficient of ethnic fractionalization is positive and turned statistically significant in one specification, indicating that highly fractionalised societies are more at risk of conflict onset (Esteban et al., 2012; Morelli and Rhoner, 2015).[2]

Table 6 provides the estimated coefficients of equation 2, which adds country fixed effects in the goal of addressing omitted variable bias and unobserved heterogeneity. The null effect of climate-migrants is robust to this specification. In this specification, time invariant controls such as ethnic diversity and controls for geography and disease environment are absorbed in the country fixed effects. The corresponding first stage results are presented in column (3) of Table 3. As before, when we employ as instrument the inflows predicted by the OLS gravity model we reject the null hypothesis of weak instrument.

[2]The variable ethnic fragmentation is time invariant and should not be influenced by the inflows of migrants.

It could be that what burdens the resource of receiving areas or produces ethnic tension and distrust is the number of inflows relative to the destination country population rather than the total inflows. In this respect we replace the total inflows of migrants with the immigration rate, which is the total inflows divided by the destination country population. Table 7 shows the estimates of climate migrants per capita in both the conflict incidence and onset specifications. A null effect emerges, no matter if we estimate a pooled cross section or we add country fixed effects.

Tables 8 considers a different threshold to record the existence of a battle. The above analysis considers civil conflicts with 25 or more battle deaths in a year. This low threshold ensures that even small and intermediate conflict events are captured. However, for robustness check and in agreement with some of the existing literature, we use alternative definitions. We increase the minimum threshold to 1000 or more battle deaths in a year, to capture the onset/existence of a war. Major conflicts such as wars are of particular relevance, because of their critical damaging consequences. The coefficients of climate migrants and climate migrants per capita are not statistically significant either in the civil war incidence or in the civil war onset specifications.

The importance of ethnic diversity as a driver of civil conflict has been largely recognized on a theoretical ground. However, support to this hypothesis has been weak empirically, insofar as many papers find no statistically significant relationship between ethnic fractionalization and conflict. Some authors have argued that the link could be non-linear, as both highly homogeneous and highly heterogeneous societies may be characterized by low tension and violence. If this is so, an index of polarization rather than fragmentation could be more correlated to conflicts (Montalvo and Reynal-Querol, 2005). Esteban et al. (2012), drawing on Esteban and ray (2011) emphasize that conflict intensity is connected to different measures of ethnic distribution, which include both ethnic diversity and ethnic polarization. For this reason, as a robustness check, we add to the pooled cross section specification 1 a measure of ethnic polarization along with ethnic fragmentation. The coefficients of climate migrants and climate migrants per capita are robust to the inclusion of ethnic polarization (Table 9). The coefficient of ethnic fragmentation remains positive and statistically significant in the onset specifications. On the contrary, the coefficient of ethnic polarization is not statistically significant.

Given that the control of interest is available on a decade basis, the time for the estimations is divided into 10-year sub-periods. In the baseline specifications, we averaged all controls over the 10-year sub-periods. As a robustness check, we follow Esteban et al. (2012) and measure the controls in the first year of each period. The coefficients of both measures of climate-migrants are not affected by this alternative specification (Table 10).

In table 11 we conduct a robustness check using an alternative estimation strategy. We employ a non-linear instrumental variable procedure using a pooled IV probit model. The coefficients of both the inflows of migrants and the immigration rates remain statistically non-significant.

5 Climate-induced lack of emigration

In this section we will analyse if the climate-induced lack of emigration could represent a source of internal conflict in the origin countries. Cattaneo and Peri (2016) predict in a simple two-period model in the spirit of Roy-Borjas (Roy, 1951; Borjas,1987), and confirm empirically that, by impoverishing the rural population and worsening their income perspectives, long-term warming may affect migration in different ways, depending on the availability of resources to finance emigration of those rural populations. Individuals from rural communities in poor countries are near subsistence, so a lower income worsens their liquidity constraint, implying a reduced ability to pay migration costs. In this case, global warming traps very poor rural workers, making them unable to migrate. To the contrary, in countries in which individuals are not extremely poor, a decline in agricultural income may provide incentives to migrate abroad. Global warming, by decreasing agricultural productivity, stimulates international migration from middle income countries.

In rich origin countries we may expect a null effect of null effect of climate on emigration because the main pathways between climate and migration is represented by agricultural income, which is important in poor and middle-income countries, and less important in rich countries. As in rich countries, agriculture represents only a small source of income and the rural population is a small percentage of the total, the impact of temperature on these countries should be negligible.

If lower available resources because of climate change may constrain the outflows of the people from poor countries, temperature and precipitation changes may in turn deprive a country of an important safety valve, and this missed outflows could translate into local conflicts for scarce resources.

To test this hypothesis we first estimate a bilateral gravity equation with temperature and precipitation of the origin countries as controls. We then compute counterfactual predictions of migration flows from poor countries, assuming that the effect of temperature and precipitation in poor countries were the same as in middle income countries. We then add these counterfactual predictions in a conflict equation as in 1and 2. In the bilateral gravity equation we allow different estimated parameters of temperature and precipitation depending on the level of income of origin countries as follows:

$$lnM_{cjt} = \alpha + \beta_1 T_{ct} D_R + \beta_2 T_{ct} D_M + \beta_3 T_{ct} D_P + \delta_1 R_{ct} D_R +$$

$$+ \delta_2 R_{ct} D_M + \delta_3 R_{ct} D_P + \mathbf{G}'_{cj} \gamma + \theta_c t + \theta_{c2} t^2 + \mu_c + \upsilon_j + \nu_t + \varepsilon_{cjt} \quad (4)$$

where $lnM_{cjt\,cjt}$ is flow of migrants from country c to destination j in decade beginning with year t (= 1960, 1970, 1980, 1990). T_{ct} is temperature of the origin country, R_{ct} is precipitation of the origin country, D_R, $D_M$and $D_P$are dummies for a country being rich, middle income or poor, respectively. Given that the Organization for Economic Cooperation and Development (OECD) is usually considered as the club of developed countries, we equate OECD to rich countries. We use the World Bank classification (World Bank, 2015) to distinguish between poor and middle income. We include the term $\mu_c$to capture time-invariant factors that influence the origin countries' average emigration rates and υ_j to capture destination countries pull factors. ν_t is a decade fixed effect to absorb factors of variation in economic conditions over time. We finally add flexible country-specific time trends and their squared ($\theta_c t + \theta_{c2} t^2$) which capture slowly changing factors within a country. These terms allow migration flows to vary non-linearly over time, as in Burke at al. (2015).

We do not add traditional determinants of migration such as income, population size, sociopolitical environment for two reasons. First, because these controls are themselves an outcome of climatic events. The inclusion of these additional controls above the inclusion of temperature and precipitation would produce an over-controlling problem.[3] We only add a set of bilateral geographic controls (G_{cj}) which are independent from climate at origin. These are the natural logarithm of bilateral (geodesic) distance, common border, common official language, common colonial history and difference in agro-ecological zoning between origin and destination. Second, the use of flexible time-invariant and time-varying terms in place of observed variables allows us to account for both observed and unobserved controls, it is robust to mismeasurement of controls, and it allows these controls to differentially influence different countries. These time-varying terms also account for multilateral resistance, that arises from time varying common origin shocks to migration which influence migrants' locations decisions (Anderson and Van Wincoop, 2003; Ortega and Peri, 2013).[4]

Temperature and precipitation are averaged over the 10 years of the decade t. Standard errors are clustered by origin-destination country pairs. We run a Poisson regression by pseudo-maximum likelihood estimator (PPML) to address important heteroskedasticity and selection bias issues due to the large number of zeroes in bilateral migration flows (Santos Silva and Tenreyro, 2006).

Table 12, column (1) shows the estimated parameters for the bilateral gravity equation and confirms that warming temperature in middle-income economies increases international migration while in poor countries it has a null effect on emigration flows. The predicted effect of climate on migration flows in the different countries of origin (Ψ_{cjt}) can

[3]This issue is discussed in detail in Dell et al. (2014)

[4]Ortega and Peri (2013) shows that bilateral migration rates depend on the opportunities to migrate to other countries, namely multilateral resistance to migration, when the assumption of independence of irrelevant alternatives does not hold in the individual migration choices. They also show that one can control for such multilateral resistance to migration by including a time-varying origin country term.

be calculate as:

$$\Psi_{cjt} = \begin{cases} \beta_1 T^R_{ct} + & \delta_1 R^R_{ct} \\ \beta_2 T^M_{ct} + & \delta_2 R^M_{ct} \\ \beta_3 T^P_{ct} + & \delta_3 R^P_{ct} \end{cases} \quad (5)$$

for rich, middle income and poor countries, respectively.

We compute counterfactual migration flows from poor countries due to warming and precipitation as if the coefficient of temperature and precipitation in poor countries were the same as in middle income countries:

$$\widetilde{\Psi}^P_{cjt} = \beta_2 T^P_{ct} + \delta_2 R^P_{ct} \quad (6)$$

We then sum over all the available destinations j :

$$\widetilde{\Psi}^p_{ct} = \sum \widetilde{\Psi}^P_{cjt} \quad (7)$$

We finally compute the missed flows for poor countries as the difference between the counterfactual and the predicted migration flows due to climate. We finally include these counterfactual missed flows in a conflict equation for the country of origin c.

Tables 13 and 14 present the estimated coefficients for the incidence and onset of civil conflict, respectively, for a panel of 28 poor countries which face climate-induced lack of emigration.[5] We use both the natural logarithm of the total missed flows and of the missed flow rate, which is equal the total missed flows divided by the origin population at the beginning of the decade. We run both a pooled cross section and a panel estimation adding country fixed effects. Standard errors are clustered by country. It should be noted that the counterfactual missed flows are a generated regressor (Pagan, 1984). Inference in case of generated regressors is problematic as the sampling variation of the vector of parameters of the first step estimation is unknown. To address this problem, we also employ bootstrapped standard errors.

Interestingly the estimated parameter of the missed flows variable is positive and statistically significant at 10 percent level in both the incidence and onset specifications when country fixed effects are added (columns 3 and 4). These are our preferred specifications as the inclusion of country fixed effects allow to address unobserved heterogeneity between countries. The point estimates indicate that a one percent increase in the missed flows of migrants due to warming and precipitation change increases the risk of conflict incidence by 13 percentage points and the risk of conflict onset by 20 percentage points.

As robustness check we compute the number of missed flows from a gravity equation that includes country of destination time trends. This alternative specification of the

[5]The variables oil exporter and non-contiguity have been dropped because they are always equal to zero in the constrained sample of poor countries.

bilateral gravity equation is reported in column (2) of table 12. The estimated parameters are very similar to the one presented in column (1), which include country of destination fixed effects and confirm a positive effect of warming migration flows only in middle income countries. The conflict estimations with the corresponding missed flow variable is presented in table 15 and 16. The coefficients are very similar to the one presented above, although turned statistically insignificant in the incidence specification.

International migration is a costly investment and subsistence level farmers in poor countries may find it hard to have access to international migration. It could be the case that warming temperature depresses international migration, but people substitute away from international costly migration in favour of cheaper and less risky internal migration. If this is the case, then the predicted missed flows overestimate the true missed number. However, first Cattaneo and Peri (2016) find that warming temperature not only reduces emigration rates to third countries, but it leads to lower urbanization rates in poor countries. Recent research emphasizes that during the most recent decades the largest part (around two-thirds) of the change in urbanization rates in developing countries is driven by rural–urban migration, while the rest may be due to differential population growth. This evidence may ensure that a switch from international migration to internal migration does not occur because of climate change. Second, even in a presence of a substitution between the two types of migration, the hypothesis that climate change may deprive a poor country of an important safety valve, represented by the flows out of the country, is still valid.

6 Summary and conclusion

Human migration has been identified as an important response to climate stress. Indirect impacts of climate change through migration could be as substantial as the direct ones, but so far these indirect effects have been noted only in a qualitative sense. One such indirect effect could be a link between climate induced migration and conflicts. Competition over resources, ethnic tensions, distrust, demolition of social capital, crossing of fault lines have been identifies as possible bridging factors between conflicts and climate-induced migration.

In this paper we have tested the possibility that climate change through migration could cause new conflicts or fuel existing ones. A macro level empirical estimation is conducted to provide an answer to this question. Given that data on climate-migrants is not available, we exploit the statistical property of an instrumental variable approach. Migration flows are an endogenous regressor with respect to conflicts. We therefore apply a similar framework as in Frankel and Romer in the context of trade and growth and identify the average effects on conflicts for those immigrants that are induced by temperature and precipitation change. The paper finds no statistically significant effect of climate migrants on conflicts. The result is robust to alternative specifications, to alternative definitions of conflicts, whether onset or incidence and to different thresholds based on the number of deaths. Conversely we find higher chances of civil conflicts in countries where climate constrain emigration. 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.

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Tables and Figures

Figure 1: Observed and predicted inflows of migrants (OLS)

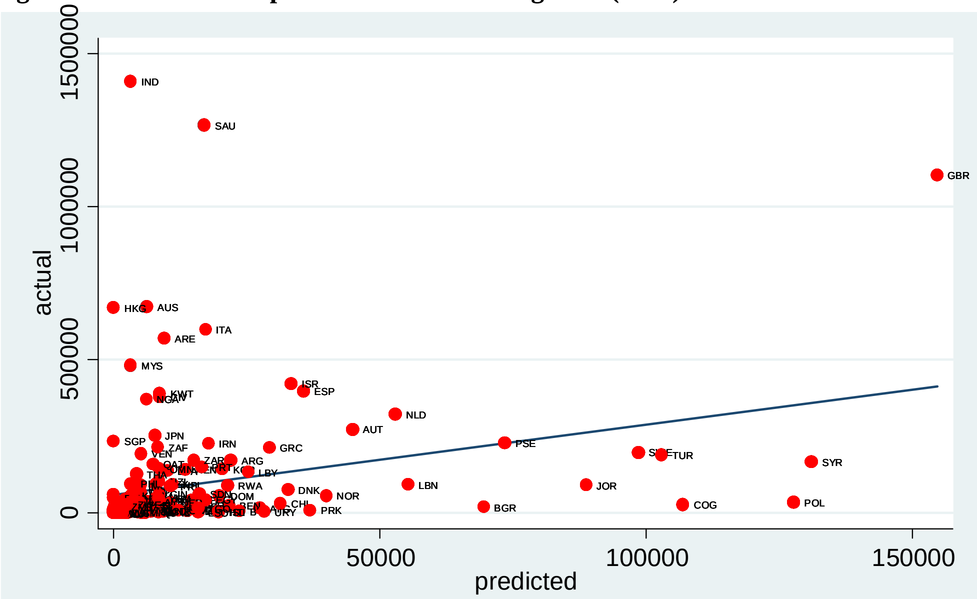

Figure 2: Observed and predicted inflows of migrants (PPML)

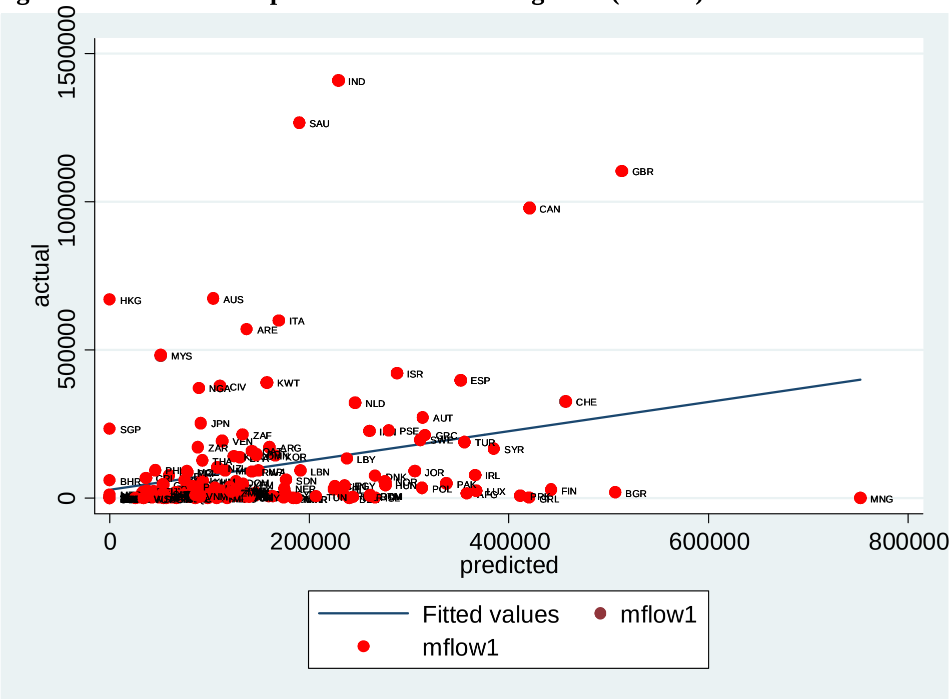

Figure 3: Inflows of migrants and climate-migrants by income level

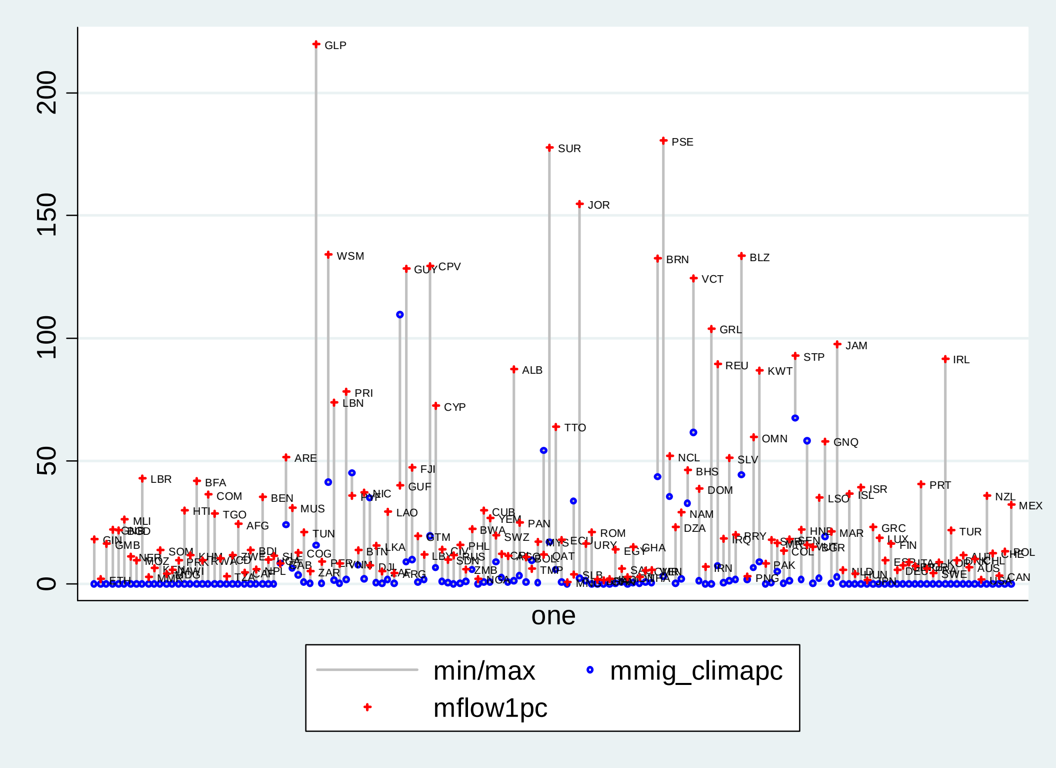

Table 1: Summary Statistics

Countries Included in The Sample	Non-OECD Sample Middle-Income Countries		
Variable	**Obs**	**Mean**	**Std. Dev.**

Table 2: Gravity model for flows of migrants with bilateral geography/climate variables

	(OLS)	(PPML)
(Temperature difference)*middle income dummy	0.098***	0.051***
	(0.004)	(0.011)
(Precipitation difference)*middle income dummy	0.022***	0.052***
	(0.004)	(0.017)
(Temperature difference)*low income dummy	0.057***	-0.019
	(0.006)	(0.032)
(Precipitation difference)*low income dummy	0.024***	0.033***
	(0.006)	(0.011)
(Temperature difference)*OECD dummy	0.101***	0.094***
	(0.007)	(0.011)
(Precipitation difference)*OECD dummy	0.006	0.039*
	(0.005)	(0.022)
Ln distance	-0.972***	-0.583***
	(0.034)	(0.150)
Common Border	2.162***	1.662**
	(0.165)	(0.781)
Common official language	1.252***	0.652**
	(0.065)	(0.301)
Colonial Ties	2.198***	1.080***
	(0.191)	(0.383)
Origin-time fixed effects	Yes	Yes
Decade fixed effects	Yes	Yes
Origin fixed effects	Yes	Yes
Observations	34,054	93,030
R-squared	0.332	0.091

Note: The dependent variable is the (bilateral) flows of migrants. *, **, *** indicate significance at the 10, 5 and 1% confidence level. Standard errors are clustered by origin country-destination pair. OLS model in logs, PPML model in levels.

Table 3: 2SLS - first stage of endogenous flows of migrants

	(1)	(2)	(3)	(4)
OLS predicted inflows	0.348***		0.470***	
	[0.115]		[0.149]	
PPML predicted inflows		0.184		1.331**
		[0.313]		[0.585]
Ln(GDP per capita)	1.369***	1.345***	0.560	0.691*
	[0.191]	[0.198]	[0.358]	[0.409]
Ln(Population)	0.576***	0.539***	-1.712**	-1.858**
	[0.072]	[0.076]	[0.816]	[0.873]
Years of peace	0.013	0.013	0.008	0.007
	[0.009]	[0.009]	[0.011]	[0.010]
Democracy	0.543**	0.572*	0.350	0.311
	[0.265]	[0.299]	[0.263]	[0.280]
Oil Exporter	-0.332	-0.354	-0.245	-0.560
	[0.323]	[0.328]	[0.494]	[0.575]
New State	0.203	0.014	-0.004	0.115
	[0.309]	[0.327]	[0.255]	[0.299]
Non-contiguity	0.306	0.165	0.098	0.107
	[0.366]	[0.349]	[0.272]	[0.279]
Agriculture VA share	2.541**	2.061*	-1.886	-2.258
	[1.206]	[1.227]	[2.444]	[2.759]
Ethnic diversity	0.529	0.388		
	[0.476]	[0.475]		
Mountainous terrain	-1.451***	-1.357***		
	[0.419]	[0.424]		
Yellow fever	-0.521	-0.294		
	[0.394]	[0.396]		
Abs. Latitude	-0.055***	-0.044**		
	[0.017]	[0.018]		
Land in tropical area	-0.980*	-1.225**		
	[0.549]	[0.602]		
Coastal Population	-0.807**	-0.913**		
	[0.399]	[0.392]		
Malaria Incidence	1.312**	1.437***		
	[0.511]	[0.519]		
Decade X Region Fixed effects	Yes	Yes	Yes	Yes
Decade Dummies	Yes	Yes	Yes	Yes
Country fixed effects	No	No	Yes	Yes
Observations	312	312	308	308
R-squared	0.657	0.630	0.428	0.372
F-test instrument	9.08	0.34	9.806	5.17

Note: Standard errors are clustered by country. *, **, *** indicate significance at the 10, 5 and 1% confidence level;

Table 4: Civil Conflict Incidence, 2SLS. Pooled cross section. Migration Inflows

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ln(Migrants)	0.032	0.039	0.030	0.019	0.038	0.068	0.036	0.065
	[0.046]	[0.043]	[0.045]	[0.035]	[0.046]	[0.066]	[0.041]	[0.044]
Ln(GDP per capita)	-0.062	-0.019	-0.074*	-0.056	-0.065	-0.098	-0.058	-0.060
	[0.043]	[0.060]	[0.043]	[0.037]	[0.043]	[0.062]	[0.050]	[0.067]
Ln(Population)	0.002	-0.001	0.001	0.007	-0.001	-0.007	0.001	-0.008
	[0.028]	[0.026]	[0.028]	[0.023]	[0.028]	[0.034]	[0.026]	[0.026]
Years of peace	-0.029***	-0.029***	-0.029***	-0.029***	-0.029***	-0.029***	-0.029***	-0.029***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Democracy	-0.011	-0.002	-0.011	-0.011	-0.013	-0.035	-0.008	-0.029
	[0.053]	[0.055]	[0.053]	[0.052]	[0.054]	[0.061]	[0.055]	[0.063]
Oil Exporter	0.003	0.024	0.013	0.005	0.002	0.016	0.001	0.052
	[0.051]	[0.050]	[0.049]	[0.049]	[0.052]	[0.056]	[0.052]	[0.051]
New State	-0.261***	-0.265***	-0.268***	-0.261***	-0.261***	-0.257***	-0.263***	-0.276***
	[0.078]	[0.078]	[0.076]	[0.078]	[0.078]	[0.079]	[0.078]	[0.079]
Non-contiguity	0.100**	0.104**	0.104**	0.105**	0.098**	0.049	0.095**	0.076
	[0.045]	[0.048]	[0.047]	[0.045]	[0.045]	[0.059]	[0.046]	[0.061]
Ethnic diversity	-0.011	-0.012	0.035	0.014	-0.023	-0.009	-0.031	0.062
	[0.097]	[0.094]	[0.096]	[0.094]	[0.098]	[0.102]	[0.084]	[0.089]
Mountainous terrain	0.122*	0.088	0.099	0.113*	0.133*	0.212**	0.128**	0.187*
	[0.066]	[0.072]	[0.069]	[0.068]	[0.075]	[0.088]	[0.065]	[0.107]
Agriculture VA share		0.471**						0.476**
		[0.234]						[0.207]
Yellow fever			-0.096*					-0.096*
			[0.050]					[0.055]
Abs. Latitude				0.001				0.004
				[0.002]				[0.003]
Land in tropical area					0.017			0.123
					[0.045]			[0.115]
Coastal Population						0.160		0.150*
						[0.097]		[0.083]
Malaria Incidence							0.037	-0.005
							[0.077]	[0.101]
Decade X Region Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Decade Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	312	312	312	312	312	312	312	312
R-squared	0.535	0.537	0.540	0.540	0.531	0.515	0.533	0.530
F-test instrument	4.167	4.367	4.274	8.995	5.534	2.899	6.330	9.083

Note: The dependent variable is equal to one if at least one civil conflict was ongoing in the decade t in country j and zero otherwise; *, **, *** indicate significance at the 10, 5 and 1% confidence level; the standard errors are clustered by country.

Table 5: Civil Conflict Onset, 2SLS. Pooled cross section. Migration Inflows

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ln(Migrants)	0.005	0.015	0.005	-0.012	-0.016	0.030	0.007	0.005
	[0.052]	[0.050]	[0.052]	[0.044]	[0.052]	[0.066]	[0.046]	[0.044]
Ln(GDP per capita)	-0.020	0.034	-0.023	-0.012	-0.011	-0.046	-0.018	0.034
	[0.049]	[0.063]	[0.049]	[0.045]	[0.049]	[0.059]	[0.054]	[0.063]
Ln(Population)	0.015	0.012	0.015	0.022	0.025	0.008	0.014	0.023
	[0.031]	[0.029]	[0.031]	[0.028]	[0.032]	[0.033]	[0.029]	[0.026]
Years of peace	-0.016***	-0.016***	-0.016***	-0.016***	-0.016***	-0.016***	-0.016***	-0.016***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.002]	[0.003]	[0.003]
Democracy	-0.002	0.010	-0.002	-0.001	0.001	-0.019	-0.001	0.003
	[0.060]	[0.059]	[0.059]	[0.060]	[0.060]	[0.065]	[0.062]	[0.068]
Oil Exporter	0.044	0.071	0.046	0.047	0.046	0.053	0.043	0.084
	[0.058]	[0.057]	[0.057]	[0.057]	[0.057]	[0.059]	[0.059]	[0.054]
New State	-0.254***	-0.259***	-0.255***	-0.254***	-0.251***	-0.251***	-0.255***	-0.255***
	[0.070]	[0.067]	[0.070]	[0.072]	[0.073]	[0.070]	[0.071]	[0.069]
Non-contiguity	0.068	0.074	0.069	0.076	0.073	0.033	0.066	0.041
	[0.064]	[0.063]	[0.062]	[0.063]	[0.063]	[0.073]	[0.064]	[0.067]
Ethnic diversity	0.142	0.141	0.152	0.176	0.181	0.143	0.133	0.199*
	[0.113]	[0.108]	[0.126]	[0.121]	[0.125]	[0.112]	[0.112]	[0.114]
Mountainous terrain	0.138	0.095	0.133	0.126	0.103	0.201*	0.141	0.109
	[0.091]	[0.102]	[0.097]	[0.098]	[0.115]	[0.113]	[0.090]	[0.135]
Agriculture VA share		0.594**						0.626***
		[0.239]						[0.211]
Yellow fever			-0.020					0.005
			[0.065]					[0.061]
Abs. Latitude				0.001				0.001
				[0.002]				[0.003]
Land in tropical area					-0.054			-0.089
					[0.064]			[0.114]
Coastal Population						0.111		0.127
						[0.101]		[0.084]
Malaria Incidence							0.018	0.049
							[0.089]	[0.102]
Decade X Region Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Decade Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	312	312	312	312	312	312	312	312
R-squared	0.280	0.291	0.280	0.276	0.275	0.280	0.280	0.300
F-test instrument	4.167	4.367	4.274	8.995	5.534	2.899	6.330	9.083

Note: The dependent variable is equal to one if at least one civil conflict started in the decade t in country j and zero otherwise; *, **, *** indicate significance at the 10, 5 and 1% confidence level; the standard errors are clustered by country.

Table 6: Civil Conflict Incidence and Onset, 2SLS. Panel Estimates. Migration Inflows

	(1)	(2)	(3)	(4)
	Incidence		Onset	
Ln(Migrants)	0.030	0.026	0.050	0.052
	[0.057]	[0.057]	[0.071]	[0.072]
Ln(GDP per capita)	-0.036	-0.071	0.081	0.097
	[0.150]	[0.157]	[0.174]	[0.180]
Ln(Population)	-0.070	-0.069	0.156	0.155
	[0.285]	[0.283]	[0.373]	[0.373]
Years of peace	-0.009**	-0.009**	-0.003	-0.003
	[0.004]	[0.004]	[0.005]	[0.005]
Democracy	0.121	0.130	0.166	0.162
	[0.119]	[0.122]	[0.125]	[0.128]
Oil Exporter	0.077	0.071	0.153	0.156
	[0.170]	[0.170]	[0.183]	[0.183]
New State	-0.190**	-0.177*	-0.158	-0.164
	[0.095]	[0.100]	[0.122]	[0.126]
Non-contiguity	-0.076	-0.078	0.778***	0.779***
	[0.150]	[0.150]	[0.134]	[0.135]
Agriculture VA share		-0.531		0.246
		[0.921]		[0.985]
Country Fixed effects	Yes	Yes	Yes	Yes
Decade X Region Fixed effects	Yes	Yes	Yes	Yes
Decade Dummies	Yes	Yes	Yes	Yes
Observations	308	308	308	308
R-squared	0.099	0.102	0.071	0.071
Number of countries	109	109	109	109
F-test instrument	9.888	9.806	9.888	9.806

Note: The dependent variable is equal to one if at least one civil conflict was ongoing in the decade t in country j and zero otherwise in columns (1) and (2) and it is equal to one if at least one civil conflict started in the decade t in country j and zero otherwise in columns (3) and (4); *, **, *** indicate significance at the 10, 5 and 1% confidence level; the standard errors are clustered by country.

Table 7: Civil Conflict Incidence and Onset, 2SLS. Immigration rates

	(1)	(2)	(3)	(4)
	Incidence		Onset	
Ln(Migrants per capita)	0.062	0.031	0.004	0.056
	[0.041]	[0.059]	[0.042]	[0.073]
Country Fixed effects	No	Yes	No	Yes
Decade X Region Fixed effects	Yes	Yes	Yes	Yes
Decade Dummies	Yes	Yes	Yes	Yes
Observations	306	302	306	302
R-squared	0.544	0.111	0.312	0.085
F-test instrument	9.681	10.11	9.681	10.11

Note: The dependent variable is equal to one if at least one civil conflict was ongoing in the decade t in country j and zero otherwise in columns (1) to (4) and it is equal to one if at least one civil conflict started in the decade t in country j and zero otherwise in columns (5) to (8); *, **, *** indicate significance at the 10, 5 and 1% confidence level; the standard errors are clustered by country. All regressions include controls for Gdp per capita, population, years of peace, democracy, oil exporter, new state, non-contiguity, agriculture va share. Pooled cross sections (1 and 3) contain also controls for mountainous terrain, yellow fever, latitude, land in tropical area, coastal population, malaria incidence and ethnic diversity.

Table 8: Civil War Incidence and Onset, 2SLS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Incidence				**Onset**			
	Ln(Migrants)		Ln(Migrants pc)		Ln(Migrants)		Ln(Migrants pc)	
Climate Migrants	0.063	0.056	0.056	0.052	0.042	0.085	0.037	0.083
	[0.056]	[0.039]	[0.053]	[0.037]	[0.037]	[0.079]	[0.035]	[0.078]
Country Fixed effects	No	Yes	No	Yes	No	Yes	No	Yes
Decade X Region Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Decade Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	312	308	306	302	312	308	306	302
R-squared	0.407	0.149	0.420	0.157	0.122	0.073	0.139	0.089
F-test instrument	9.083	9.923	9.681	10.11	9.083	9.923	9.681	10.11

Note: The dependent variable is equal to one if at least one civil conflict was ongoing in the decade t in country j and zero otherwise in columns (1) to (4) and it is equal to one if at least one civil conflict started in the decade t in country j and zero otherwise in columns (5) to (8); *, **, *** indicate significance at the 10, 5 and 1% confidence level; the standard errors are clustered by country. All regressions include controls for Gdp per capita, population, years of peace, democracy, oil exporter, new state, non-contiguity, agriculture va share. Pooled cross sections (1, 3, 5, 7) contain also controls for mountainous terrain, yellow fever, latitude, land in tropical area, coastal population, malaria incidence and ethnic diversity.

Table 9: Civil Conflict Incidence and Onset, 2SLS. Control for polarization

	(1)	(2)	(3)	(4)
	Incidence		Onset	
	Ln(Migrants)	Ln(Migrants pc)	Ln(Migrants)	Ln(Migrants pc)
Climate Migrants	0.052	0.053	0.012	0.016
	[0.058]	[0.055]	[0.067]	[0.064]
Ethnic diversity	0.045	0.060	0.215*	0.235*
	[0.099]	[0.095]	[0.127]	[0.132]
Ethnic Polarization	0.036	0.049	-0.071	-0.059
	[0.106]	[0.103]	[0.110]	[0.109]
Country Fixed effects	No	No	No	No
Decade X Region Fixed effects	Yes	Yes	Yes	Yes
Decade Dummies	Yes	Yes	Yes	Yes
Observations	279	274	279	274
R-squared	0.544	0.552	0.312	0.320
F-test instrument	8.099	8.759	8.099	8.759

Note: The dependent variable is equal to one if at least one civil conflict was ongoing in the decade t in country j and zero otherwise in columns (1) and (2) and it is equal to one if at least one civil conflict started in the decade t in country j and zero otherwise in columns (3) and (4); *, **, *** indicate significance at the 10, 5 and 1% confidence level; the standard errors are clustered by country. All regressions include controls for Gdp per capita, population, years of peace, democracy, oil exporter, new state, non-contiguity, agriculture va share, mountainous terrain, yellow fever, latitude, land in tropical area, coastal population, malaria incidence.

Table 10: Civil Conflict Incidence and Onset, 2SLS. Controls at the beginning of the decade

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Incidence				**Onset**			
	Ln(Migrants)		Ln(Migrants pc)		Ln(Migrants)		Ln(Migrants pc)	
Climate Migrants	0.067	0.027	0.063	0.068	0.010	0.034	0.019	0.113
	[0.043]	[0.055]	[0.045]	[0.077]	[0.038]	[0.060]	[0.043]	[0.094]
Country Fixed effects	No	Yes	No	Yes	No	Yes	No	Yes
Decade X Region Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Decade Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	300	296	281	273	300	296	281	273
R-squared	0.515	0.103	0.520	0.056	0.324	0.069	0.322	0.027
F-test instrument	11.89	9.624	10.79	4.439	11.89	9.624	10.79	4.439

Note: The dependent variable is equal to one if at least one civil conflict was ongoing in the decade t in country j and zero otherwise in columns (1) to (4) and it is equal to one if at least one civil conflict started in the decade t in country j and zero otherwise in columns (5) to (8); *, **, *** indicate significance at the 10, 5 and 1% confidence level; the standard errors are clustered by country. All regressions include controls for Gdp per capita, population, years of peace, democracy, oil exporter, new state, non-contiguity, agriculture va share. Pooled cross sections (1, 3, 5, 7) contain also controls for mountainous terrain, yellow fever, latitude, land in tropical area, coastal population, malaria incidence and ethnic diversity.

Table 11: Gravity model for bilateral migration flows. PPML

	(1)	(2)
Temperature*middle income dummy	1.041***	1.104***
	(0.372)	(0.372)
Precipitation*middle income dummy	0.003	0.006
	(0.029)	(0.028)
Temperature*low income dummy	-0.122	-0.035
	(0.748)	(0.730)
Precipitation*low income dummy	-0.207**	-0.178*
	(0.101)	(0.095)
Temperature*OECD dummy	-0.972	-0.769
	(0.634)	(0.683)
Precipitation*OECD dummy	0.208	0.250
	(0.129)	(0.165)
Ln distance	-1.161***	-0.975***
	(0.064)	(0.072)
Common Border	1.188***	1.432***
	(0.189)	(0.311)
Common official language	0.932***	0.873***
	(0.162)	(0.178)
Colonial Ties	1.072***	1.047***
	(0.188)	(0.254)
Agro Ecological Zone difference	2.647***	0.122***
	(0.611)	(0.037)
Decade fixed effects	Yes	Yes
Country of origin*time trend	Yes	Yes
Country of origin*time trend squared	Yes	Yes
Country of origin fixed effect	Yes	Yes
Country of destination fixed effect	Yes	No
Country of destination *time trend	No	Yes
Observations	129,140	130,356
R-squared	0.686	0.550

Note: The dependent variable is the (bilateral) flows of migrants. *, **, *** indicate significance at the 10, 5 and 1% confidence level. Standard errors are clustered by origin country-destination pair.

Table 12: Civil Conflict Incidence in poor countries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Ln(Missed outflows of migrants)				Ln(missed outflows of migrants pc)			
Ln(Missed Migrants)	1.202	1.202	13.369*	13.369	1.282*	1.282	1.357	1.357
	(0.929)	(1.665)	(7.261)	(11.981)	(0.705)	(1.267)	(1.000)	(2.006)
Ln(GDP per capita)	0.136	0.136	0.409	0.409	0.113	0.113	0.393	0.393
	(0.139)	(0.205)	(0.291)	(0.407)	(0.130)	(0.205)	(0.276)	(0.631)
Ln(Population)	0.108***	0.108	-0.496	-0.496	1.347*	1.347	0.154	0.154
	(0.035)	(0.110)	(0.903)	(1.294)	(0.695)	(1.367)	(1.307)	(2.251)
Years of peace	-0.030***	-0.030***	-0.022**	-0.022*	-0.031***	-0.031***	-0.023**	-0.023*
	(0.006)	(0.007)	(0.009)	(0.012)	(0.005)	(0.004)	(0.010)	(0.012)
Democracy	0.052	0.052	0.070	0.070	0.002	0.002	0.090	0.090
	(0.136)	(0.170)	(0.248)	(0.279)	(0.137)	(0.105)	(0.255)	(0.332)
New State	-0.107	-0.107	-0.003	-0.003	-0.134	-0.134	-0.094	-0.094
	(0.162)	(0.185)	(0.224)	(0.216)	(0.164)	(0.139)	(0.226)	(0.264)
Ethnic diversity	0.055	0.055			0.028	0.028		
	(0.182)	(0.279)			(0.153)	(0.124)		
Mountainous terrain	0.269	0.269			0.308	0.308		
	(0.396)	(0.676)			(0.296)	(0.825)		
Agriculture VA share	0.596	0.596	0.593	0.593	0.612	0.612	0.525	0.525
	(0.561)	(0.881)	(1.120)	(1.572)	(0.549)	(1.116)	(1.222)	(1.333)
Yellow fever	-0.097	-0.097			-0.131	-0.131		
	(0.233)	(0.521)			(0.192)	(0.215)		
Abs. Latitude	-0.007	-0.007			-0.011	-0.011		
	(0.016)	(0.028)			(0.013)	(0.019)		
Land in tropical area	-0.102	-0.102			-0.174	-0.174		
	(0.253)	(0.537)			(0.268)	(0.485)		
Coastal Population	0.143	0.143			0.121	0.121		
	(0.179)	(0.369)			(0.177)	(0.430)		
Malaria Incidence	0.101	0.101			0.069	0.069		
	(0.202)	(0.395)			(0.216)	(0.411)		
Country Fixed effects	No	No	Yes	Yes	No	No	Yes	Yes
Decade X Region Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Decade Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	80	80	80	80	77	77	77	77
R-squared	0.545	0.545	0.320	0.320	0.555	0.555	0.324	0.324

Note: The dependent variable is equal to one if at least one civil conflict was ongoing in the decade t in country j and zero otherwise; *, **, *** indicate significance at the 10, 5 and 1% confidence level; the standard errors are clustered by country. In (2), (4), (6) and (8) standard errors are bootstrapped with 200 replications.

Table 13: Civil Conflict Onset in poor countries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Ln(Missed outflows of migrants)				Ln(missed outflows of migrants pc)			
Ln(Missed Migrants)	0.081	0.081	19.675*	19.675*	0.920	0.920*	1.360	1.360
	(1.324)	(1.408)	(10.485)	(11.726)	(1.105)	(0.499)	(1.303)	(1.403)
Ln(GDP per capita)	0.156	0.156	0.541	0.541	0.117	0.117	0.583*	0.583
	(0.109)	(0.191)	(0.378)	(0.914)	(0.102)	(0.161)	(0.342)	(0.410)
Ln(Population)	0.018	0.018	1.129	1.129	0.876	0.876	1.122	1.122
	(0.048)	(0.081)	(1.394)	(2.059)	(1.101)	(0.589)	(1.987)	(2.274)
Years of peace	-0.020***	-0.020***	-0.024**	-0.024	-0.022***	-0.022***	-0.024**	-0.024*
	(0.006)	(0.006)	(0.010)	(0.015)	(0.006)	(0.004)	(0.011)	(0.014)
Democracy	0.015	0.015	0.062	0.062	-0.023	-0.023	0.100	0.100
	(0.175)	(0.242)	(0.312)	(0.348)	(0.162)	(0.193)	(0.297)	(0.451)
New State	-0.149	-0.149	0.069	0.069	-0.230	-0.230	-0.102	-0.102
	(0.186)	(0.265)	(0.264)	(0.298)	(0.190)	(0.307)	(0.251)	(0.226)
Ethnic diversity	0.077	0.077			0.203	0.203		
	(0.219)	(0.466)			(0.171)	(0.413)		
Mountainous terrain	0.219	0.219			0.635	0.635***		
	(0.496)	(0.787)			(0.441)	(0.246)		
Agriculture VA share	0.396	0.396	1.053	1.053	0.240	0.240	1.125	1.125
	(0.591)	(1.075)	(1.382)	(3.181)	(0.570)	(0.614)	(1.447)	(1.566)
Yellow fever	0.217	0.217			-0.019	-0.019		
	(0.328)	(0.508)			(0.305)	(0.182)		
Abs. Latitude	0.002	0.002			-0.011	-0.011***		
	(0.019)	(0.027)			(0.016)	(0.003)		
Land in tropical area	-0.088	-0.088			-0.081	-0.081		
	(0.329)	(0.785)			(0.393)	(0.446)		
Coastal Population	0.054	0.054			-0.026	-0.026		
	(0.220)	(0.326)			(0.251)	(0.457)		
Malaria Incidence	0.353	0.353			0.267	0.267		
	(0.261)	(0.378)			(0.318)	(0.317)		
Country Fixed effects	No	No	Yes	Yes	No	No	Yes	Yes
Decade X Region Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Decade Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	80	80	80	80	77	77	77	77
R-squared	0.295	0.295	0.269	0.269	0.341	0.341	0.255	0.255

Note: The dependent variable is equal to one if at least one civil conflict started in the decade t in country j and zero otherwise; *, **, *** indicate significance at the 10, 5 and 1% confidence level; the standard errors are clustered by country. In (2), (4), (6) and (8) standard errors are bootstrapped with 200 replications.

Table 14: Civil Conflict Incidence in poor countries. Alternative missed flow variable

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Ln(Missed outflows of migrants)				Ln(missed outflows of migrants pc)			
Ln(Missed Migrants)	1.236	1.236	12.450	12.450	1.292*	1.292	1.347	1.347
	[0.938]	[1.309]	[7.618]	[8.907]	[0.718]	[0.864]	[0.996]	[1.178]
Country Fixed effects	No	No	Yes	Yes	No	No	Yes	Yes
Decade X Region Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Decade Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	80	80	80	80	77	77	77	77
R-squared	0.545	0.545	0.317	0.317	0.555	0.555	0.324	0.324

Note: The dependent variable is equal to one if at least one civil conflict started in the decade t in country j and zero otherwise; *, **, *** indicate significance at the 10, 5 and 1% confidence level; the standard errors are clustered by country. In (2), (4), (6) and (8) standard errors are bootstrapped with 200 replications. All regressions include controls for Gdp per capita, population, years of peace, democracy, new state, and agriculture va share. Pooled cross sections (1, 2, 4, 5) contain also controls for mountainous terrain, yellow fever, latitude, land in tropical area, coastal population, malaria incidence and ethnic diversity.

Table 15: Civil Conflict onset in poor countries. Alternative missed flow variable

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Ln(Missed outflows of migrants)				Ln(missed outflows of migrants pc)			
Ln(Missed Migrants)	0.026	0.026	18.817*	18.817**	0.912	0.912	1.352	1.352
	[1.348]	[2.374]	[10.893]	[9.097]	[1.128]	[0.764]	[1.301]	[1.697]
Country Fixed effects	No	No	Yes	Yes	No	No	Yes	Yes
Decade X Region Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Decade Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	80	80	80	80	77	77	77	77
R-squared	0.295	0.295	0.265	0.265	0.341	0.341	0.255	0.255

Note: The dependent variable is equal to one if at least one civil conflict started in the decade t in country j and zero otherwise; *, **, *** indicate significance at the 10, 5 and 1% confidence level; the standard errors are clustered by country. In (2), (4), (6) and (8) standard errors are bootstrapped with 200 replications. All regressions include controls for Gdp per capita, population, years of peace, democracy, new state, and agriculture va share. Pooled cross sections (1, 2, 4, 5) contain also controls for mountainous terrain, yellow fever, latitude, land in tropical area, coastal population, malaria incidence and ethnic diversity.