Examining the link between climate, conflict and cross-border migration.

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Abstract

Recent media headlines, especially those on Europe's migration crisis, often cited climate change-induced conflict in the Middle East and Africa as a major driver of the surge of migrants to Europe in the past couple of years. Establishing scientifically based link between climate change, conflict and migration is however a complex task. This requires a panel data approach accounting for potential confounding factors in order to draw causal inferences on the relationship between climate and conflict. Likewise, the study of the relationship between climate change and migration needs to control for a range of other drivers of migration including social, political, economic and demographic factors. Given the complexity in establishing connections between climate change, conflict and migration, extant empirical studies on the subject are generally organized along the twin axes of climate change and conflict, and climate change and migration. To our knowledge, empirical literature that simultaneously investigates climate change, conflict and migration is scarce. To this end, this paper aims to systematically examine the connection between climate change and conflict and explore how the two factors interplay in influencing cross-border migration. Using gravity-type model and country-fixed effects, we attempt to draw a causal link between climate, conflict and migration. Cross-border migration is estimated based on the UNHCR global bilateral international refugee flows collected annually from 1951-2014. Climatic conditions are measured as rainfall variability, temperature anomalies and natural disaster events at a country-level. We control for demographic, social, economic and political characteristics of countries of origin and destination that drive conflict as well serve as "push" and "pull" factors in determining migration. This study expects to provide a comprehensive overview of climate- and conflict-induced global migration flows and identify origin and destination areas that may need interventions.

1. Background

The ongoing Syrian conflict which began in March 2011 has drawn both scientific and public attention on how climatic conditions can contribute to political unrest and civil war. Recent studies of the Syrian uprising have shown that growing water scarcity and frequent droughts coupled with poor water management led to multiyear crop failures, economic deterioration and consequently mass migration of rural families to urban areas (Gleick 2014; Kelley et al. 2015). Rapid growing population, overcrowding, unemployment and increase inequality put pressures in the urban centres and finally the breakout of political unrest. In fact, scientific literature on the link between possible climatic changes and human conflict has been developing over the past two decades. Meta-analysis of 60 quantitative studies confirms that the risk of conflict increases substantially with deviations from normal precipitation and mild temperatures (Hsiang et al. 2013). If this is true, and given that anthropogenic climate change will affect the frequency and intensity of extreme events, these pressures can indirectly increase risks of violent conflicts by aggravating such drivers of conflicts as poverty, food insecurity and inequalities (IPCC 2014).

Increased conflicts bring about a series of negative consequences including premature death, disability, psychological trauma, physical injury and malnutrition (Murray et al. 2002). Likewise, conflict can also be the cause of displacement. Recent media headlines, especially those on Europe's migration crisis, often cited climate change-induced conflict in the Middle East and Africa as a major driver of the surge of migrants to Europe in the past couple of years. However, establishing scientifically based link between climate change, conflict and migration is a complex task. The consequences of climate on conflict are highly dependent upon a country's socioeconomic, institutional and political characteristics. In fact, climatic conditions alone do not cause conflict but changes in climate can affect many factors that may in turn induce conflict such as agriculture income, human health, breakdown of social relations and institutional failures. This requires a panel data approach accounting for potential confounding factors in order to draw causal inferences on the relationship between climate and conflict (Burke et al. 2015).

Similarly, the study of the relationship between climate change and migration needs to control for a range of other drivers of migration including social, political, economic and demographic factors (Black et al., 2011; Fussell et al., 2014). While it is possible that climate change may directly lead to migration, it is more probable that the climate impact on migration is indirectly mediated through economic and political factors which are affected by environmental change. Furthermore, despite an increase in scholarly and policy interests regarding the impacts of climate change on migration, knowledge in the field remains varied, patchy and limited (Piguet et al. 2011). For instance, estimates and predictions of climate/environmental migrants are in fact rooted only in one or two publications, especially those of Norman Myers, a British environmentalist. Using a crude method, Myers (1993, 2002) calculated the number of people likely to be affected by sea-level rise and an increase in extreme weather events in vulnerable regions based on anticipated population growth in the coming decades and predicted between 150 to 200 million environmental migrants in 2050. However, in the absence of relevant statistical information, it is not possible to assess such predictions (Gemenne 2011).

Given the complexity in establishing connections between climate change, conflict and migration, extant empirical studies on the subject are generally organized along the twin axes of climate change and conflict, and climate change and migration. To our knowledge, empirical literature that simultaneously investigates climate change, conflict and migration is scarce. To this end, this paper aims to systematically examine the connection between climate change and conflict and explore how the two factors interplay in influencing cross-border migration. Using gravity-type model and country-fixed effects, we attempt to draw a causal link between climate, conflict and migration.

2. Data

2.1 Migration data

In order to estimate climate- and conflict-induced cross-border migration at a global scale, time-series data recording global bilateral international migration flows are required. We therefore turn to the population data from the United Nations High Commissioner for the Refugees (UNHCR) which collect information on refugees, asylum-seekers and displaced persons for a given year and country of residence and origin. The data are available for selected countries over the past thirty years allowing us to proximate global migration flows associated with climate variability and conflict.

2.2. Climate data

Climate conditions are captured by two sources: 1) Emergency Events Database (EM-DAT); and 2) CRU-TS historic climate database. The EM-DAT data provided by the Centre for the Research of the Epidemiology of Disasters record the number of disasters and disaster types both natural and manmade by country and year since 1900 (EM-DAT 2015). For the purpose of this study, we focus on floods, droughts, storms, mass movements, extreme temperature events and wildfires – those natural disasters that are expected to increase due to climate change.

Precipitation and daily mean temperature data are obtained from the CRU-TS historic climate database version 3.22 produced by the Climate Research Unit at the University of East Anglia (University of East Anglia Climatic Research Unit et al. 2014). The time-series data for rainfall consist of monthly mean precipitation spanning from the period 1901 to 2013 calculated on high-resolution (0.5 x 0.5 degree) grids. The precipitation grids are used to calculate drought and rainfall variability for each country. Daily mean temperature data are used to calculate the number of extremely hot and cold days in a year.

2.3 Conflict data

Conflict data are obtained from the Uppsala Conflict Data Program (UCDP) which collects information on several aspects of armed violence since 1946 and ongoing violent conflicts since the 1970s. The data are collected on an annual basis with information on state-based armed conflicts as well as non-state actors and one-sided violence including fatality estimates. This allows us to measure the scale of conflicts within a country on a yearly basis.

2.4 Demographic and socioeconomic data

Since both conflict and migration are context-specific, it is important to account for demographic, socioeconomic and political characteristics of a country. We combine data from various sources such as the Wittgenstein Centre for Demography and Global Human Capital, the World Bank and the Polity IV Project to account for population dynamics, economic performance and political regime characteristics of a country. Global migrant stocks from the United Nations are also employed to control for migrant stocks in a country of destination as a proxy for migration networks.

3. Measurement and model specification

3.1 Measurement

Count of **migration flows** (y_{ij}) are taken from the number of refugees and asylum seekers from UNICEF.

Distance $(DIST_{ij})$ between origin and destination is computed using Euclidean distance i.e. straight-line distance between two points calculated from the center of the source cell to the center of each of the surrounding cells. **Contiguity** $(CONT_{ij})$ is a dummy variable equals 1 if countries are continuous, 0 otherwise.

POP is the total number of population. ECO is a vector of socioeconomic and political characteristics. $CONFLICT$ is the total number of violent conflicts. $CLIMATE$ is a series of indicators of climatic conditions including rainfall variability, temperature anomalies and the number of natural disasters.

3.2 Model specification

A sequence of spatial interaction models are fit using Poisson regression for each country, time and migration interval combination. Derived from the gravity theory of migration (Zipf 1946), this model focuses on the role of distance in explaining spatial movements as well as population sizes. In an extension of the spatial interaction model, other relevant factors such as unemployment rates or GDP can also be considered jointly (Lowry 1966; Morrison 1973). For the analysis of migration flows, a set of variables are sequentially added, starting with Zipf (1946) specification for count of internal migrant transitions (y_{ij}) between origin i and destination j. Climate-related variables and information on conflicts are added at the end in order to observe the impact of environmental driver on migration controlling for other relevant drivers.

The models estimated can be written as:

$$y_{ij} \sim Poisson\ (\lambda_{ij})$$

$$\begin{aligned}\lambda_{ij} = \ & \beta_0 + \beta_1^O logPOP_i + \beta_1^D logPOP_j + \beta_2 DIST_{ij} \\ & + \beta_3 CONT_{ij} \\ & + \beta_4^O ECO_i + \beta_4^D ECO_j \\ & + \beta_5^O CONFLICT_i + \beta_5^D CONFLICT_j \\ & + \beta_6^O CLIMATE_i + \beta_6^D CLIMATE_j\end{aligned}$$

4. Results

We are currently preparing the data for model estimation. We expect to obtain preliminary results by early 2016 and can update the abstract accordingly.

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