

# Climatic Factors as Determinants of International Migration: Redux

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## Climate and Migration

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- ▶ International migration as a consequence of climate change has become an important topic of debate.
- ▶ Debate takes place at different levels : policy making , academic, media coverage.
- ▶ These debates are interrelated. Academic studies are needed to understand the channels and the way policy makers can intervene.
- ▶ Useful to evaluate the predictions of future international migration flows triggered by climatic events. Myers (2002) predicted 200 millions environmental migrants by 2050.
- ▶ Here: academic contribution to summarize the previous works and propose a new evaluation accounting for specific methodological choices.

Methological choices of the literature

## Summarizing the literature

- ▶ The literature on climate change and migration has exploded over the last 5-10 years. See surveys such as Dallmann and Millock (2013) and Millock (2015).
- ▶ This literature takes **very diverse approaches**, which explains in turns different findings.
- ▶ It is important to characterize the various methodological options in order to clarify our contribution.
- ▶ These options affect not only the results but also the policy implications.

## Internal vs international (e)migration

- ▶ Mobility of people as a adjustment strategy to the occurrence of negative climate shocks. But what mobility to consider?
- ▶ Evidence that climatic shocks affect **internal migration**. Findley (1994), Barrios et al. (2006), Gray (2009), Ruiz (2015), Gröger and Zylberberg (2015), ... .
- ▶ In general, less evidence for **international emigration** : higher costs of migration, existence of poverty traps, less information on external opportunities, role of restrictive immigration policies. Possible substitution between international and internal destinations.

## Internal vs international (e)migration

- ▶ At a macro level, Beine and Parsons (2015) fail to find a direct impact of long-run factors and natural disasters, but indirect evidence in favour of internal migration as a result of natural disasters in developing countries.
- ▶ Internal and international migration can be also **complementary processes**: two-step sequential process (Marchiori et al., 2012).
- ▶ Very few studies account at the same time for internal and external destinations as possible options for migrants (see e.g. Ruiz, 2015).

## Climate shocks ?

- ▶ Climatic shock and climate change are elusive concepts. Conceal different dimensions with different implications.
- ▶ **Unexpected , short-run shocks** : natural disasters (earthquakes, hurricanes, extreme droughts, ...). Requires sometimes immediate strategy such as displacement. But do all natural disasters fall into category of climatic events?
- ▶ Gradual, **long-run evolutions in climatic conditions** . Gradual warming and gradual decrease in rainfall precipitations. Mobility is one of the possible coping strategies (other: change in occupations, investment, ...).
- ▶ The literature has considered both types of shocks , not often in the same analysis.
- ▶ Sometimes, distinction can be artificial since natural disasters such as droughts can be persistent and can be partly anticipated.



## Climate shocks ?

- ▶ **Natural disasters** : Findley (1994) (drought) , Ruiz (2015) (droughts and floods), Gröger and Zylberberg (2015) (typhoons), Beine and Parsons (2015) (9 disasters).
- ▶ **Long-run climate change** : Barrios et al. (2006), Gray (2009) (increasing precipitations), Backlaus (2015), Coniglio and Pesce (2015) (changing cycles and variability), Cai et al. (2014), Marchiori et al. (2012) (rising temperatures and shortages of rain), Beine and Parsons (2015) (anomalies and deviations of temperatures and rain), Cattaneo and Peri (2015) (temperatures and rain)
- ▶ Very few studies consider both dimensions at the same time. Beine and Parsons (2015) and Cattaneo and Peri (2015) are the exceptions.

## Dimensions of the migration data

- ▶ Individual data vs aggregate flows of migrants.
- ▶ Individual data :single individuals (Munshi, 2003) or household level (Gröger and Zylberberg, 2015).
- ▶ Aggregate flows can concern internal migration (Ruiz, 2015) or international migration (Reuveny and Moore, 2009; Beine and Parsons, 2015; Cattaneo and Peri, 2015).

## Dimensions of the migration data

- ▶ **Corridor-specific data** (Munshi, 2003) vs **global data** (multiple destinations or cross-country data).
- ▶ Geographical coverage. Most of the countries consider **developing countries** while some papers look at the world level, pooling developing and developed countries (Beine and Parsons, 2015).
- ▶ Unilateral dimension (single origin and/or single destination) vs bilateral data (multi-origin and multi-destination framework).

## Geographical coverage

- ▶ Most countries focus on effect of climate change in **developing countries**.
- ▶ Justification : one expects climate change to affect **more** due to importance of the agricultural sector and/or less strategies alternative to mobility. Also, migration response to climate change in developed countries can be of different nature.
- ▶ But Cattaneo and Peri (2015) and Beine and Parsons (2015) find no evidence specific to countries with important agricultural sector.
- ▶ On the other hand, presence of poverty traps and liquidity constraints → climate shocks might rather **reduce** mobility in developing countries. Evidence of negative impact (e.g. Findley, 1994).

## Unilateral data vs Bilateral data

- ▶ Macro studies: **unilateral** data vs **bilateral** data (multiple origins and multiple destinations)
- ▶ Bilateral data and **internal migration** : Ruiz (2015) covers flows between all Mexican regions
- ▶ Bilateral data and **international migration** : Beine and Parsons (2015). Bilateral flows between all origins and all destinations (+ subsamples)

## Advantages of bilateral data

- ▶ 3 main advantages of bilateral data.
- ▶ (1) **Micro-founded gravity specifications** using Random Utility Maximisation approach (Borjas, 1987; Grogger and hanson, 2011). Allows to identify factors and functional forms.
- ▶ (2) Allows to include a rich set of fixed effects that are able to account for **some unobserved factors**. e.g. Beine and Parsons (2015) include destination-time fixed effects accounting for important factors such as immigration policies (no satisfying measures so far).
- ▶ (3) allows to look if effect is specific to **some migration corridors** (e.g. in which migration costs are lower).
- ▶ Gravity models have drawbacks, too : issue of multilateral resistance to migration, presence of zeroes as dependent, sample selection, inferred data ...

## Heterogenous measures of climatic shocks

- ▶ **Natural disasters** : some specific disasters (droughts, floods, hurricanes) or number of disasters of all kinds (9 types) (Beine and Parsons, 2015).
- ▶ **Long-run factors** : temperatures and/or rainfall.
- ▶ Different measures : (1) levels (Cattaneo and Peri, 2015) , (2) deviations from LR average in both directions , (3) specific deviations (excessive temperatures and rainfall shortages), (4) anomalies (scaled by standard deviations) , (5) Change in volatility (Coniglio and Pesce, 2015).
- ▶ Heterogeneity of measures , approaches, data , geographical coverage and specifications explain also heterogeneity of results.

## Channels of influence of climate change



## Direct and indirect channels of influence

- ▶ **Direct effect**: quality of environment decreases → forced to leave . This has been coined some amenity channel. e.g Situation of Kiribati and Tuvalu with rising sea levels. No evidence from macro data.
- ▶ **Labour market channel** (decrease in wage or decrease in employment rate or probability).
- ▶ Extensive **micro** evidence (Mueller and Quisumbing, 2011; Mueller and Osgood, 2009, Gröger and Zylberberg, 2015, ...) and **macro** (Beine and Parsons, 2015).

## Direct and indirect channels of influence

- ▶ **Institutional channel** : Climate affects institutional quality (Acemoglu et al. 2001, 2012) which leads to emigration (Ariu et al.; 2013).
- ▶ **Conflict channel** : Climate change increases likelihood of conflict (Dell, 2014) which in turn might lead to emigration. See also Cattaneo (2016).
- ▶ **Demographic channel** : climatic conditions can affect demography, which is a major cause of migration pressure.

## Channels and specifications

- ▶ **Direct effect.** Beine and Parsons (2015) account for all covariates associated to indirect channels → fail to find evidence in favour of amenity channel.
- ▶ Cattaneo and Peri (2015) include only climatic factors → estimate **net partial effect** of climatic factors which is the sum of various channels.
- ▶ Find evidence of positive impact for middle-income countries of warming. No evidence for low income countries and countries with large agriculture.
- ▶ This illustrates how the diversity of approaches results in globally diverging results. → It is important to clarify precisely the approach.

## Our contribution

## Specificities

- ▶ We revisit the global impact of **short-run** (natural disasters) and **long-run climatic factors** (temperatures and rainfall) on emigration at the world level. We build on our previous work (Beine and Parsons, 2015).
- ▶ We look only at **developing countries**. We make a distinction between poor (bottom Q25 in terms of GDPPH) and middle income countries (remaining non OECD countries). This allows for the possible existence of poverty traps preventing people to move.
- ▶ We look at **the net partial effect** of the climatic factors (Cattaneo and Peri, 2015)
- ▶ We use the **bilateral dimension**, which allows to look at corridor-specific impacts.

## Estimated equation (RUM-derived)

$$\ln\left(\frac{N_{ij,t}}{N_{ii,t}}\right) = \beta_1 \ln(P_{it}) + \beta_2 C_{ij} * \ln(P_{it}) + \beta_3 \ln(T_{it}) + \beta_4 C_{ij} * \ln(T_{it}) \\ + \beta_5 \ln(D_{i,t}) + \beta_6 C_{ij} * \ln(D_{i,t}) + \alpha_{j,t} + \alpha_i + \epsilon_{ij,t}$$

$P_{it}$  and  $T_{it}$  are measures of long-run negative deviations of temperatures (excess) and rainfall (shortages).

$D_{it}$  are the number of disasters over period  $t$  at origin.

$C_{ij}$  is a particular feature of relationship between  $i$  and  $j$ .

Contiguity or colonial links.

## Details

- ▶ We build bilateral flows from 10 year differences in bilateral stocks (Ozden et. al, 2011).
- ▶ The data allows to have precise measures of  $N_{ii,t}$  which is the number of natives staying in  $i$ .
- ▶ Long-run factors are deviations and anomalies of rain shortages and excess temperatures. Anomalies are normalized by standard deviations.
- ▶ Natural disasters are the sum of 9 possible disasters over the 10 year period occurring in  $i$ .
- ▶ Specification includes origin fixed effects (e.g. geography) and destination-time fixed effects (e.g. immigr. policies).
- ▶ Poisson ML estimates.

Table 1: Baseline Results. Dependent Variable : Bilateral migration rate

	(1)	(2)	(3)	(4)
	Poor countries	Middle income	Poor countries	Middle income
<i>Variable</i>	<i>Climatic Deviations</i>		<i>Climatic anomalies</i>	
Natural Disasters	-0.238 (0.179)	-0.187 (0.120)	-0.218 (0.179)	-0.236* (0.126)
Excess Temperature	-0.021 (0.103)	-0.504*** (0.082)	-0.001 (0.119)	-0.725*** (0.133)
Shortage Precipitation	0.017 (0.089)	0.316*** (0.075)	0.054 (0.103)	-0.132* (0.068)
Origin FE	YES	YES	YES	YES
Destination-Year FE	YES	YES	YES	YES
Number observations	22,362	113,767	22,362	113,767
R <sup>2</sup>	0.200	0.973	0.201	0.980

Notes: Time period: 1960-2000. Poisson ML estimates. Estimated specification : equation (1)



Table 2: Specific Emigration patterns: **contiguity**. Dependent Variable : Bilateral migration rate

	<b>Poor countries</b>	<b>Middle income</b>	<b>Poor countries</b>	<b>Middle income</b>
Variable	<i>Climatic Deviations</i>		<i>Climatic anomalies</i>	
Natural Disasters	<b>-0.677***</b> (0.155)	-0.247* (0.123)	<b>-0.695***</b> (0.169)	<b>-0.314**</b> (0.131)
Disasters*Contiguity	<b>1.177***</b> (0.132)	0.984 (0.163)	<b>1.270***</b> (0.120)	<b>1.095***</b> (0.182)
Excess Temperature	0.098 (0.086)	-0.446*** (0.091)	0.183 (0.136)	-0.668*** (0.149)
Temperature*Contiguity	-0.299 (0.204)	-0.967*** (0.125)	-0.317 (0.335)	-0.816*** (0.134)
Precipitation Shortage	-0.156** (0.072)	0.286*** (0.077)	0.173 (0.130)	-0.049 (0.070)
Precipitation*Contiguity	0.559*** (0.175)	0.689** (0.335)	-0.820*** (0.266)	-0.941*** (0.136)
Origin FE	YES	YES	YES	YES
Destination-Year FE	YES	YES	YES	YES
Number observations	22,362	113,767	22,362	113,767
Pseudo R <sup>2</sup>	0.374	0.977	0.394	0.970

Notes: Time period: 1960-2000. Poisson ML estimates. Estimated specification : equation (2).  $C_{ij}$  is a dummy variable capturing whether origin and destination share a common border

Table 3: Specific Emigration patterns:colonial links\_ Dependent Variable : Bilateral migration rate

	Poor countries	Middle income	Poor countries	Middle income
	<i>Climatic Deviations</i>		<i>Climatic anomalies</i>	
Natural Disasters	-0.255 (0.180)	-0.235** (0.118)	-0.241 (0.179)	-0.317** (0.126)
Disasters*Colony	0.533*** (0.222)	0.845*** (0.208)	0.661*** (0.152)	0.948*** (0.155)
Excess Temperature	-0.012 (0.106)	-0.467*** (0.084)	0.001 (0.122)	-0.691*** (0.135)
Temperature* Colony	-0.363** (0.183)	-0.592*** (0.115)	-0.221 (0.191)	-0.534*** (0.128)
Precipitation Shortage	0.005 (0.089)	0.303*** (0.075)	0.074 (0.107)	-0.062 (0.070)
Precipitation* Colony	0.318 (0.243)	0.060 (0.292)	-0.347 (0.213)	-0.471*** (0.143)
Origin FE	YES	YES	YES	YES
Destination-Year FE	YES	YES	YES	YES
Number observations	22,362	113,767	22,362	113,767
Pseudo R <sup>2</sup>	0.205	0.981	0.202	0.974

Notes: Time period: 1960-2000. Poisson ML estimates. Estimated specification: equation (2).  $C_{ij}$  is a dummy variable capturing whether origin and destination shared a colonial link after 1945.

## Summarizing the findings

- ▶ No clear global effect of SR factors and LR factors in poor developing countries → reflect existence of constraints.
- ▶ For middle income countries, estimation of LR factors reflects that **measures of climatic shocks matter** (see rainfall shortages)
- ▶ The corridor specific effects suggest that **natural disasters can exert a contrasted effect: negative global effect** (reflecting poverty traps, liquidity constraints and/or higher propensity to move within countries).
- ▶ But in face of natural disasters : **emigration to destinations with lower migration costs**. Low distance (contiguous countries) or countries with existing links (and in general high diasporas): colonial links.

## Conclusions

- ▶ This paper reflects the importance of **methodological options** when capturing the impact of climatic factors on migration.
- ▶ Many different choices to do: level of analysis, type of data, geographical coverage, type and measures of climatic shocks, type of channels, ...
- ▶ Paper illustrates the importance of **constraints to mobility in poor countries** → the impact might not be as big as expected.
- ▶ Our analysis also shows that **where people go is important** to take into account.
- ▶ Finally, the findings illustrate the importance of **how to measure the climatic factors**.