Human Mobility and Climate Change

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WITHER THE WEATHER??

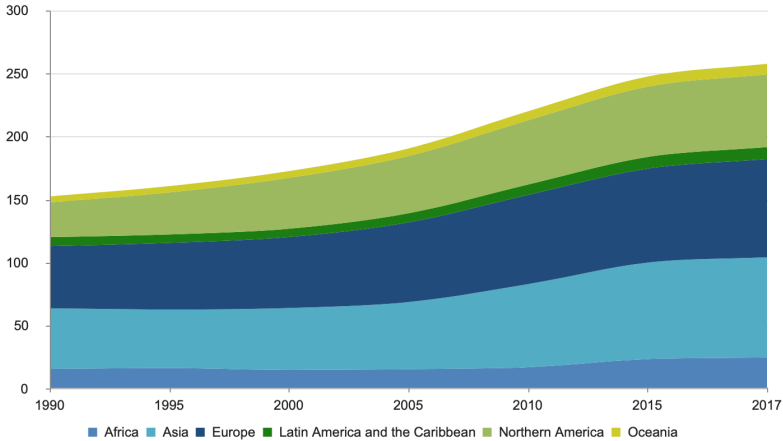
Welcome to the Age of Climate Migration

Where should you move to save yourself from climate change?

Climate change 'will create world's biggest refugee crisis'

The global climate refugee crisis has already begun

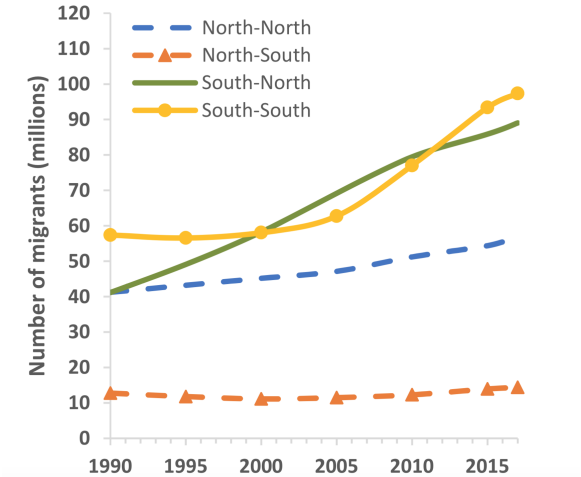
1. Introduction: What's in a number?



International migrants (millions) 1990-2017.

Source: UNDESA (2018)

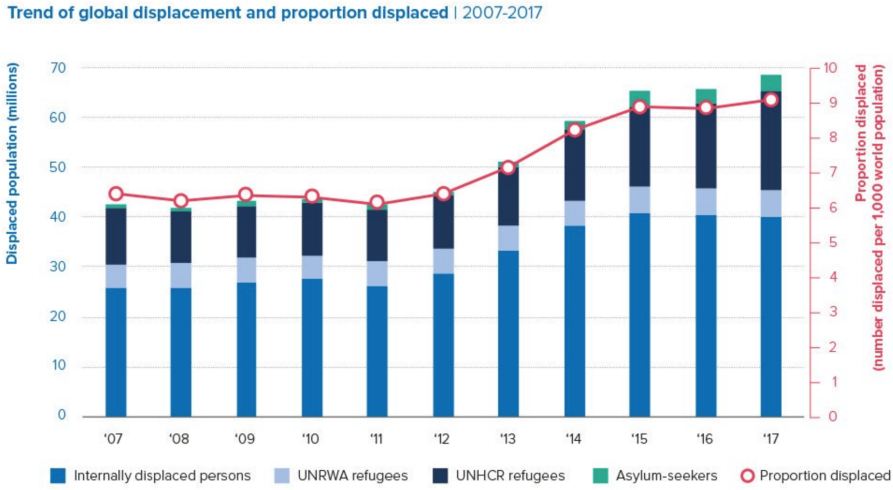
International migration in the last decades



Origin and destination of international migrants by development group

Source: UNDESA (2017)

Displacement: the numbers



Source: UNHCR (2018)

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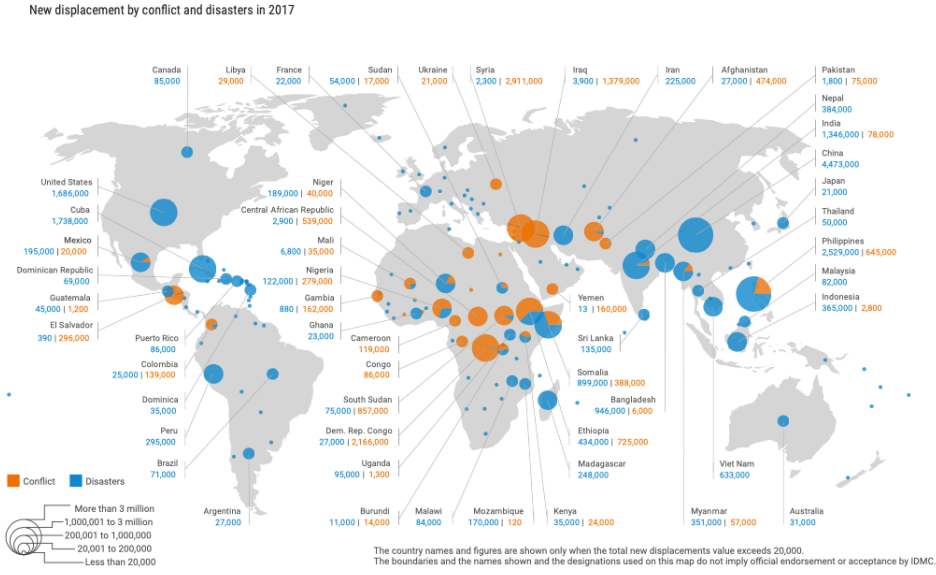
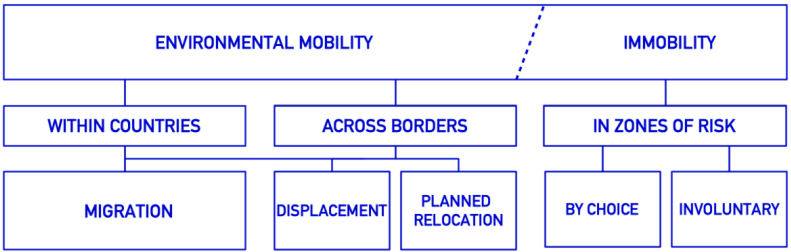


From economic migration to forced displacement



Source: Adapted from Kumari Rigaud et al., 2018. Groundswell: Preparing for Internal Climate Migration. Washington DC: The World Bank.

Who are climate migrants?

A refugee is a person who is outside of her country of nationality owing to a well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group or political opinions...

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Climate migrants are persons or groups of persons who, predominantly for reasons of sudden or progressive changes in the environment that adversely affect their lives or living conditions, are obliged to leave their habitual homes, or choose to do so, either temporarily or permanently, and who move either within their country or abroad.

IOM (2014)

The migratory response depends on the form of climatic change

- **Slow onset events**:
  long-term changes in temperature and rainfall averages, drought, desertification, sea-level rise.

- **Fast onset events**:
  floods, tropical cyclones

What do we know about migratory responses?

Internal migration:

- *Fast onset events:*
  - Floods induce temporary displacement migration.
    (Perch-Nielsen et al. 2008; Gray and Mueller, 2012)
  - Hurricanes induce migration that can be permanent.
    (Strobl, 2011; Boustan et al., 2012; Baez et al., 2017; Boustan et al., 2017)

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- Natural disasters and higher temperatures increase urbanisation rates.
  (Barrios et al., 2006; Marchiori et al., 2012; Beine and Parsons, 2015; Henderson et al., 2017)

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- But, higher temperatures decrease long-term emigration rates from the poorest countries.
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- The role of cities...
  (Henderson et al., 2017)

2. Modelling migration choices

No *good* model ever accounted for *all* the facts, since some data was bound to be misleading if not plain wrong.

Francis Crick, *What Mad Pursuit* (1988)

The gravity model (Ravenstein, 1885)

$$M_{ij} = G\frac{P_i^{\alpha} P_j^{\beta}}{d_{ij}^{\gamma}}$$

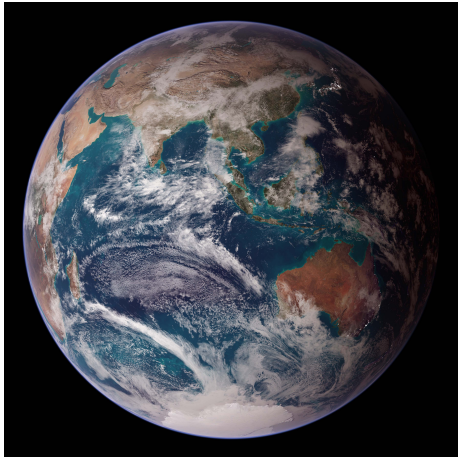
M_{ij}=bilateral migration flow from i to j

P_i=population in country i

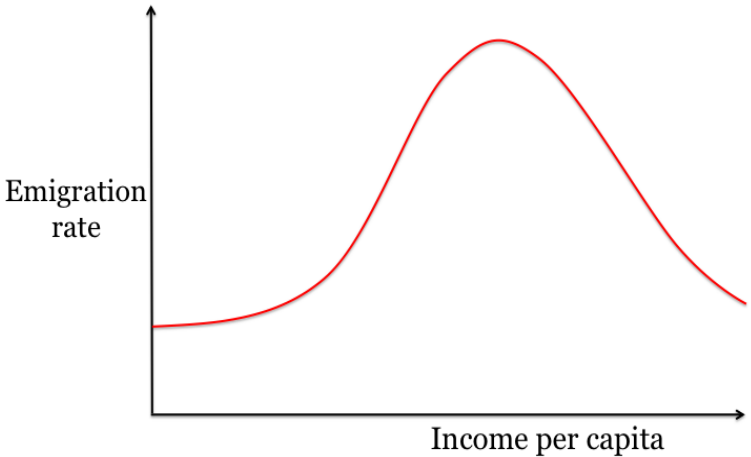
P_j=population in country j

d_{ij}=distance between country i and j

- Since extended to incorporate the amenity of living in a location.
- Problematic with bad controls...
- Correlated shocks?



Selective migration: the migration transition



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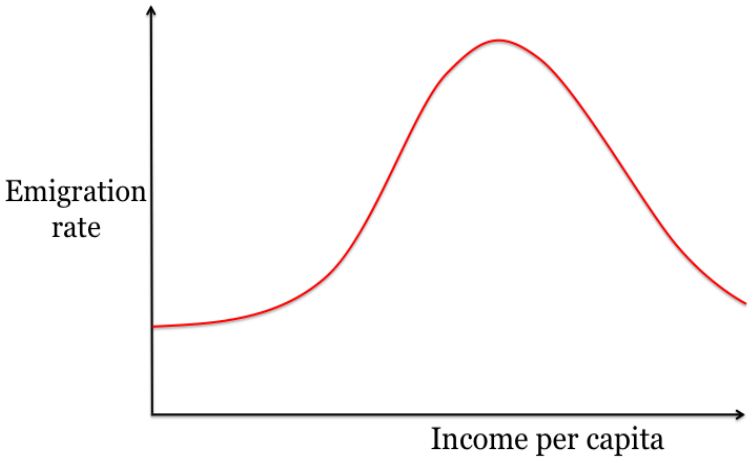

→ The importance of liquidity constraints

(Bazzi, 2017; Kleemans, 2015)

Climate change and selective migration: the Roy-Borjas model

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- Destination country wage rate assumed not dependent on weather factors (T):

$$w_1 = \mu_1 + \epsilon_1$$

- Assumptions:

$\mu_1 > \mu_0(T_0)$; $\epsilon_0 \sim N(0, \sigma_0^2)$ and $\epsilon_1 \sim N(0, \sigma_1^2)$

Climate change and selective migration in the Roy-Borjas model

- An individual migrates if the gains from migration exceed the migration costs C:

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- The migration rate in poor countries can be defined as

$$1 - \Phi(C - \mu_0(T_0))$$

where Φ is the cdf of a normal distribution.

Climate change and selective migration

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  - migration increases in middle income countries;
  - migration decreases in poor countries.
- If migration costs are weather sensitive, migration decreases following an increase in temperature.
- If climate change worsens the income distribution in poor countries, migrants may become less selected on skills.

3. How do the models stand up to reality?

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Climate change impacts on human capital and migration

Introduce schooling:

$$s = \mu_s(T_0) + \epsilon_s$$

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- The effects of climate change on human capital will further limit migration, in addition to any direct effect on wages?
- ...but this does not take into account fertility changes nor indirect incentives to invest in education. (Shayegh, 2017; Casey et al., 2019)

More focus on the mechanisms!

- agricultural impacts
  (Schlenker, Hanemann and Fisher, 2006; Deschênes and Greenstone, 2007; Roberts and Schlenker, 2009)
- labour productivity effects in other sectors
  (Graff Zivin and Neidell, 2014; Somanathan et al., 2015)
- conflict
  (Burke, Hsiang and Miguel, 2015; Ghimire et al., 2015; Bosetti, Cattaneo and Peri, 2018; Abel et al., 2018)
- health
  (Deschênes and Moretti, 2009; Deschênes, 2014; Burgess et al., 2017)

Taking other adaptation strategies into account

On-farm adaptation

- Changes in technology: irrigation, tilling, drought-resistant crops and crop variety (Olmstead and Rhode, 2011; Hornbeck and Keskin, 2014; Taraz, 2018)
- Changes in dates of planting and harvesting (Kala, 2017)

Adaptation via the off-farm labour market

- Asset accumulation, use of formal or informal credit and participation in risk-reducing networks

Theoretical framework

- Existence of other adaptation options, A_0, in the origin country (public infrastructure).
- Origin country wage rate (with ϵ_0 normally distributed):

$$w_0 = \mu_0(T_0, A_0) + \epsilon_0$$

- Adaptation reduces the negative impact of "bad weather" factors (higher temperatures T):

$$\frac{\partial \mu_0(T_0, A_0 = 1)}{\partial T_0} > \frac{\partial \mu_0(T_0, A_0 = 0)}{\partial T_0}$$

Modelling migration with other forms of adaptation

- Access to other adaptation options would reduce the incentives to migrate:

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- Access to other adaptation options would enable paying for migration:

$$\mu_0(T_0, A_0) + \epsilon_0 > C$$

4. Outstanding challenges for modelling climate induced migration

Challenge 1:

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- Different destination choices...

Challenge 2:

Better integration of beliefs and adaptation to climate change

- Difference in response to risk and the actual ex post response to an extreme weather event.

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- ...but migration as adaptation is typically modelled without taking beliefs into account.
- Accurate forecasts would allow for welfare-enhancing anticipatory migration.
  (Rosenzweig and Udry, 2014)

Challenge 3:

Improve the projections of future migration caused by climate change

- Learning from the past
- Migration surveys on intentions to migrate
- General equilibrium models
- Agent-based modelling

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(Hornbeck, 2012; Long and Siu, 2018)

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  Q2: To which country would you like to move?

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Nevertheless, migration intentions have been found to correlate well with realized migration.

(Docquier, Peri and Ruyssen, 2014; Tjaden, Auer and Laczko, 2019; Bertoli et al., 2019)

Challenge 3: Projections of future migration caused by climate change

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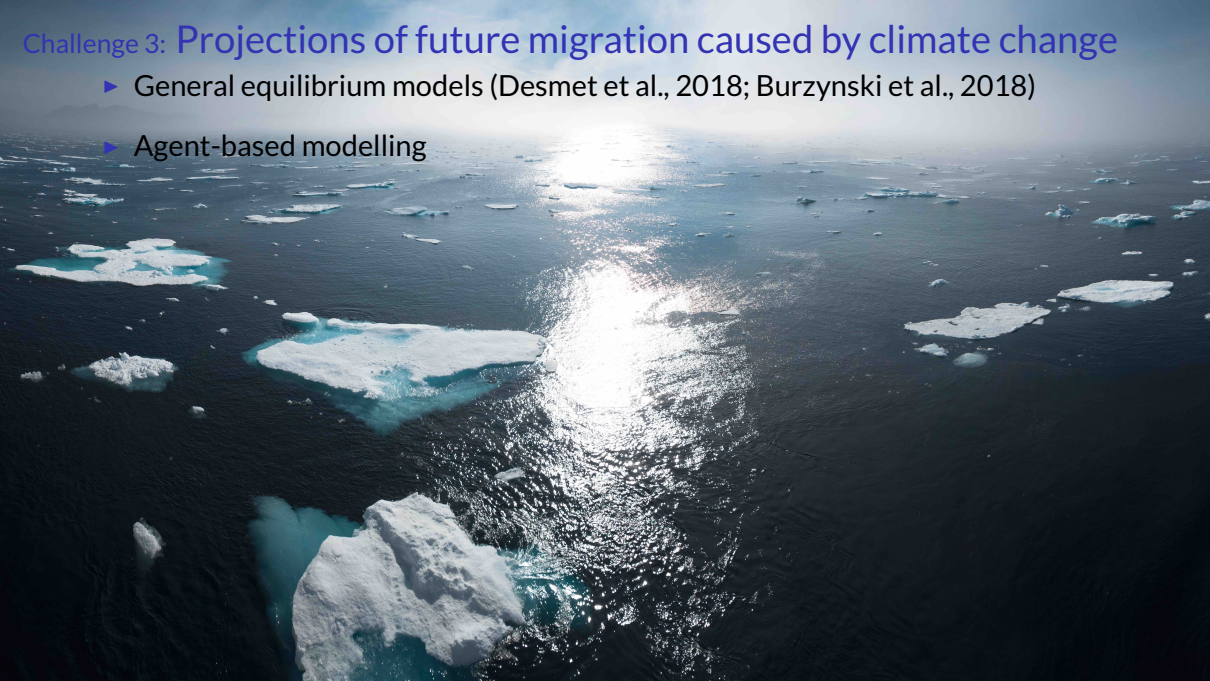

Conclusions

- Future research needs to integrate better the forced nature of climate-induced displacement;
- improve the modelling of beliefs and their role in integrated analysis of other adaptation options together with migration decisions;
- use a wider set of tools to build projections for the future (GE models, ABM).

Many thanks to my co-authors and colleagues who collaborated with me on research in this area:

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Meta analyses

Beine, M. and L. Jeusette.
A meta analysis of the literature on climate change and migration.

Sedova, B. et al.
A meta-analysis of the climate migration literature.

Hoffmann, R. et al.
A meta-analysis of country-level studies on environmental change and migration.