Climate Migration

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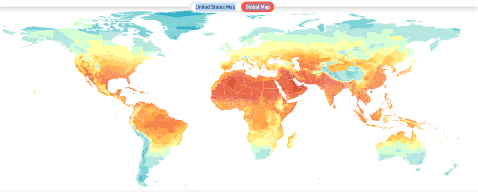
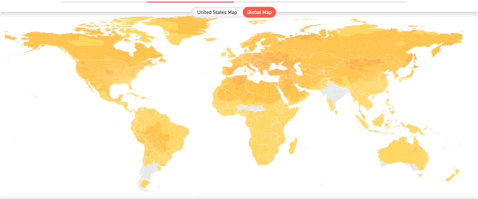
Climate change is a spatial phenomenon

- Country
  - Poorer countries will be more exposed
- Regional
  - Coastal parts of countries
- Sectoral
  - Weather-dependent agriculture vs. manufacturing
- Spatial issue: will likely lead to flows of people
  - Migrants: leave because of both direct (e.g., weather) + indirect (e.g.,violence)
  - Migrants: cause both direct (e.g., wage impacts) and indirect (e.g., GE) effects

Temperature change: hitting poorest countries



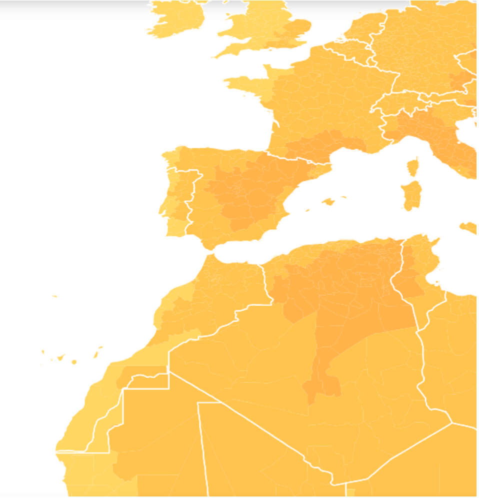
(a) Current



(b) Change

Source: Climate Impact Lab, https://impactlab.org

Spatial effects: temperature change heterogeneous within region/country



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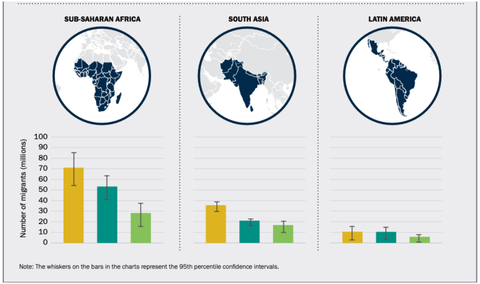
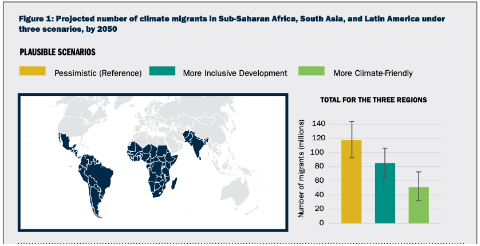
Number of climate migrants will potentially be large

- WB predicts 143m climate migrants (2.8% of pop) in SSA, South Asia, Latin America





World Bank, 2018, Groundswell report

Plan

Existing empirical evidence

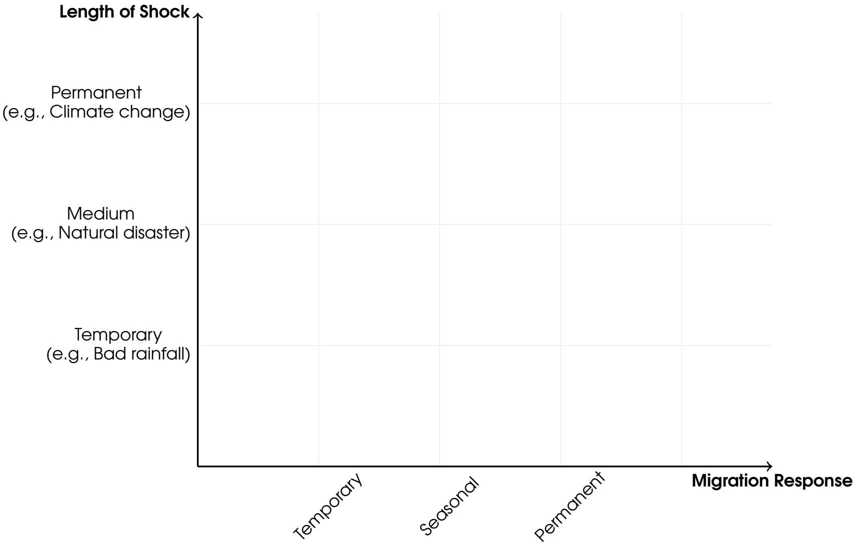
Baseline spatial model to analyze migration

- 2 locations
- N locations
- Endogenous prices

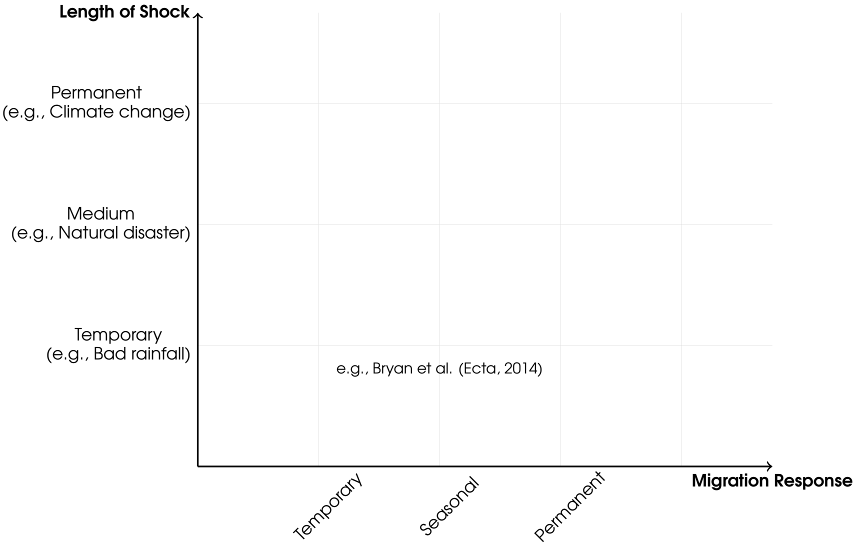
Model predictions & model problems

Conclusion

Taxonomy of climate shocks and migration responses



Taxonomy of climate shocks and migration responses



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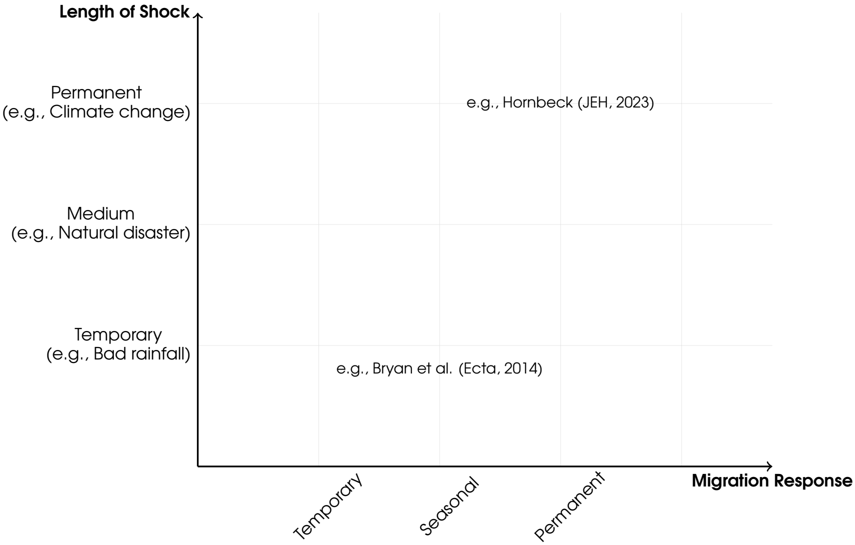
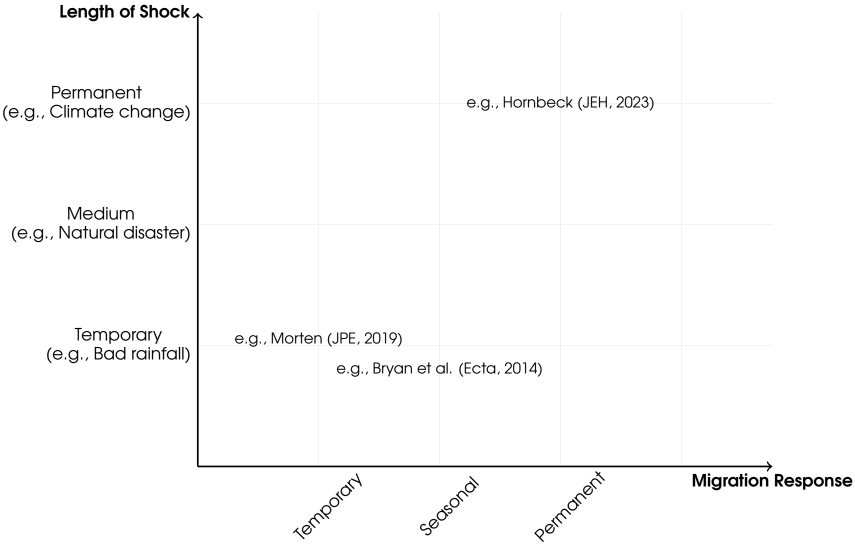


Taxonomy of climate shocks and migration responses



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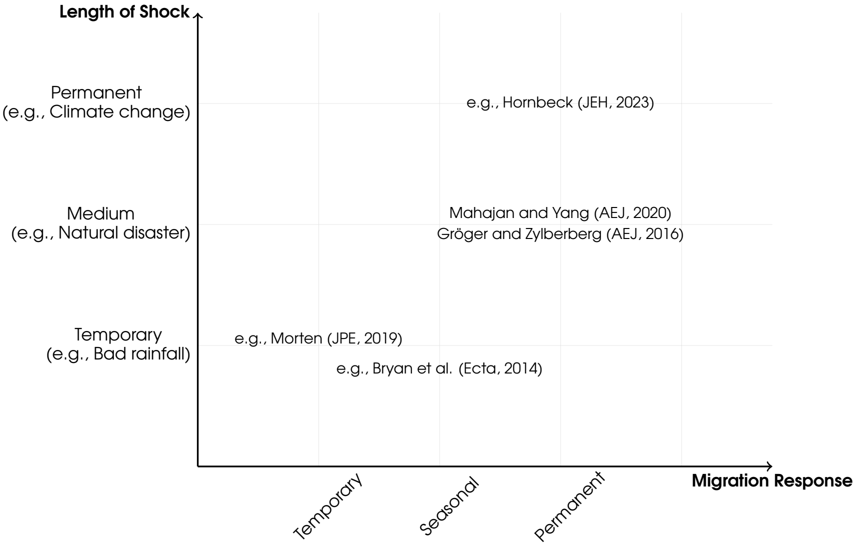
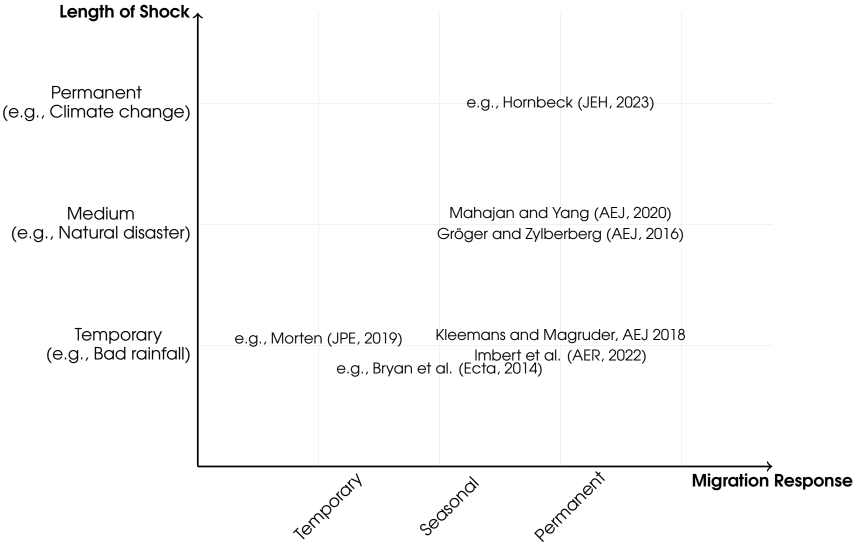


Taxonomy of climate shocks and migration responses



Where do (temporary/permanent) migrants go?

- Rural individuals very exposed to climatic shocks
- Destination choices
  - Rural-rural
  - Rural-urban
  - International
- Structural change: broader implications

External validity of current empirical results

- Current evidence: localized shocks
- What happens when climate shock hits many people at the same time?
  - World-wide permanent shock
- GE effects, other channels of assistance may differ

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Migration through the lens of a spatial model

- Economists think about spatial equilibrium
- People choose where to live based on returns and costs
  - Not just wages: amenities, cost of living,...
- Spatial equilibrium adjusts through endogenous wages, house prices
- Natural starting point for analyzing impact of climate shocks

Simple example: 2 locations, exogenous prices

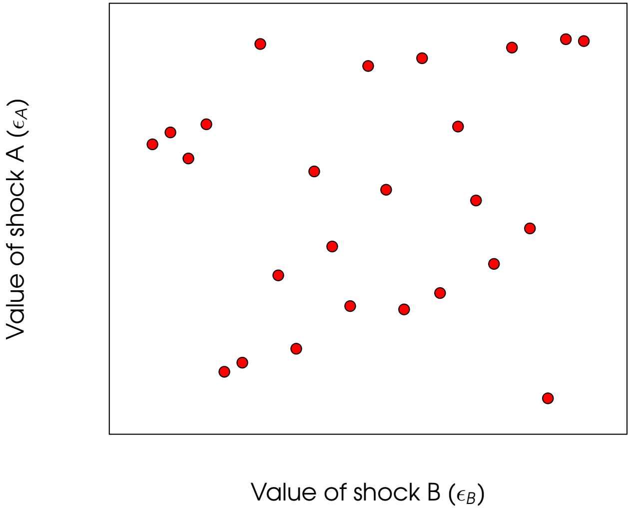
- Assume wages, rents, amenities are exogenous
- Person *i*'s indirect utility of being in A:

$$V_A^i = \underbrace{\textbf{wage}_A - \textbf{rent}_A + \textbf{Amenities}_A}_{\text{common to A } (V_A)} + \epsilon_A^i$$

- Person *i*'s indirect utility of being in B:

$$V_B^i = \underbrace{\textbf{wage}_B - \textbf{rent}_B + \textbf{Amenities}_B}_{\text{common to B } (V_B)} + \epsilon_B^i$$

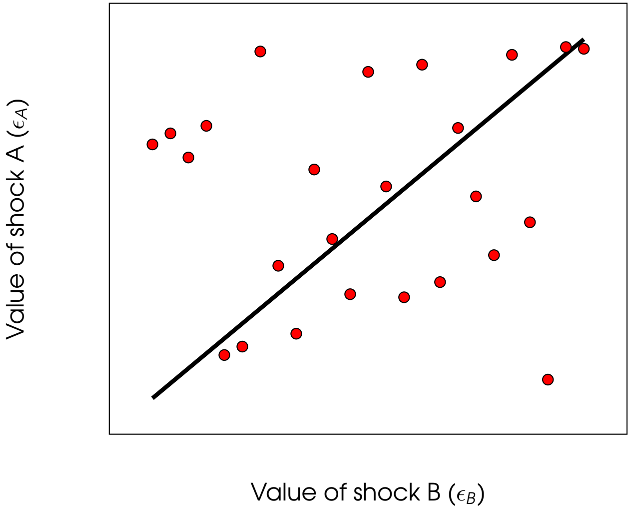
Migration decision: choose location that maximizes utility



Live in A if:

$$V_A + \epsilon_A > V_B + \epsilon_B$$
$$\epsilon_A > \epsilon_B + (V_B - V_A)$$

Migration decision: choose location that maximizes utility



Live in A if:

$$V_A + \epsilon_A > V_B + \epsilon_B$$
$$\epsilon_A > \epsilon_B + (V_B - V_A)$$

Spatial equilibrium: what share of people live in each location?

- Person i will choose to live in A if:

$$V_A + \epsilon_A^i > V_B + \epsilon_B^i$$
$$\rightarrow \epsilon_B - \epsilon_A < V_A - V_B$$

- Assume $\epsilon_B - \epsilon_A$ is uniform on $[-S, S]$[1]
- Overall share of the population who live in A

$$\begin{aligned} P(\epsilon_B - \epsilon_A < V_A - V_B) &= F_{\epsilon_B - \epsilon_A}(V_A - V_B) \\ &= \frac{V_A - V_B + s}{2s} \\ &= \frac{1}{2} + \frac{V_A - V_B}{2s} \end{aligned}$$

- If it's costly to move from b to a: return is $V_A - V_B - \tau$

$$P(\text{move to A if start in B}) = \frac{1}{2} + \frac{V_A - V_B - \tau}{2s}$$

[1] $F(x) = \frac{x-a}{b-a}$

How to extend to more than 2 locations?

- Can easily extend to whole country / whole world
- Very convenient to assume that the ϵ are distributed extreme-value
- In this case, get closed-form solutions for migration:

$$\text{Gumbel}: p(\text{choose i}) = \frac{e^{v_i}}{\sum_i e^{v_i}}$$

$$\text{Frechet}: p(\text{choose i}) = \frac{v_i^{\theta}}{\sum_i v_i^{\theta}}$$

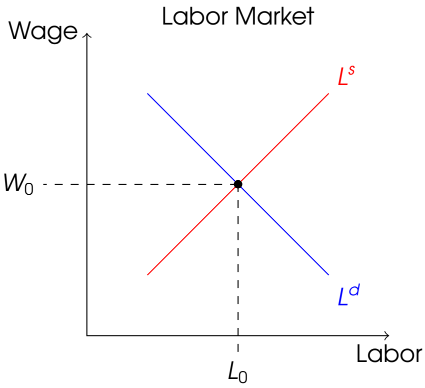
- Can make predictions about how people will move, how welfare will change
- But the economics is the same as the simple case

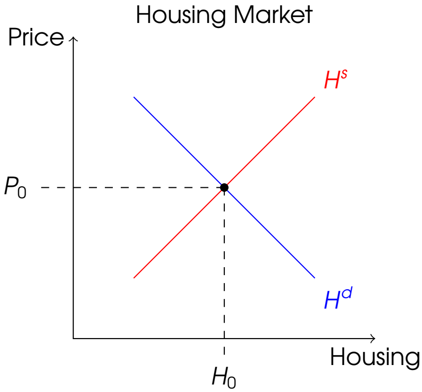
Endogenous prices (wages, housing, goods price)

- First model with endogenous prices: Rosen-Roback (endogenous cost of living)
  - Easy to extend to endogenous wages, trade model for prices
- Consider a productivity shock in A
  - Wages increase in A
  - Holding prices constant, more people want to live there
  - If more people move, rents increase
    - Could easily add other spillovers e.g., congestion, agglomeration
  - So, not all people would move
- End up with new equilibrium where noone wants to change location

See Moretti (2011, Handbook of Labor Economics) and Redding and Rossi-Hansberg (2018, Annual Review) for overviews of spatial models.

Spatial adjustment after a productivity shock





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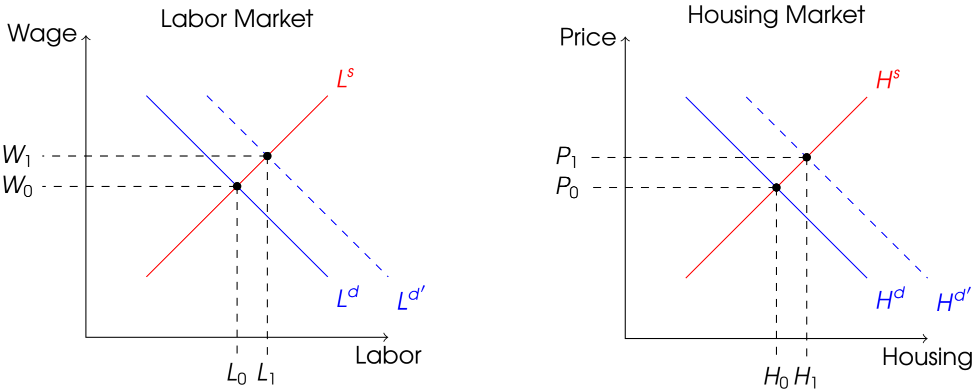

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What can we do with a model?

Spatial models could be use to answer many questions, here are three

1. How many migrants should we expect?
2. What will be the welfare impact of climate change?
3. How does the welfare impact depend on migration constraints?

Answering these question requires estimating key parameters of the model, e.g.,

- How many will leave affected areas? Elasticity of migration to productivity change
- What will happen to productivity at destination? Elasticity of productivity to population
- What will happen to amenity at destination? Elasticity of amenity to population
- $\rightarrow$ last two are congestion questions, important for what follows

We can then simulate based on climate scientist's predictions of physical impact

Example parameter estimation: amenity congestion

Migration into locations may create "congestion"

- Many people in London means less space to move, more disease etc.
- (these are policy dependent ...)

We usually model this as

- $a_l = \bar{a}_l N_l^{-\lambda}$
- Taking logs and giving an error: $\ln a_l = \ln \bar{a}_l - \lambda \ln N_l + \epsilon_l$
- We want to know λ: elasticity of amenity to population

Two steps to estimate

- a_l is a "residual": lots of people live in l but wages are low and rents are high $\Rightarrow a_l$ large
- Reverse causality requires instrument for N_l: use exogenous productivity

Answer

- In US cross sectional data: $\lambda = 0.32$ (Desmet et al. 2018)
- High productivity places have more people, but not as many as you might expect
- $\rightarrow$ very long run parameter

Other parameters and what question are we asking?

Important parameters for prediction

- Spatial distribution of productivity and amenity: rationalize wages and location choices
- Costs of migration: rationalize home bias

Other key "congestion" parameters

- Elasticity of production to population
- Elasticity of migration cost wrt number of migrants
- $\rightarrow$ first is estimated similar to λ, second assumed 0 (long run)

All taken from long run data, with low migration rates, which means we are asking:

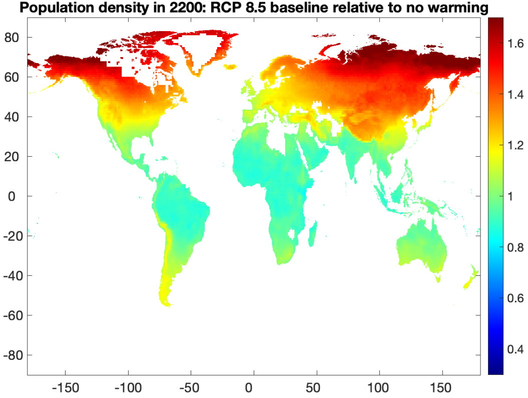
- What would be the impact of CC

$\rightarrow$ If the large permament change from CC leaves parameters unchanged

What does the model say? (Cruz and Rossi-Hansberg)

For warming alone, under RCP 8.5:

1. Welfare decreases by 6%
2. 1/2 a Billion people are displaced
3. If mig. costs $\uparrow$ 25%, welfare loss rises to 9%



How I interpret the model results

First key take-away

- Migration is essential for keeping losses low
- And there needs to be a lot of it

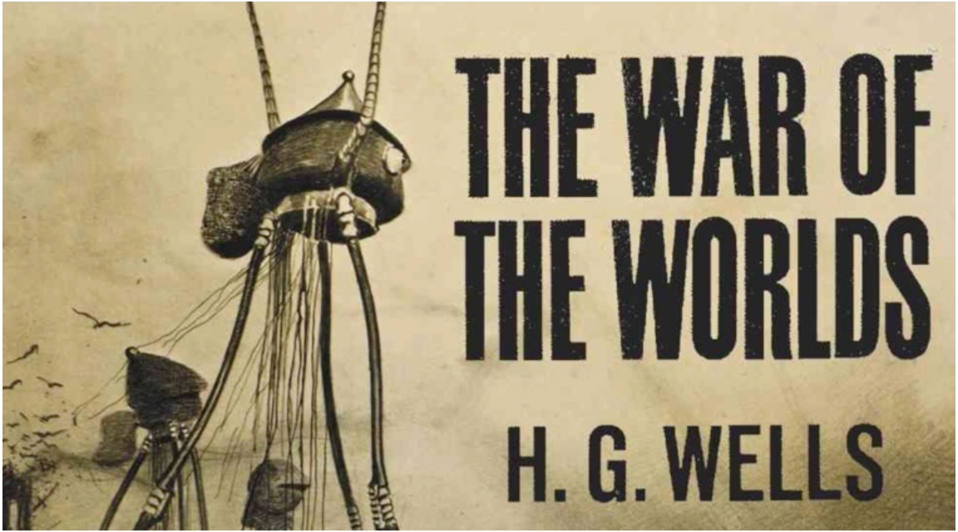
But, I see the 6% as an aspirational best case scenario

- The model is incredibly smooth, parameters are from long run, slow movement of people
- How things might look if we control "congestion"
  - Welcome migrants, build public goods in cities ...
  - Manage the timing and distribution of migrants?

But, as noted earlier

- Climate change is a permanent and large scale change
- Migration on historically large scale
- Not clear that the parameters are correct

Worst case scenarios: evidence from science fiction



- Thanks to Tom Cruise for data visualization

Worst case scenarios: evidence from science friction

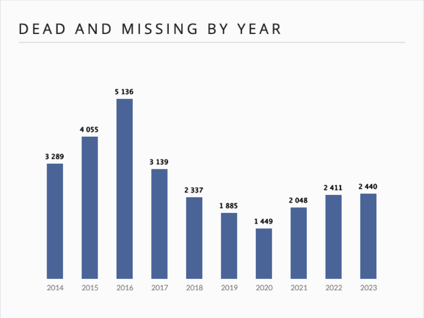
Four points from War of the Worlds

1. Real damages (deaths) occur at pinch points
   - Migration causes congestion at destination or on the path
   - These congestions are a (the?) source of losses from CC
2. We will (likely) choose to make pinch points worse
   - Close borders, create refugee camps, criminalize travel etc.
3. Migration cannot realistically be stopped
   - People will travel despite high costs, and they will then be in harm's way
4. Morally, we all suffer
   - It does not matter whether you are on the boat or not

Worst case scenarios: evidence from missing migrants

Messenia: 500 Presumed Dead

Mediteranean Per Year



https://missingmigrants.iom.int

Worst case scenarios: evidence from missing migrants

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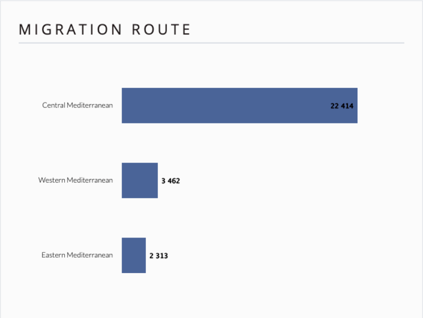
Mediteranean Total Since 2014



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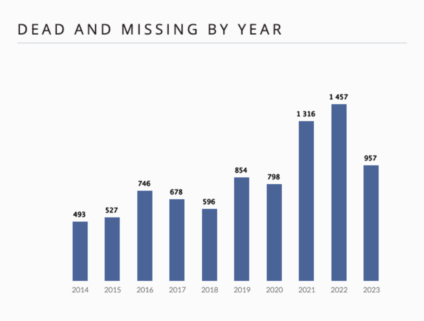
Americas Per Year



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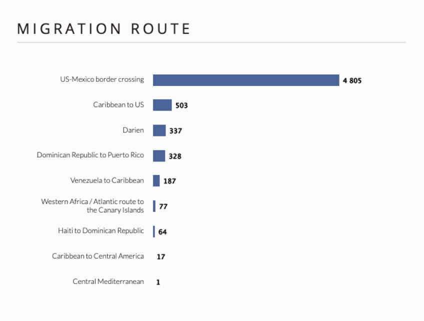

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Worst case scenarios: evidence from economists

Just a selection of what we know

- Rapid population growth causes conflict
  - Acemoglu, Fergusson, Johnson (2020)
- Refugee arrivals causes right wing voting
  - Dustman, Kasijeva, Damm (2019)
- Climate change traps populations in agriculture
  - Liu, Shadmasani, Taraz (2023)
- Politicians less likely to help recent migrants in India
  - Gaokwad, Nellis (2020)
- ...

What’s next? Find policies to get to 6%

Policy responses (that) matter

- House prices rise with refugees, but only if supply is inelastic
  - Rozo and Sviatschi (2021)
- More flexible labor markets help migrants adapt
  - Colmer (2021)
- Social cohesion between refugees and hosts improved through cash transfer to hosts
  - Beltramo, Nimoh, OBrien, Sequeira (In progress)
- Markets can be designed to allocate refugees more efficiently
  - Delacrétaz, Kominers, Teytelboym (2023)
- ...

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Some parting thoughts

Migration could play a huge role in adapting to climate change

- At best, a triple benefit
- $\rightarrow$ Adaptation, Mitigation, Development

But, it need not go well by itself

- We must identify, test, and perfect policies to
- $\rightarrow$ Smooth migrants pathways and landings
- $\rightarrow$ And keep damages as low as possible

This is a very large, but incredibly important challenge

$\rightarrow$ We need your help!