Climate Change, Conflict, and Migration: Evidence and Simulation results for MENA migration towards OECD

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Conflicts, Governance and Post-conflict Economic Agenda in War Afflicted Countries

Outline

- Literature Review
  - Climate change and migration
  - Climate change and conflict
- Modelling Climate Change (CLC):
  - Channels of transmission: temperature increase and sea level rise (SLR)
- Sketch of OLG model (145 countries + OECD as one country for destination of migrants)
- 3 scenarios (relative to a base of no CLC: minimalist-no CLC [$+0.09^0$;+0m.])
  - Maximalist [$+4.09^0$;1.3M]
  - Intermediate: [$+2.09^0$;1.1M]
  - Extreme-Utility [$+4.09^0$;1.3M;+ utility losses]
  - Extreme-Conflict [$+4.09^0$;1.3M;+ utility losses; + conflict in poorest]
  Results

Literature Review: CLC and migration

- Mix of case studies and cross-country econometric studies (See paper)
- Contrasted findings with small migration responses on slow-onset CLC (except historical—See Faigan 2008)
- Strong, but usually temporary migration, for fast-onset events (storms surges, floods)
- Beine-Jeusette (2018) meta-analysis unravels components resulting in contrasted findings
- Limitations of econometric studies based on past data
  - Slow-onset CLC at early stages
  - Distinguishing between climate and other factors difficult
  - Mobility responses are context-specific (geography, development, network, cultural, socio-economic)
- Paper: 'Quantitative theory' to simulate some likely effects on migration over 21st. C. in a world model

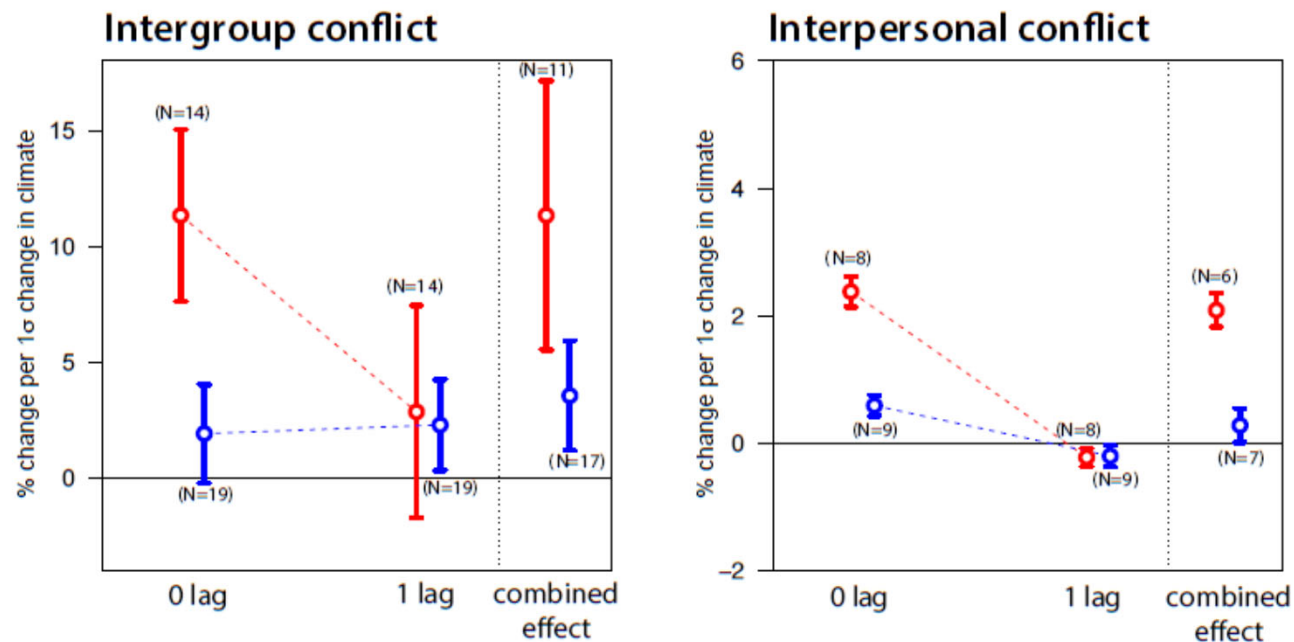# Literature Review: CLC and Conflict (55 studies)

Figure 6: Summary of meta-analysis for studies with distributed lag structure. Estimated precision-weighted mean effects and 95% confidence intervals for intergroup (left panel) and interpersonal conflict (right panel), for both contemporaneous and one period lagged temperature (red, left offset) and precipitation (blue, right offset). "Combined" effects equal the sum of the contemporaneous (0 lag) and one period lagged effects for studies where the calculation was possible. The number of studies contributing to each estimate is given in parentheses.

High degree of agreement across 55 panel studies that high temperatures and other extreme climate outcomes associated with more violence : $+2^0$ C predicted by 2050 ($\approx 3\sigma$).
In simulations, we take the mean result of this meta study: $+1\ \sigma$ increases probability of conflict by 11%

Objectives and Focus

- Estimate internal and international mobility responses to long-term, slow-onset CLC under current law and enforcement policies 'validated' by backtracking simulations for 2010 and socio-economic projections uptto 2040.

- Simplifying assumptions about CLC
  - Exogenous CLC (no feedback from growth and urbanization on CLC)
  - Long-term direct CLC=Rise in temperature + SLR
  - Indirect effects via utility loss and conflicts

- Focus on migration decisions via mechanisms recognized in theoretical and empirical literature
  - Role of migration costs
  - Fertility and education response
  - Distribution implications via 2 types of labor: skilled and unskilled

Why Link migration (and conflict) to CLC

- Heading to uncharted territory
- Surface temperature is rising at an accelerated rate since 1980
- SLR has also accelerated sharply since ≈2000 due to loss of antartic sheet in West Antarctica (see next slides)

- Many economic implications documented in Dell et al. (2014)
  - Redistribution of TFP towards higher latitudes
  - Health/drudgery of work (modelled here as utility loss)
  - Conflicts

- Heterogeneous effects across areas/sectors w/n & across countries

Contribution

- Granularity in CLC (temp +SLR) (1kmX1km) and in economic structure
- Disentangle contributing factors: displacements from flooded areas vs. economic migration
- TFP and forced displacement vs. 'less firmly' rooted effects (utility loss and conflicts)
- Two-sector model (agriculture/non-agriculture) two-class (skill/unskill), two area (flooded/unflooded) OLG model over 21st C solved by backward deduction over 30 yrs period: 2040,2070,2100)
- Modelling shortcuts : No trade &no relative prices between Ag and non-ag

- **Contribution: Reasonably suggestive predictions about likely effects and international migration responses to CLC for 145 countries to OECD countries (treated as 1 country)**

Temperature paths under RCP4.5
Distribution of changes in temperature by country and latitude in 2100
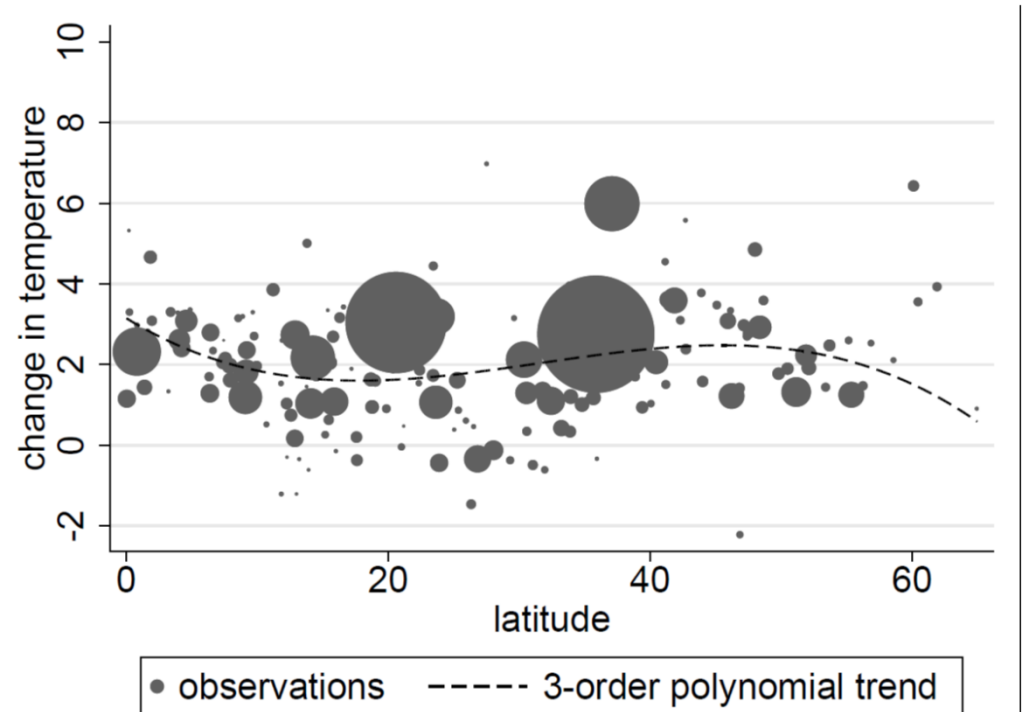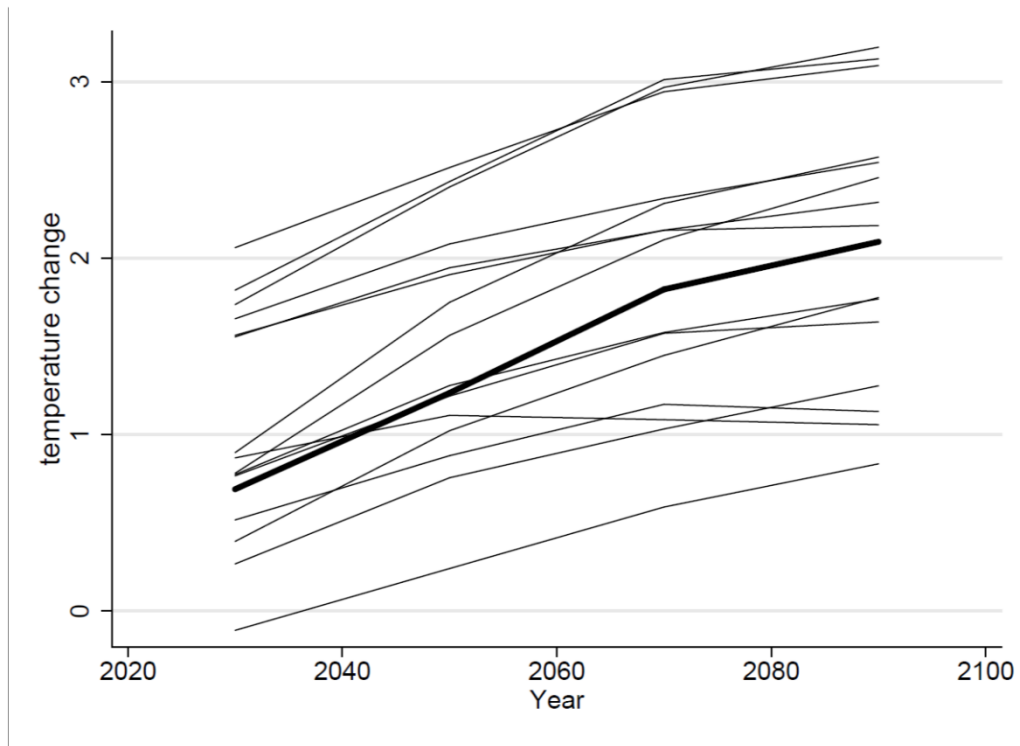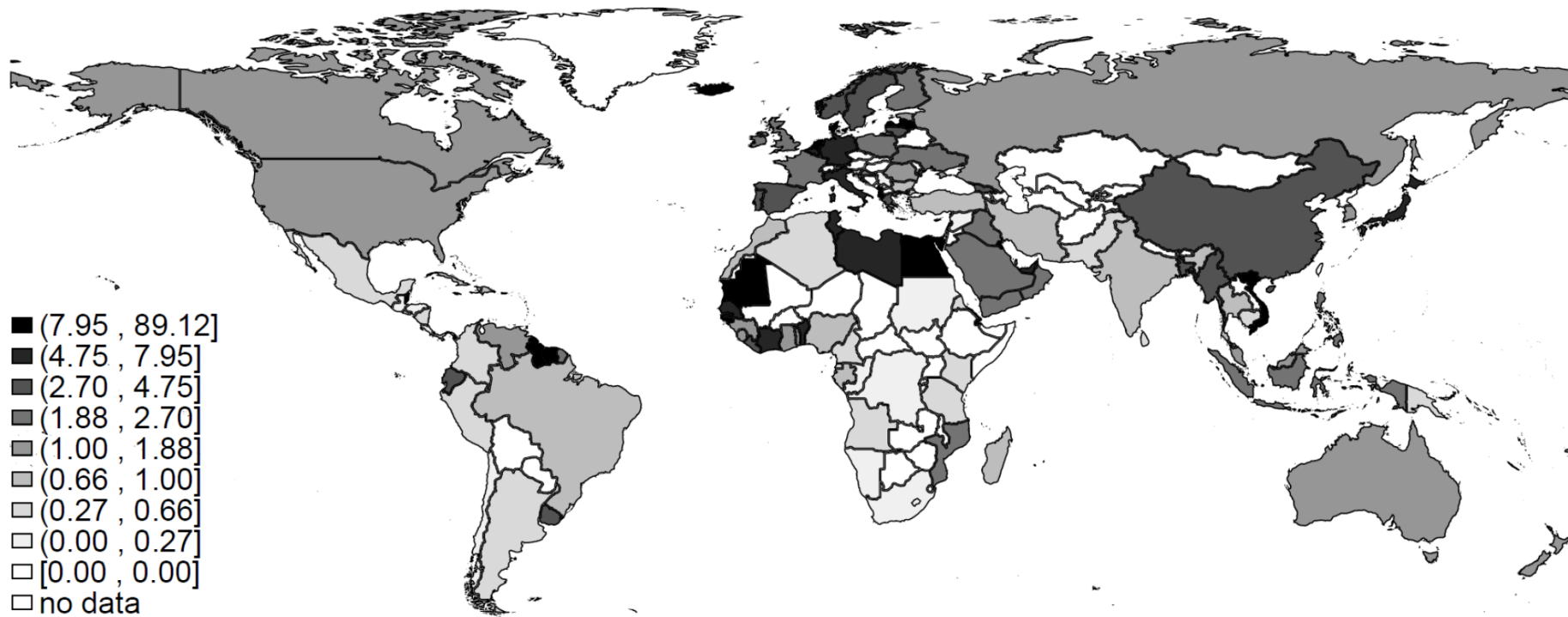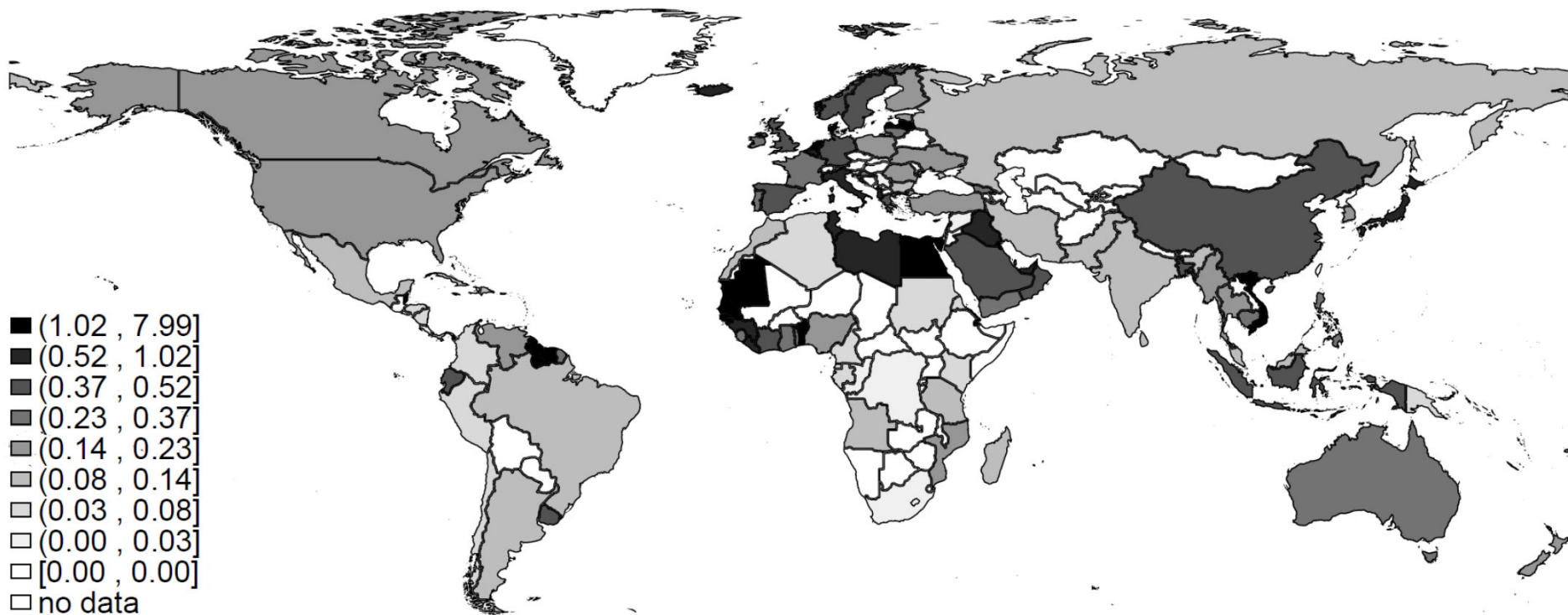
Sea level rise
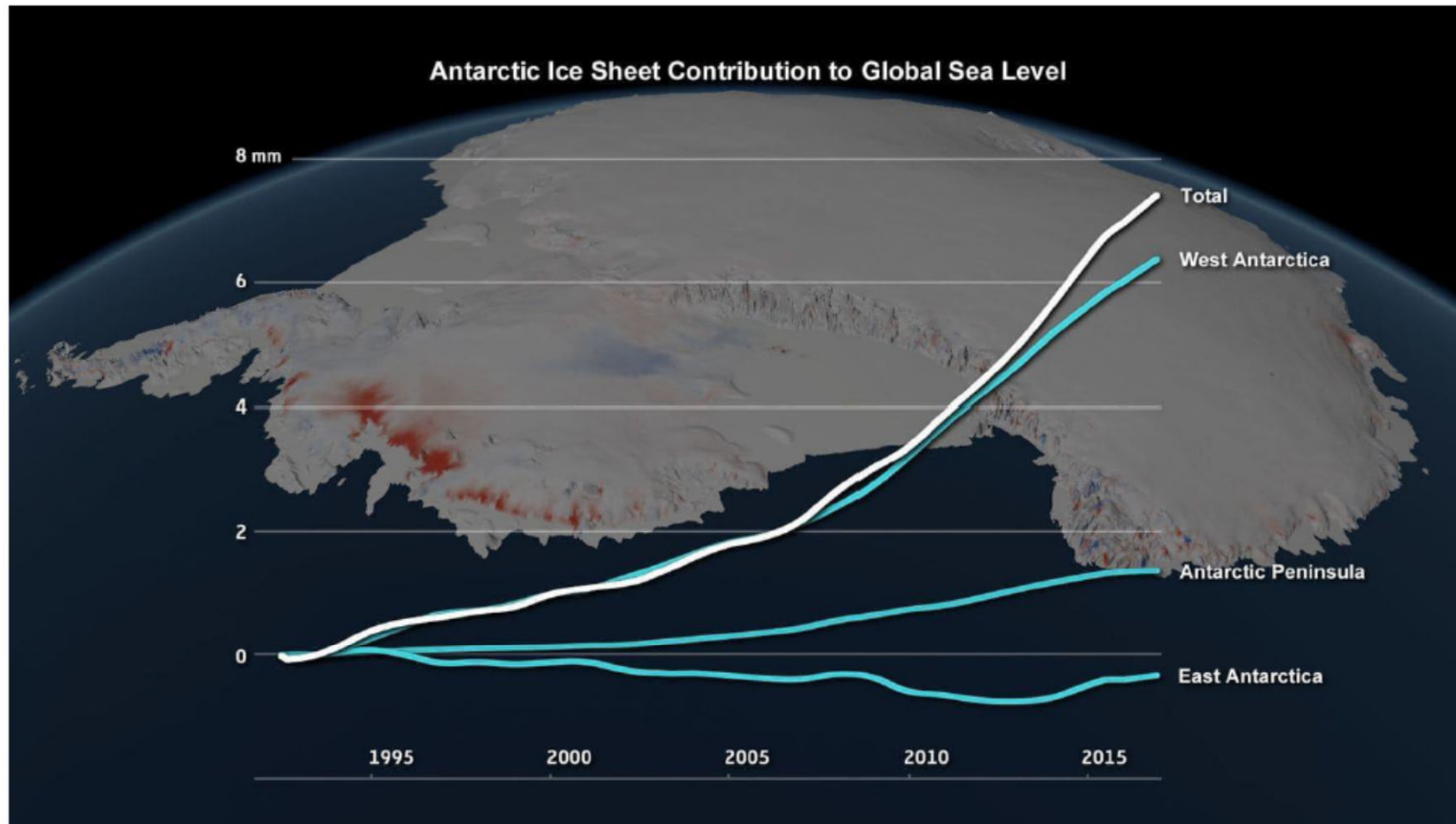
Sea-level contribution attributed to the Antarctic ice sheet between 1992 and 2017. IMBIE/Planetary Visions) Shepherd et al. (2018)

Population shares living below 1.1 m in 2010 (10 bins)

Legend:
- ■ (7.95 , 89.12]
- ■ (4.75 , 7.95]
- ■ (2.70 , 4.75]
- ■ (1.88 , 2.70]
- ■ (1.00 , 1.88]
- ■ (0.66 , 1.00]
- □ (0.27 , 0.66]
- □ (0.00 , 0.27]
- □ [0.00 , 0.00]
- □ no data

Population shares living between 1.1m & 1.3m in 2100 (10 bins)

Legend:
- (1.02 , 7.99]
- (0.52 , 1.02]
- (0.37 , 0.52]
- (0.23 , 0.37]
- (0.14 , 0.23]
- (0.08 , 0.14]
- (0.03 , 0.08]
- (0.00 , 0.03]
- [0.00 , 0.00]
- no data

Global Distribution of Vulnerability to Climate Change
Combined National Indices of Exposure and Sensitivity

10 Extreme vulnerability
9 Severe
8 Serious
7 Moderate
6 Moderate
5 Modest
4 Modest
no data

National Boundary —
Subnational boundaries dissolved
from countries for clarity of vision   Robinson Projection
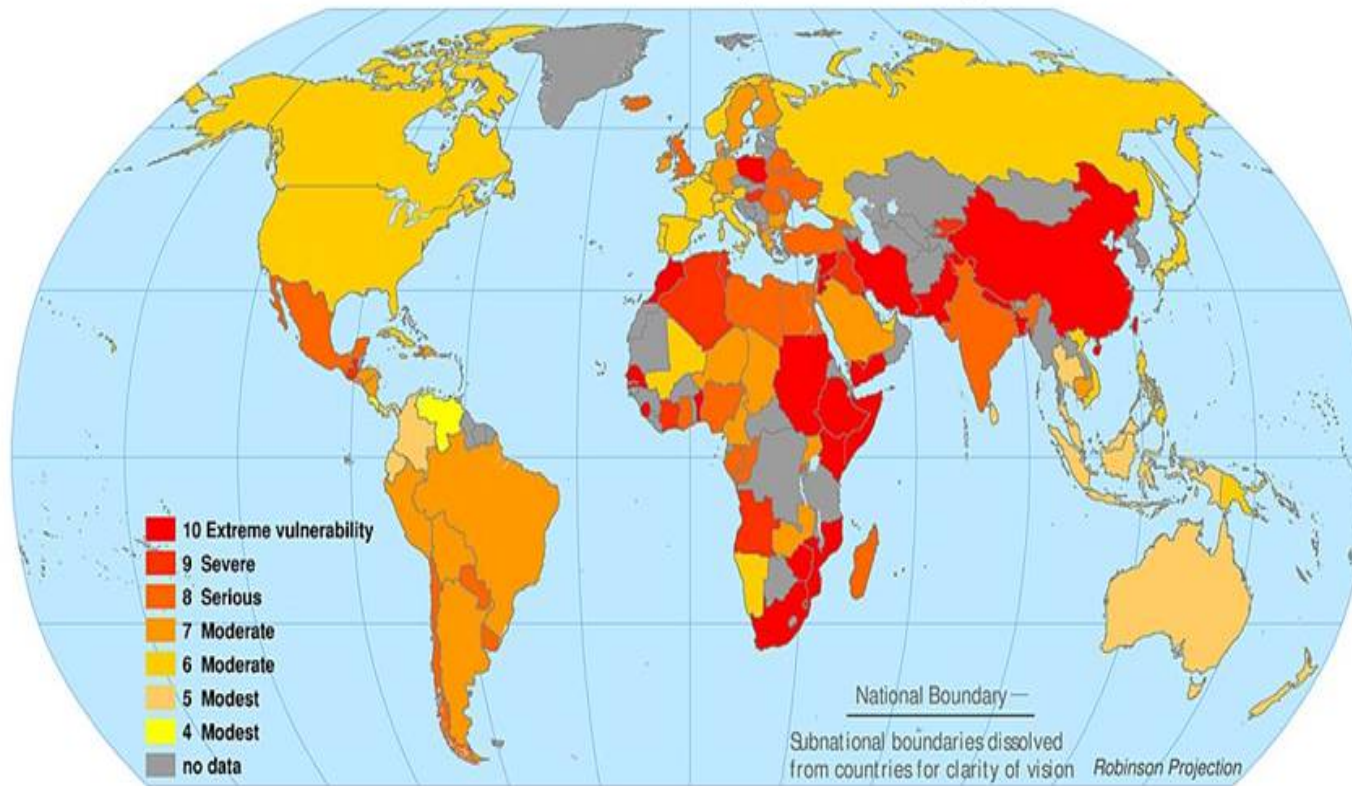
Scenario A2-550 in Year 2100 with Climate Sensitivity Equal to 5.5 Degrees C
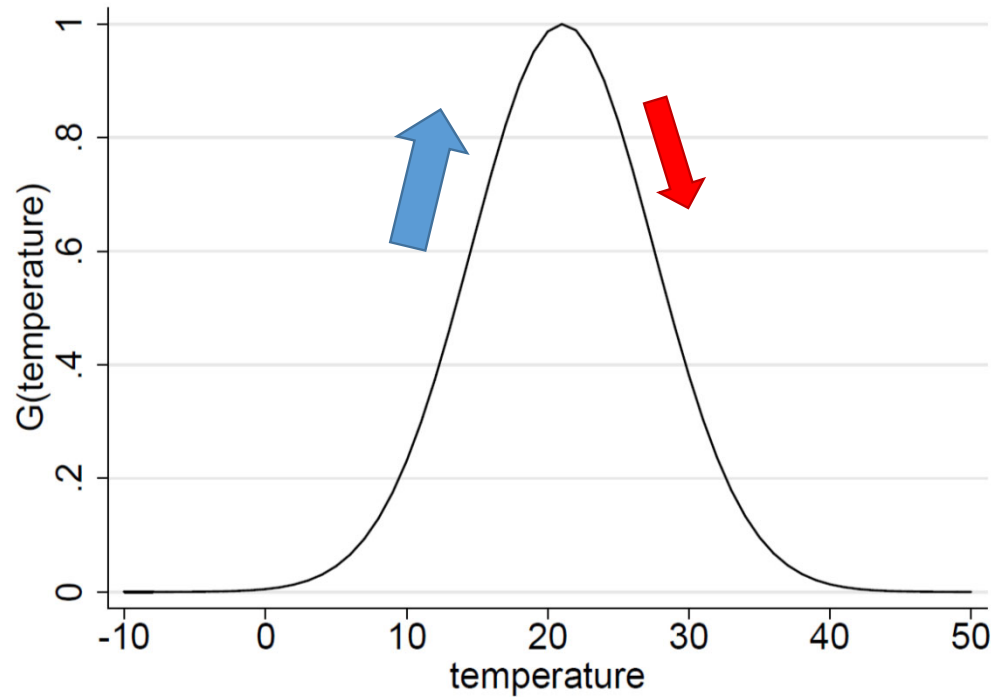Annual Mean Temperature with Aggregate Impacts Calibration

MENA in second most vulnerable group of countries

Channels of Transmission (1): Temperature and Productivity (as in Desmet and Rossi-Hansberg (2015))
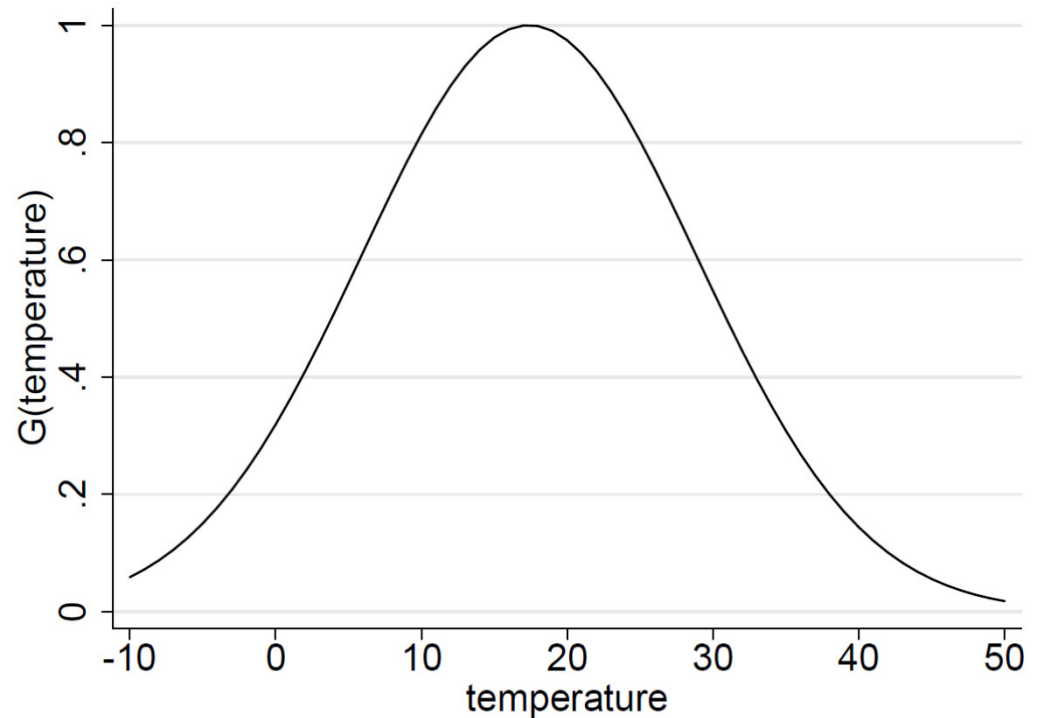
Agriculture   Productivity and Temperature   Non- Agriculture

$9.4^0 < 21.1^0 < 32.9^0$ Range $-3^0 < 17.4^0 < 38^0$

Channels of Transmission (2)

- Temperature and utility
  - Output per worker falls by 2% per $+1^0$ when above 22^0

- Use of NASA data to identify share of population per elevation

- Relocation costs for forcibly displaced people: lose B=0.5 of their labor earnings

- One σ increase in temperature raises intergroup conflict by 11.3 percent in selected countries (here the 10 poorest)-From Burke et al. meta-analysis

- Long-term conflicts captured by a reduction in int'l migration costs so as to raise emigration stocks by a factor of 2

Model Structure

- World economy with 145 countries and OECD as one recipient of migrants
  - emigrants to the OECD aggregate entity are allocated across countries on the basis of the dyadic shares of 2010
- 2 age groups: adults (decision-makers) and children
- 2 skill groups (s=h,l) college grads & less-educated
- 2 regions (r=a,na) produce the same good
- 2 areas (b=f,d). Flooded and unflooded
- The Model endogenizes
  - Mobility: local ag-nonag and to the OECD
  - Self-selection of migrants subject to mobility costs
  - Population dynamics: net migration, fertility and education
  - World distribution of income; human capital;TFP and Poverty

Preferences

- Skilled and unskilled Adults in Ag and non.ag sectors
- Area is flooded or unflooded
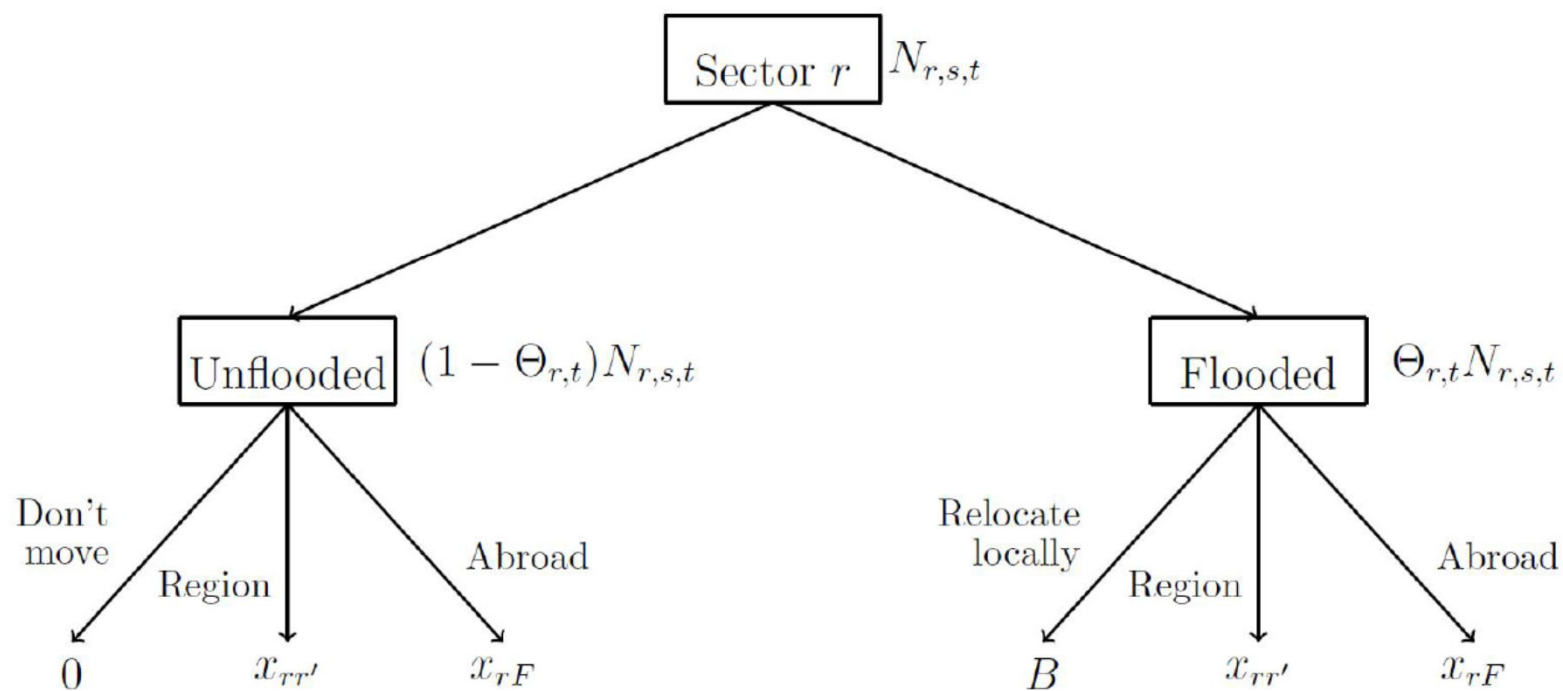
Results

Mostly internal migration (as in Rigaud et al. (2018)

	Number (in million)			As % world pop		
	2040	2070	2100	2040	2070	2100
Intermediate minus Minimalist						
Total	78.4	24.6	16.9	2.05	0.57	0.36
Ag-Nonag	13.1	4.1	1.1	0.34	0.10	0.02
International	6.4	6.9	9.2	0.17	0.16	0.20
Local	58.8	13.6	6.6	1.54	0.31	0.14
Flooded	69.4	15.5	7.5	1.82	0.36	0.16
Maximalist minus Minimalist						
Total	109.7	42.6	33.2	2.58	1.01	0.69
Ag-Nonag	26.5	13.5	4.5	0.69	0.32	0.09
International	13.6	16.5	21.2	0.35	0.38	0.46
Local	69.8	12.7	7.5	1.83	0.29	0.16
Flooded	82.5	14.5	8.5	2.16	0.34	0.18

International migration rates to OECD (percent)

	Interm. 2100	No SLR 2100	Great SLR 2100	Utility 2100	Conflict 2100
Emigration rates					
Latin America	6.7	6.7	6.7	7.6	7.6
Sub-Saharan Africa	2.2	2.2	2.2	2.8	3.2
MENA	4.6	4.6	4.6	4.7	4.7
Asia	3.0	3.0	3.1	3.6	3.7
OECD	4.7	4.7	4.7	4.5	4.5
Immigration rates					
United States	23.1	23.2	23.1	24.0	24.4
Canada	28.4	28.4	28.3	28.8	29.0
Australia	28.1	28.2	28.1	28.8	29.1
European Union	23.6	23.6	23.6	24.5	24.9
EU15	24.6	24.6	24.6	25.4	25.9
Germany	26.4	26.4	26.4	27.0	27.5
France	22.1	22.1	22.0	23.0	23.4
United Kingdom	26.6	26.6	26.5	27.2	27.5
Italy	22.5	22.5	22.4	23.6	24.2
Spain	24.3	24.3	24.2	25.2	25.7

Global Migration under extreme scenarios
(utility loss and utility loss + conflict)

**Tab. 3. Global numbers and shares of movers under extreme scenarios**

(Numbers $\times 10E6$ and shares as % of world adult population)

|	Number ($\times$10E6)			As % world pop		
	2040	2070	2100	2040	2070	2100
Extreme-Utility minus Minimalist						
Total	158.8	87.5	59.0	4.2	2.0	1.3
Rural-Urban	71.0	50.1	20.6	1.9	1.2	0.4
International	18.1	24.7	30.9	0.5	0.6	0.7
Local	69.7	12.7	7.5	1.8	0.3	0.2
Flooded	82.7	14.5	8.5	2.2	0.3	0.2
Extreme-Conflict minus Minimalist						
Total	162.1	92.1	65.5	4.2	2.1	1.4
Rural-Urban	72.0	49.8	18.9	1.9	1.2	0.4
International	20.3	29.7	39.1	0.5	0.7	0.8
Local	69.7	12.7	7.5	1.8	0.3	0.2
Flooded	82.7	14.6	8.5	2.2	0.3	0.2

Worldwide responses (moderate scenarios)

- Small effects on income per worker, population growth and education (See paper)
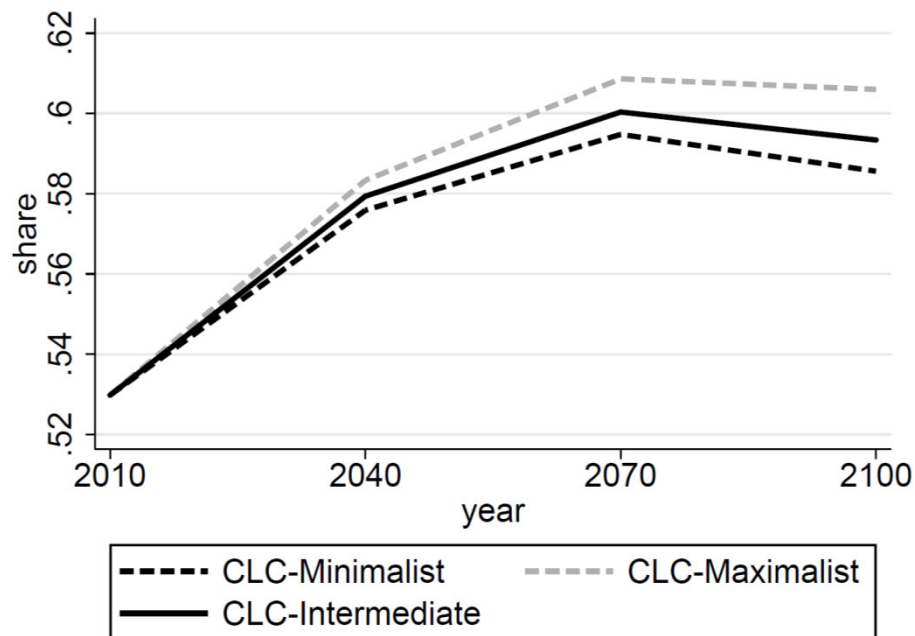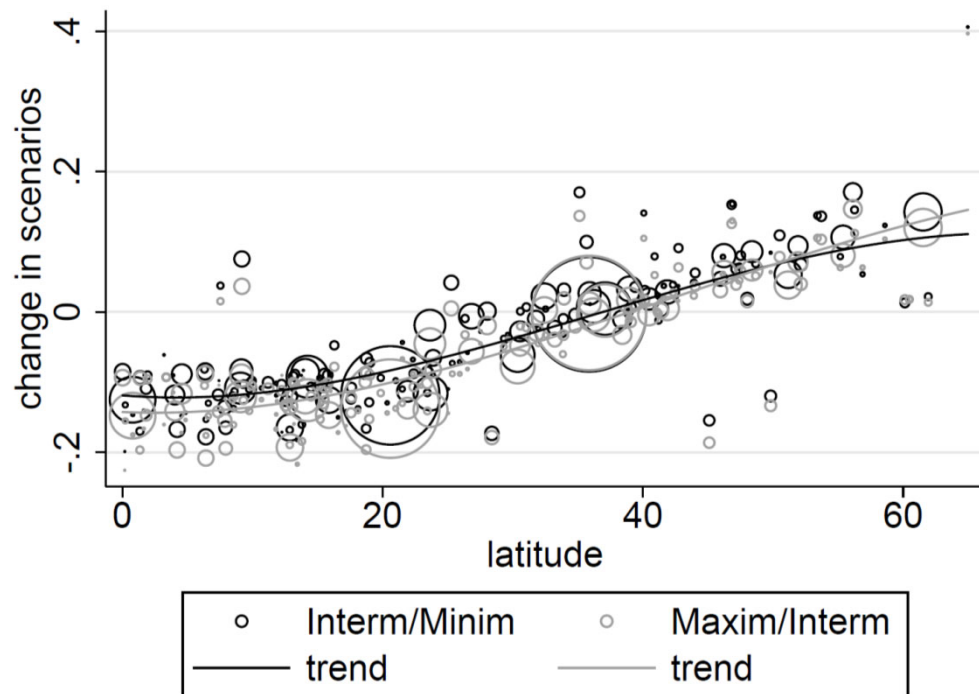
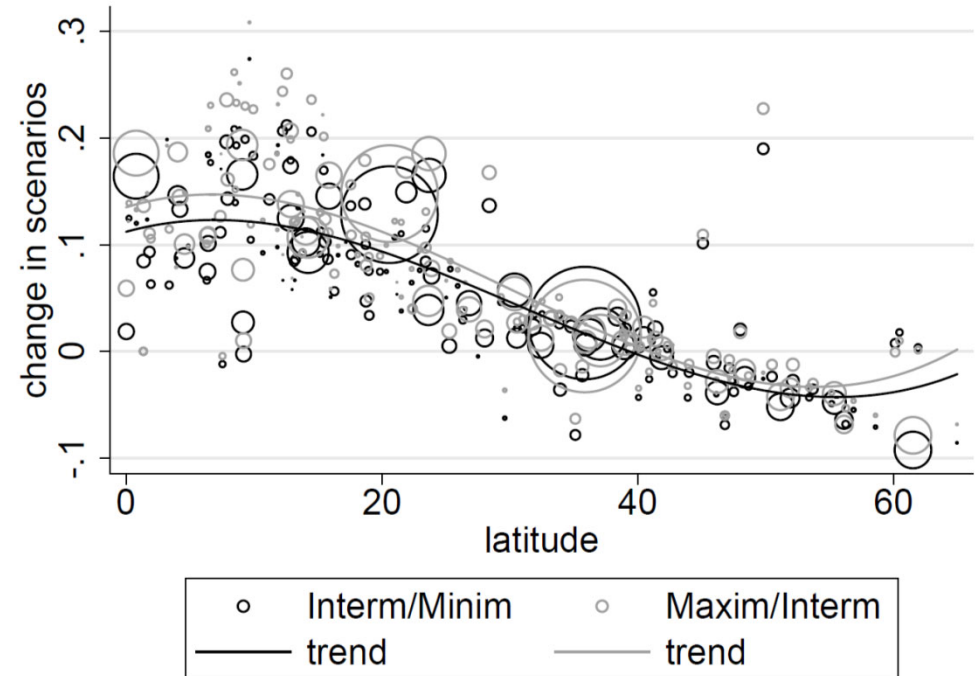Urbanization share   share of international migrants to OECD

↓   ↓
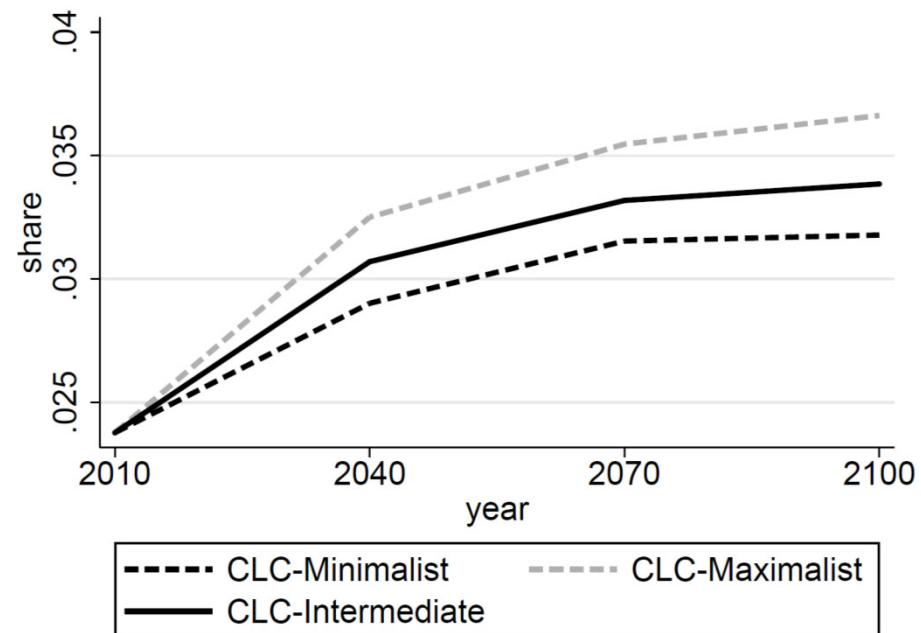
Country-specific effects by latitude
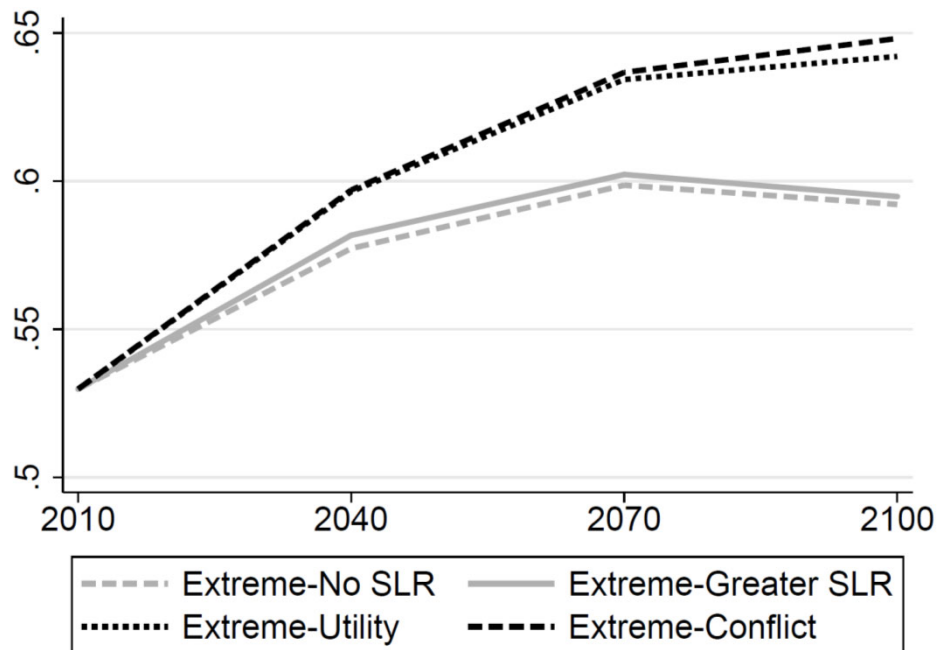
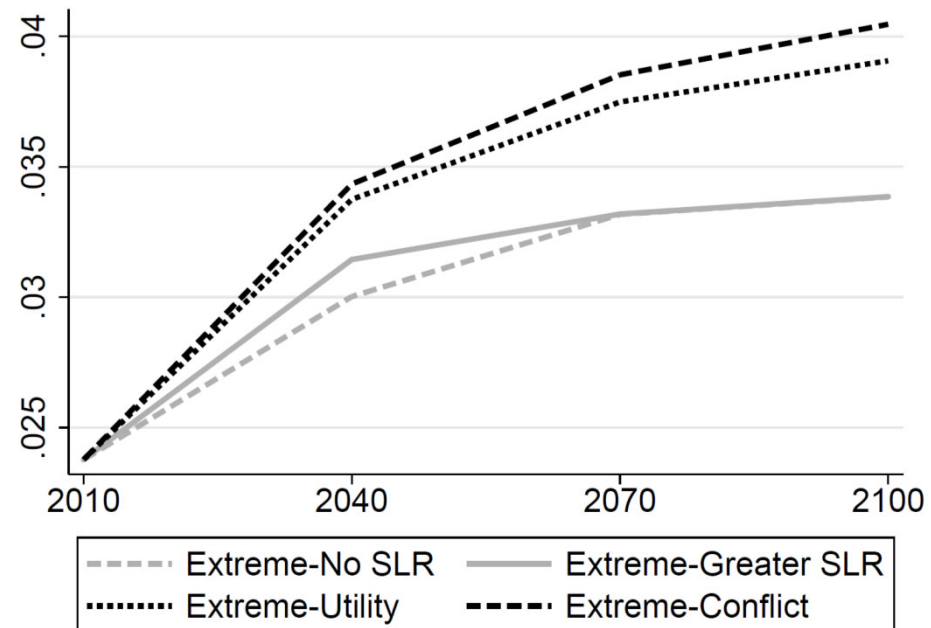Income per capita
↓

Emigration rates
↓

Worldwide responses (extreme scenarios)

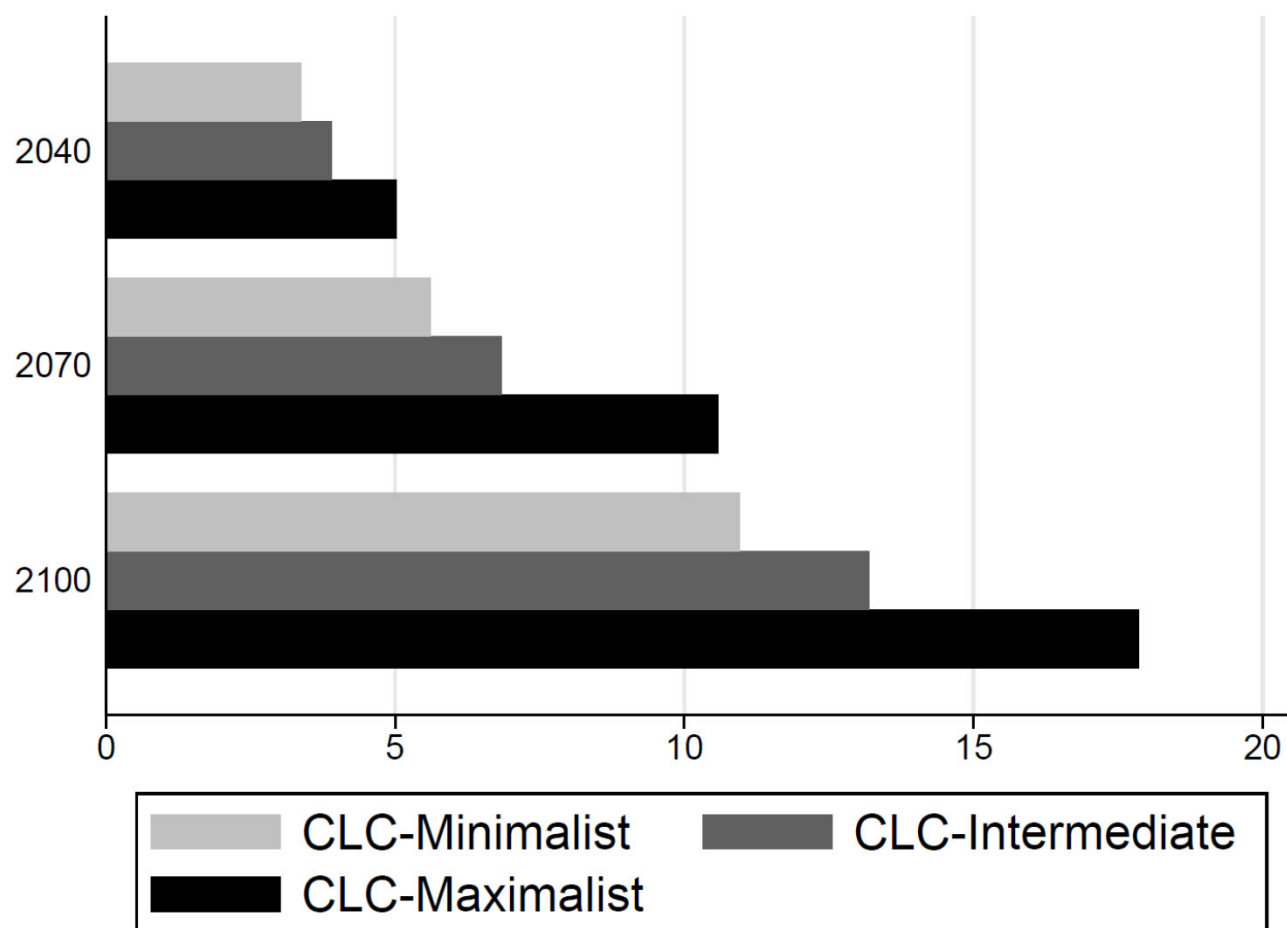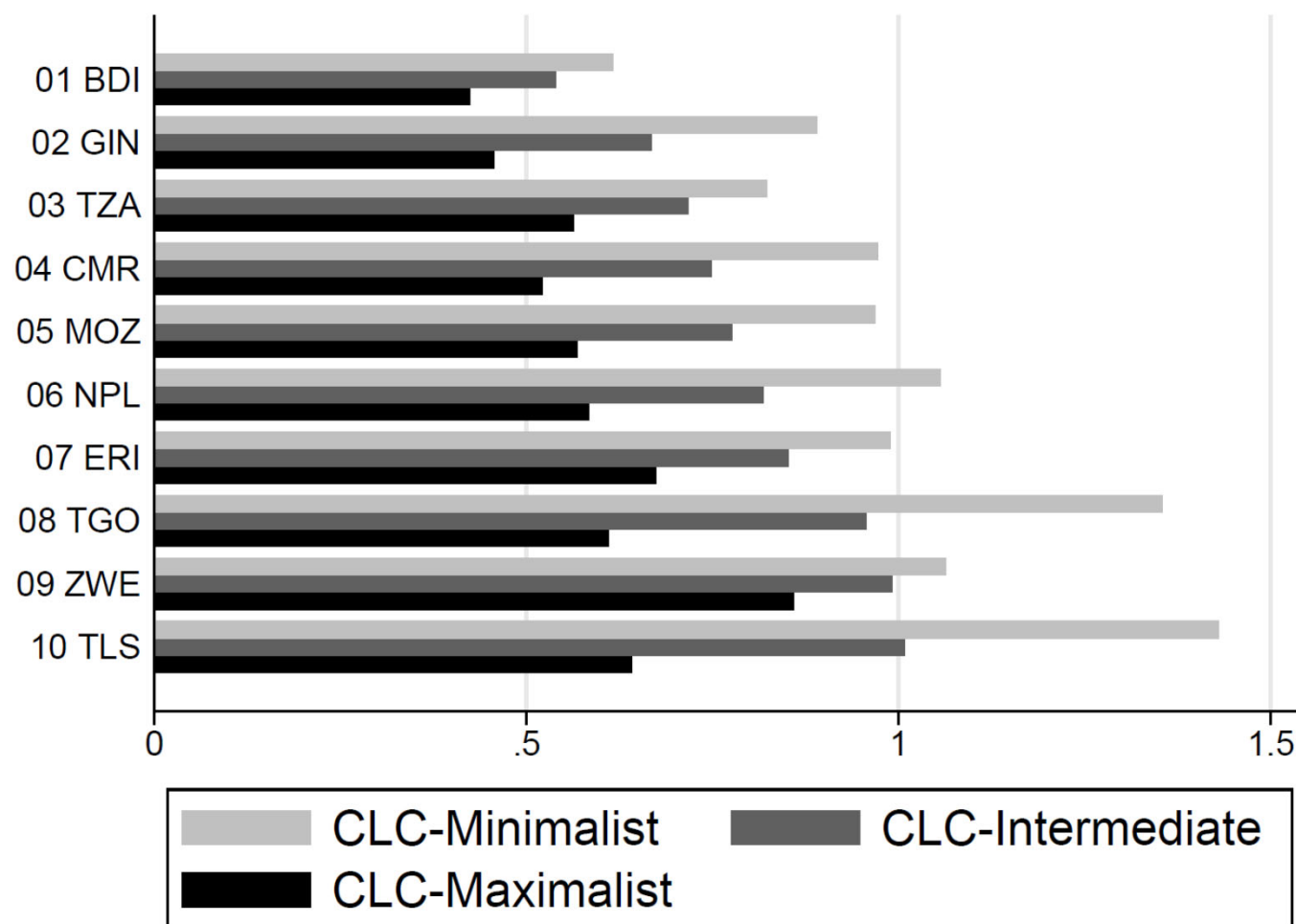- Large effects of utility losses/conflicts

Urbanization share
↓

Share of international migrants to OECD
↓

Effects on Poverty headcounts (1)

Effects on poverty headcounts

Per capita income in MENA

(ratios to Min-no CLC—Conflict here only in 10 poorest countries in sample)

Country	Maxim/Minim		Utility/Minim		Conflict/Minim	
	2040	2100	2040	2100	2040	2100
Algeria	1.32	0.15	1.28	-0.01	1.28	0.03
Bahrain	-6.31	-6.86	-14.58	-15.24	-14.57	-15.23
Egypt	0.06	1.59	-4.01	-4.04	-4.00	-4.01
Iran	2.73	2.31	3.59	3.26	3.59	3.27
Iraq	-1.78	-0.85	-5.51	-3.88	-5.51	-3.87
Jordan	0.50	0.09	-0.71	-1.14	-0.70	-1.09
Kuwait	-5.01	-3.83	-10.47	-7.69	-10.47	-7.67
Lebanon	-2.75	-3.00	-8.30	-8.14	-8.29	-8.09
Libya	-0.43	-0.85	-2.44	-3.31	-2.44	-3.29
Morocco	0.00	-0.95	-0.95	-0.85	-0.94	-0.82
Oman	-10.01	-10.92	-20.68	-22.05	-20.68	-22.04
Palestine	-1.49	-2.20	-5.04	-6.14	-5.04	-6.13
Qatar	-6.79	-7.31	-14.58	-15.41	-14.58	-15.41
Saudi Arabia	-5.71	-6.53	-12.70	-14.08	-12.70	-14.08
Syria	0.08	-0.38	-1.04	-0.59	-1.04	-0.56
Tunisia	-0.63	-0.82	-2.48	-2.59	-2.48	-2.56
United Arab Emirates	-7.78	-8.46	-16.87	-17.76	-16.87	-17.76
Yemen	-7.80	-8.74	-14.91	-11.21	-14.90	-11.19

Conclusions

- CLC increases inequality and extreme poverty.
- Mobility responses: Local >> Interregional > international.
- Concerns about international migration pressures.

  Current policies: small impacts on intĺ migration (+0.2pp).

  Small effects of reducing migration costs.
- What is a climate refugee?

  85 percent of forcibly displace people move locally.

  Half of non-local movements ....and 95 percent of international movements are voluntarty (indirect economic channel).

Climate Change, inequality andMigration Towards OECD Countries

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