International Migration in NCAR Community Demographic Model (CDM)

Leiwen Jiang[1,2] and Raphael Nawrotzki[1,3]

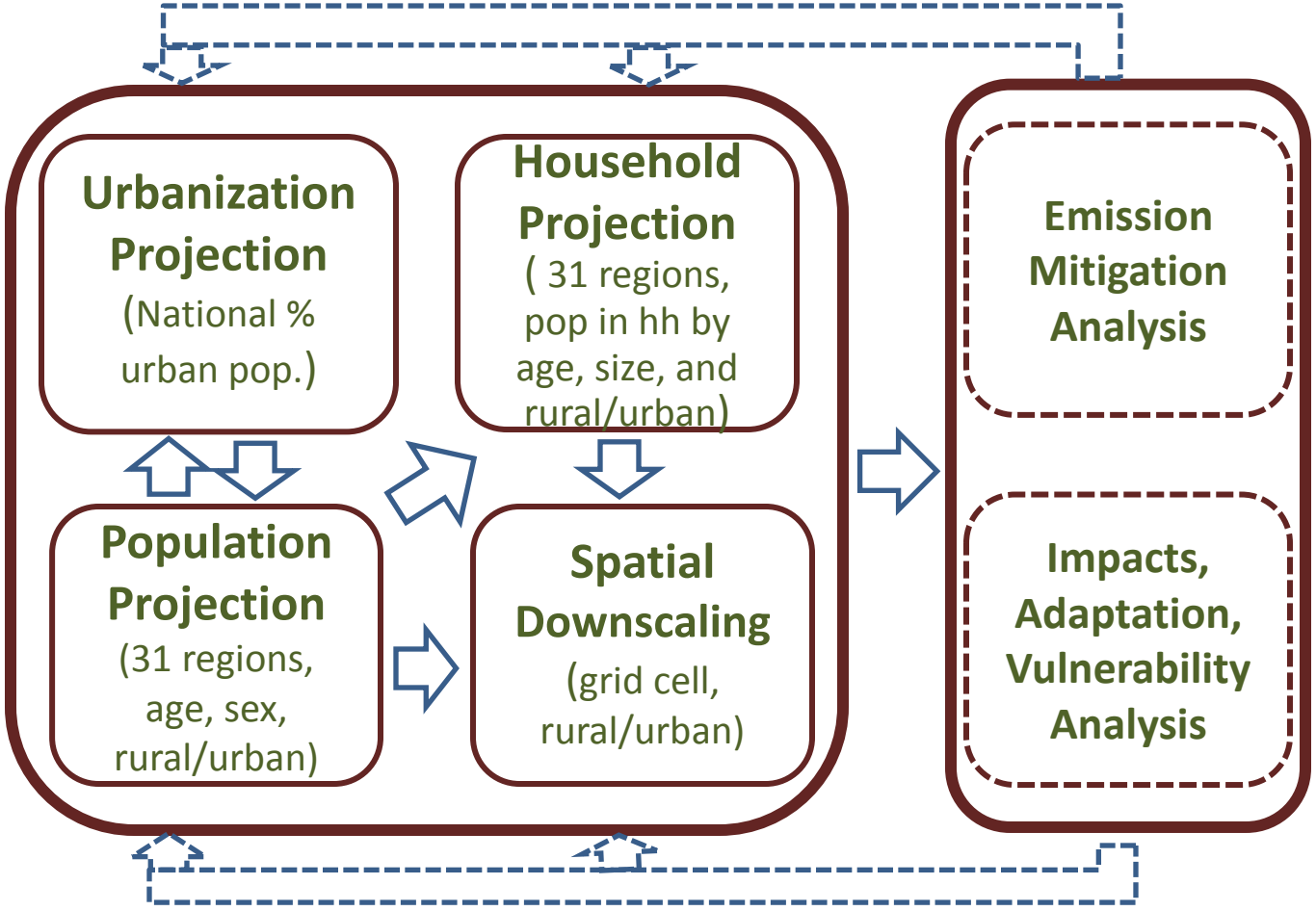
1. National Center for Atmospheric Research (NCAR)
2. Asian Demographic Research Institute (ADRI), Shanghai University
3. Minnesota Population Center (MPC)

NCAR CDM-IM Project

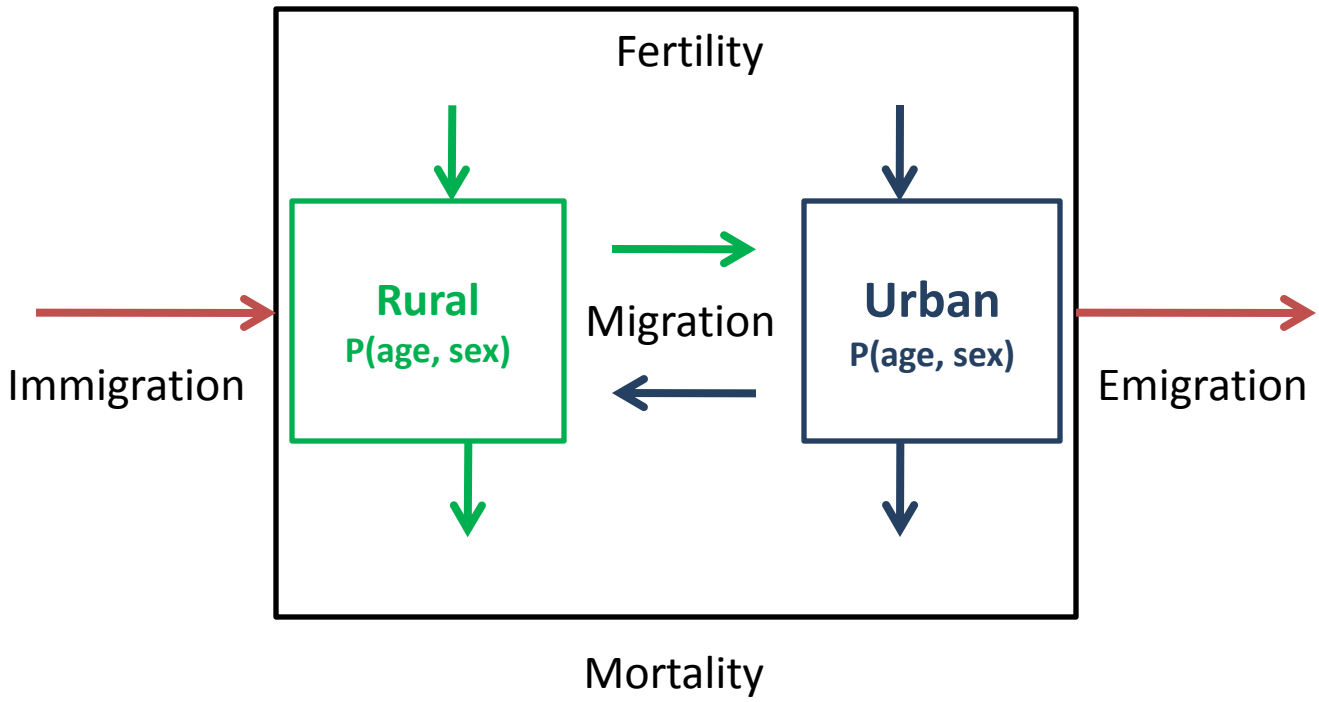
- **Motivation:** no dataset on age-gender profiles of international migration flows available
  - Global datasets by UNDP (UNDESA 2008, 2013a, 2013b) *migrant stocks* by age and sex, not on migrant flows
  - Abel's (2013) dataset, *national total number* of bilateral migrant flows, not disaggregated by age or gender
  - IMEM data set (Raymer et al. 2013) bilateral migrant flow by age and gender, but *only for Europe*

- **Goal:** Generate a data set of international migrant flows by age and gender with approximately global coverage

Community Demographic Model (CDM) for Climate Change Research



Multiregional Population/Urbanization Projection Model Structure



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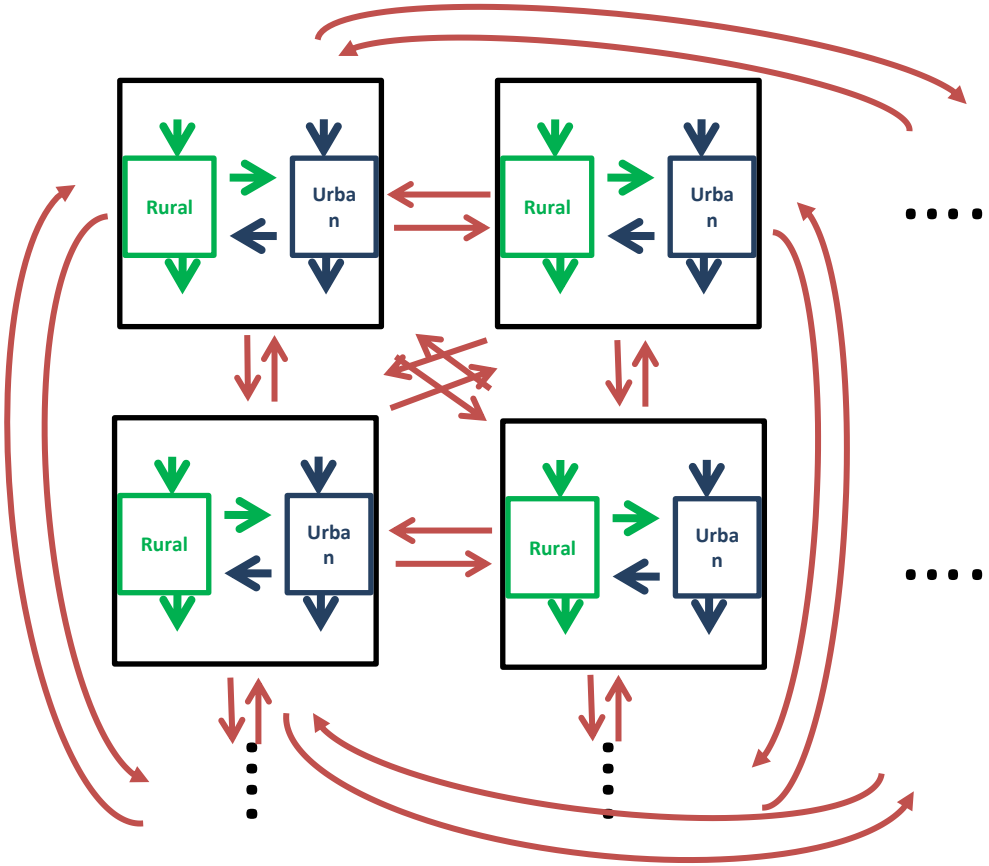

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- **Data Source**
  - **raw data** from United Nations Global Migration Database
- **Method**
  - Select ***two files*** of migrant stock data of ***best quality*** for two years ***closest to 2000***
  - Standardize age and gender categories
  - Amend stock data with lacking information from other files (same stream or region-level information)
  - Compute bilateral net migrant flows by subtracting the migrant stock of the earlier year from the migrant stock in the later year, and accounting for the effects of ***mortality and fertility***

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year 1997

Age	Male
0	2
1	2
2	2
3	2
4	2
…	…
…	…
…	…
…	…
79	10
80	7
81	5
82	3
83	2
84	1

year 2000

Age	Male
0	5
1	5
2	5
3	5
4	5
5	20
6	20
7	20
…	…
…	…
…	…
…	…
82	2
83	1
84	1

$$N^{-n} = M_t^{-n} + M_t^{-n} * (1 - S^n)/2$$

$$N^x = M_t^x * \frac{2}{1+S^x} - M_{t-n}^{x-n} * \frac{2S^x}{1+S}$$

annual flow

Age	Male
0	1.7
1	1.7
2	1.7
3	1.0
4	1.0
5	6.0
6	6.0
7	6.0
…	…
…	…
…	…
…	…
77	-2.6
78	-2.0
79	-1.3

In case migrants defined by citizenship:

$$N^{-n} = \left(M_t^{-n} + M_t^{-n} * \frac{1 - S^n}{2}\right) - \sum_{i=15}^{49} (M_{t-n,f}^i * b^i + M_{t-n,f}^i * S^i * b^{i+n}) * n/2$$

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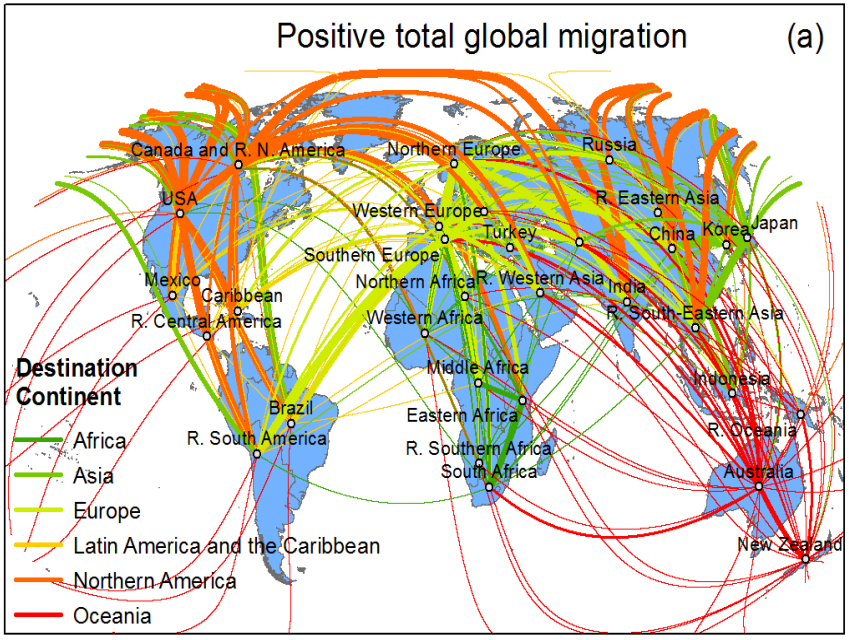
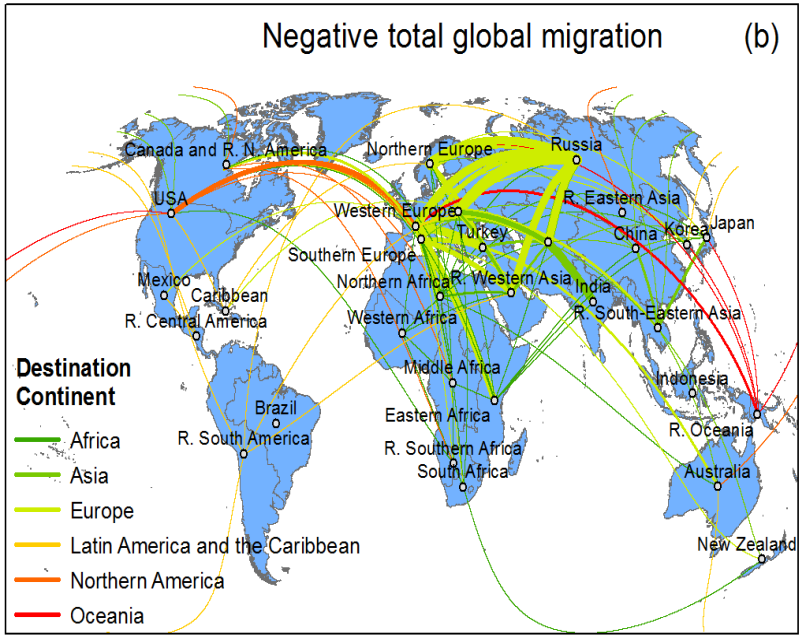
Results: Net migrant flow data for 3,713 bilateral stream





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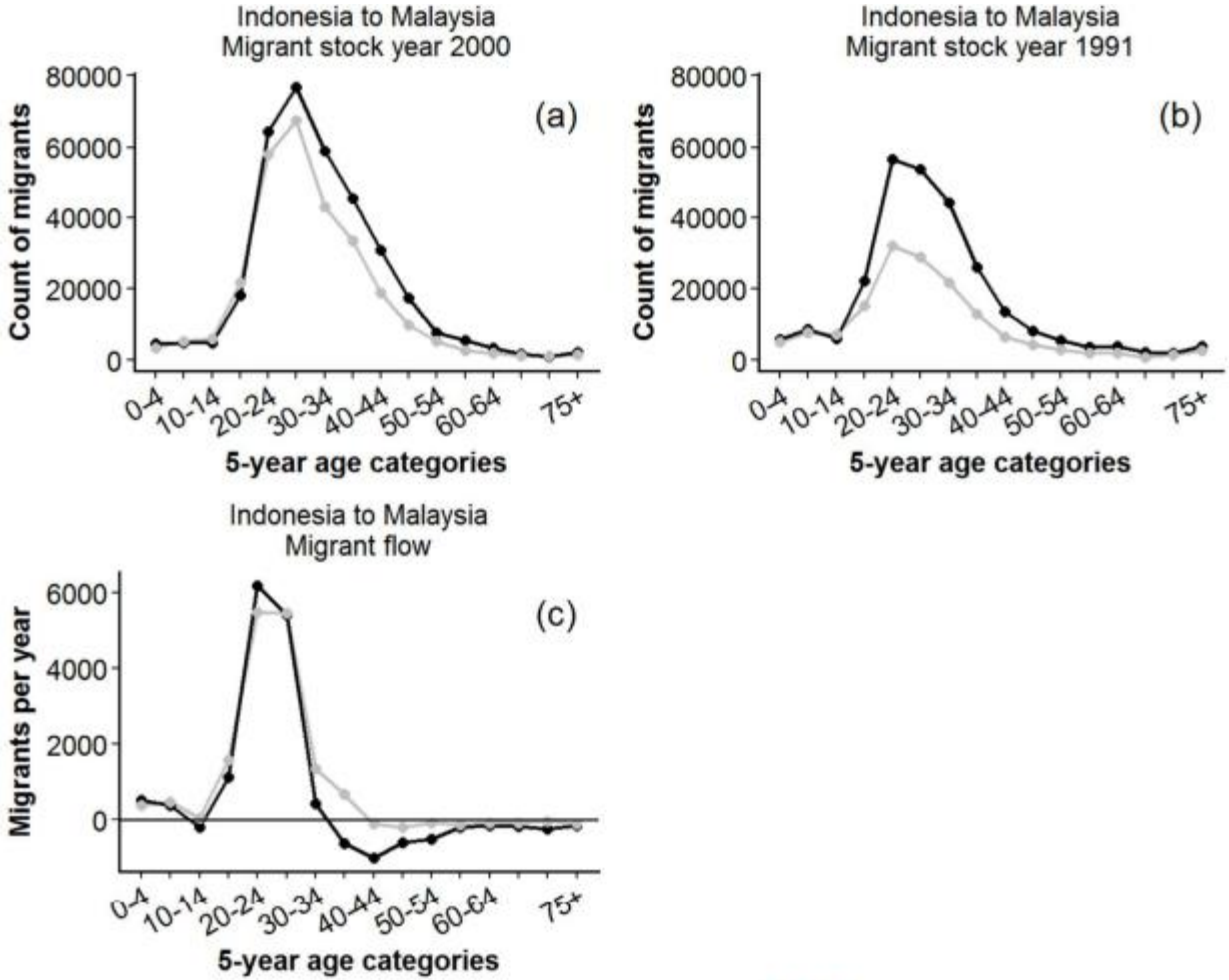

Note: Gray line represents female migrants; black line represents male migrants. Criterion of enumeration: Country of birth. Data source: Census.

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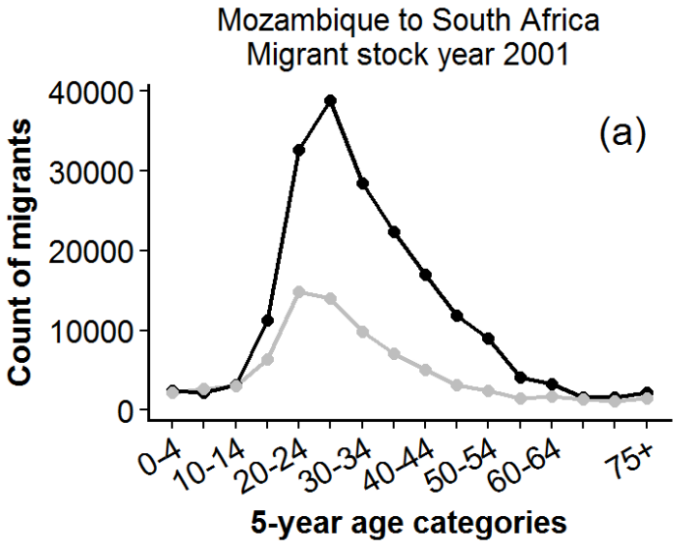

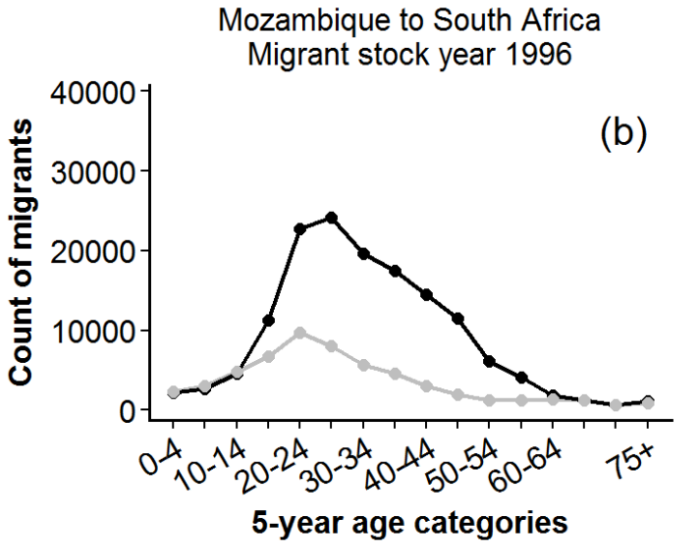

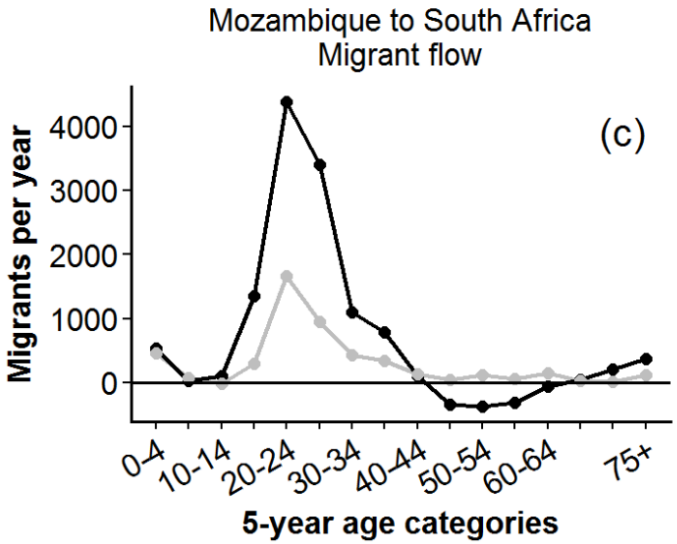

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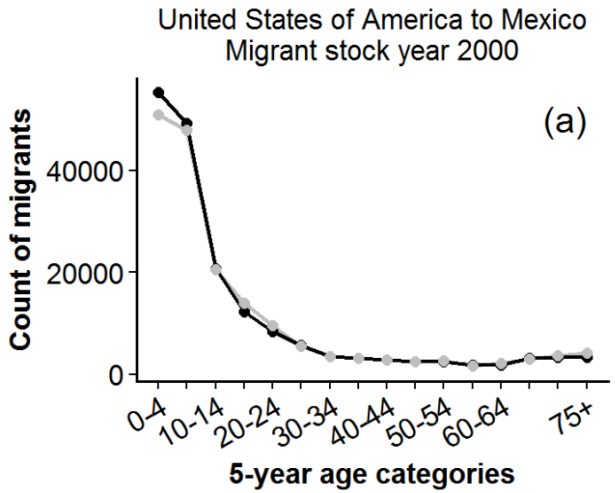

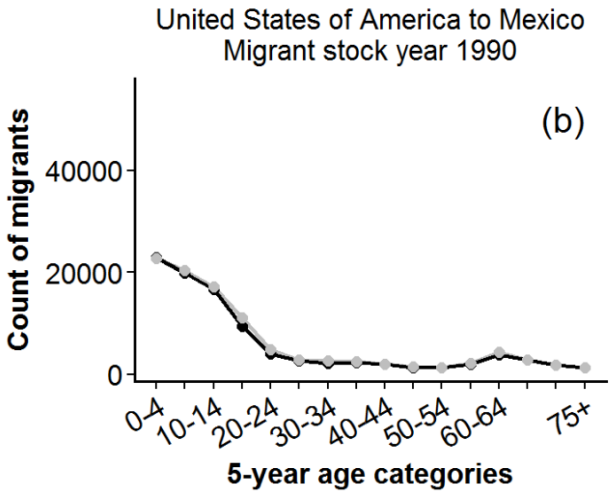

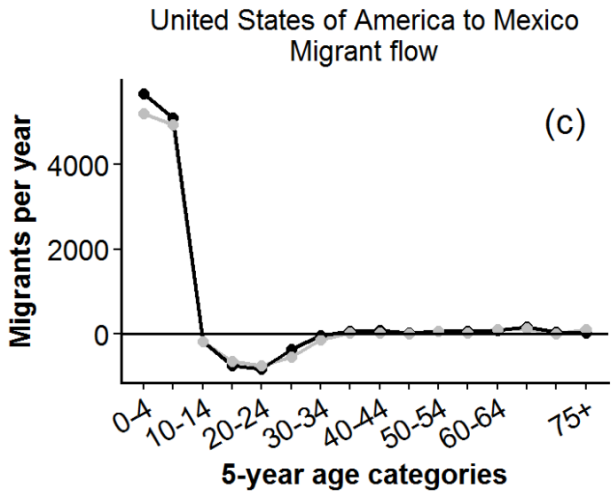

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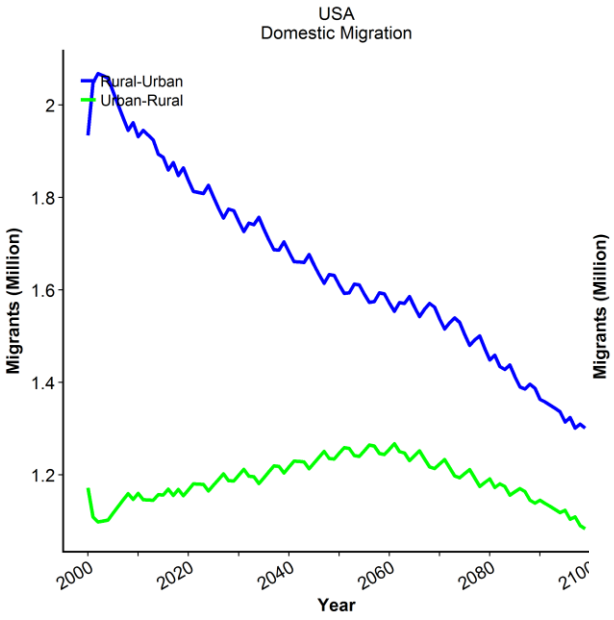
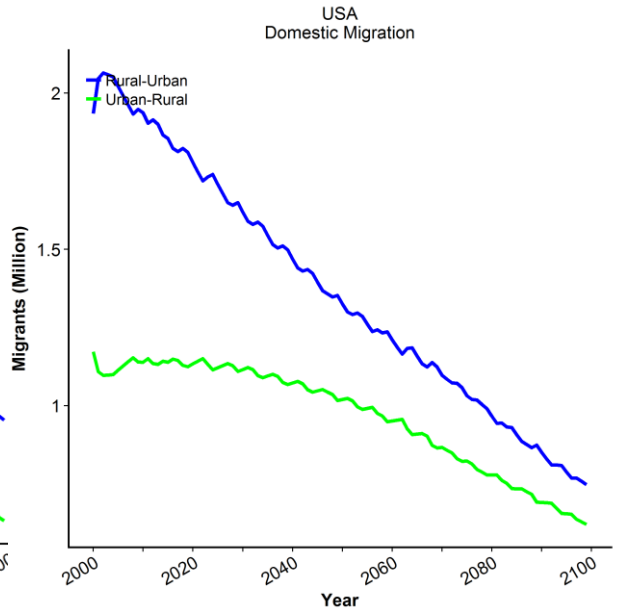
- **Validation:** reasonably high quality
  - total migrant flows: no significantly differ from IMEM and Abel's (2013) data sets
  - shape of curves: only few difference comparing to IMEM

- **Use** for population modeling
  - Directly use for projection
  - Input for migration model schedule or other indirect estimate

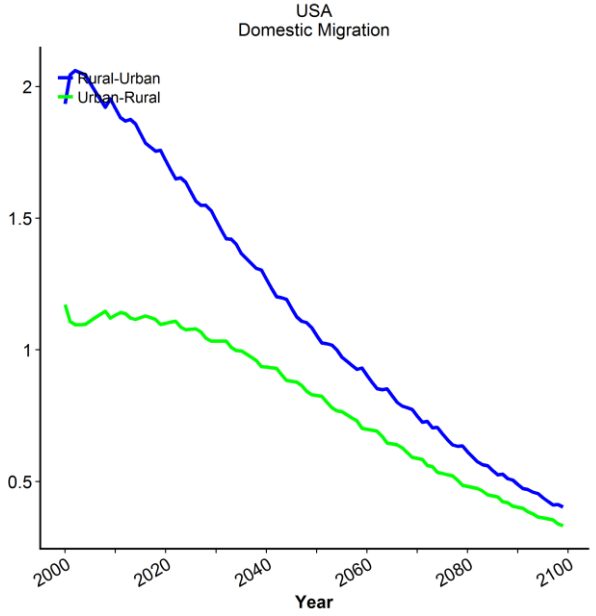
Internal Migration under SSPs for the US



SSP5



SSP2



SSP3

Source: Jiang and Nawrotzki, forthcoming