Migratory Responses to Environmental and Sociodemographic Factors in the United States: A Multi-level Approach 2010 – 2020

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Introduction

- Intergovernmental Panel on Climate Change (IPCC, 2022) warns we are approaching the 1.5°C level above pre-industrial temperature

- 150-300 million people will be displaced by environmental changes by 2050 (Gemenne 2011)

- The US suffers from sea-level rise, earthquake, hurricane, and other environmental disasters

Previous studies and knowledge gap

- Globally, previous studies primarily focused on rapid-onset environmental changes in the developing world

- In the US, studies on slow-onset environmental variabilities used aggregated data at the regional level or crude level

  Gutmann et al. (2005): Great Plains region, 1930-1990
  Feng et al. (2012): Corn belt region, 1970-2009
  Poston et al. (2009): The entire US at the state level, 1995-2000

- There is a knowledge gap regarding the impact of slow-onset environmental variabilities on migration at the individual level in developed setting

Research objectives

- Explore the migratory responses to slow-onset environmental variabilities at the individual level

- Examine the heterogeneous environmental impacts on migration on different demographic groups

Data, variables, and methods

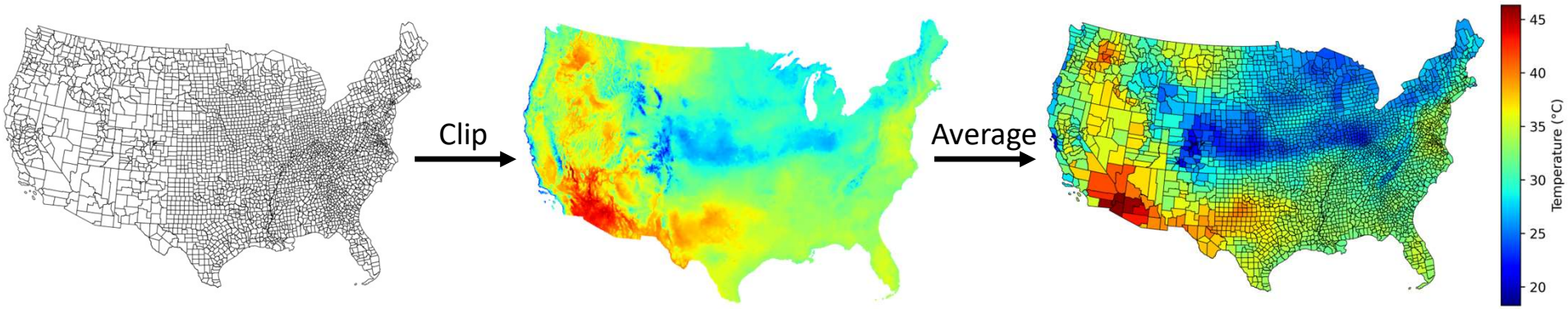
DV	Migration status	Migrants = 1; Stayers = 0	ACS
Level-1	Age	Continuous variable	ACS
	Personal income	Continuous variable	ACS
	Gender	Female = 1; Male = 0	ACS
	Marital status	Married = 1; Unmarried = 0	ACS
	Race	Non-Hispanic white = 1; Others = 0	ACS
	Education	College = 1; Below college = 0	ACS
Level-2	Precipitation anomaly	Continuous variable	PRISM
	Temperature anomaly	Continuous variable	PRISM
	Household income	Continuous variable	ACS
	Employment rate	Continuous variable	ACS
	Rent	Continuous variable	ACS
	Housing price	Continuous variable	ACS
	Homeownership	Continuous variable	ACS
	Poverty rate	Continuous variable	ACS
	Metropolitan status	Metro = 1; Nonmetro = 0	ACS

Data, variables, and methods (cont.)

$$Anomaly_{i,t} = \frac{Level_{i,t} - \mu_i^{LR}}{\sigma_i^{LR}}$$

μ_i^{LR} = Long-run (30-year) average

σ_i^{LR} = Long-run (30-year) standard deviation



Left: County boundaries of the United States in 2010 census
Middle: Gridded maximum temperature on July 31, 2020
Right: County-level maximum temperature on July 31, 2020

Data, variables, and methods (cont.)

Two-level logistic regression

Descriptive statistics

	Variable	Mean or %	SD	Min	Max
DV	Migration status	0.40%	0.49	0	1
Level-1	Age	32.55	19.88	1	96
	Personal income	32.45	52.97	-14.10	137.80
	Gender	0.50%	0.50	0	1
	Marital status	0.28%	0.45	0	1
	Race	0.68%	0.47	0	1
	Education	0.45%	0.50	0	1
Level-2	Precipitation anomaly	0.09	0.34	-0.84	1.55
	Temperature anomaly	0.05	0.11	-0.40	0.48
	Household income	89.20	20.78	48.97	178.22
	Employment rate	91.92	2.49	81.49	97.58
	Rent	1.16	0.28	0.53	2.33
	Housing price	293.56	179.47	81.88	1,111.50
	Homeownership	61.35%	10.77	18.97	87.44
	Poverty rate	10.73%	4.24	1.87	31.74
	Metropolitan status	99.12%	0.09	0	1

Two-level logistic regression

	Coef.	*SE*
Level-1 variables (N = 2,243,336)		
Age	-0.009***	0.000
Personal income	-0.001***	0.000
Gender, Female (ref. = Male)	-0.153***	0.003
Marital status, Married (ref. = Unmarried)	-0.023***	0.003
Race, non-Hispanic white (ref. = Others)	0.206***	0.003
Education, College and above (ref. = Below college)	0.089***	0.003
Level-2 variables (N = 472)		
Precipitation anomaly	0.008	0.005
Temperature anomaly	0.100***	0.015
Household income	0.003**	0.001
Employment rate	0.025***	0.002
Rent	0.985***	0.057
Housing price	-0.002***	0.000
Homeownership	-0.013*	0.001
Poverty rate	-0.006***	0.003
Constant	-2.122***	0.225

Notes: *** p<0.001, ** p<0.01, * p<0.05, + p<0.10.

Takeaways

1. Slow-onset environmental variabilities, particularly temperature anomaly, affect migration, even after controlling for sociodemographic factors

2. Individual demographics, particularly gender and race, have relatively larger impacts on migration under slow-onset environmental variabilities

Next steps…

1. Stratify the sample by the county metropolitan status and conduct separate analyses for metro counties and nonmetro counties (or control for county metropolitan status)

2. Stratify the sample by their age groups such as population aged from 15 to 65 and population aged from 65 and above

3. Interactions between the level-1 and level-2 factors

Thanks

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