Internal Migration and the Microfoundations of Gravity

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  - Tractable
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- Third fact about internal migration:
  3. Return migration is extremely common
  3'. t-year migration rate is proportional to $\sqrt{t}$
  - Suggestive of persistent preferences?

Outline

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What if we model internal migration based on persistent preferences?

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    - Preferences correlated across space and time
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   - Population elasticities key for counterfactuals and welfare
4. Compare to a moving cost model
   - Different implications for macro misallocation, long-run population elasticities, speed of adjustment

Contributions to the Literature

- Spatial dynamics
  - Rise and decline of regional economies
    Blanchard and Katz (1992); Caliendo, Dvorkin and Parro (2019); Allen and Donaldson (2020); Morris-Levenson and Prato (2022); Glaeser and Gyourko (2005); Liu, Klieman and Redding (2021); Amior and Manning (2018); Davis, Fisher and Veracierto (2021)
  - Macro adaptation to external shocks
    Tombe and Zhu (2019); Hao, Sun, Tombe and Zhu (2020); Eckert and Peters (2018); Giannone (2017); Heise and Porzio (2021); Bryan and Morten (2019); Cruz and Rossi-Hansberg (2021); Oliveira and Pereda (2020)
- How to model migration
  - Modifications of the dynamic logit
    Kennan and Walker (2011); Kaplan and Schulhofer-Wohl (2017); Giannone, Li, Paixao and Pang (2020); Porcher (2020); Mangum and Coate (2019); Monras (2018); Coen-Pirani (2010); Davis et al. (2021)
  - Persistent preferences
    Bayer and Juessen (2012)
  - Empirical evidence
    Saks and Wozniak (2011); Farrokhi and Jinkins (2021); Koşar, Ransom and Van der Klaauw (2021); Fujiwara, Morales and Porcher (2022)
- Multinomial probits
  - Butler and Moffitt (1982); Keane (1992); Geweke, Keane and Runkle (1994)

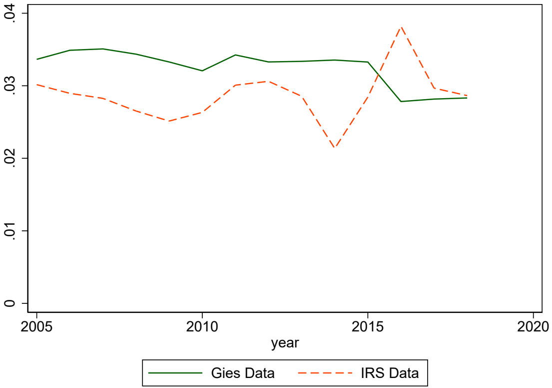
3 Facts about Internal Migration

Data

- Gies Consumer and Small Business Credit Panel (GCCP)
    - Credit data from one of the leading providers of credit reports
    - 1 percent of Americans with credit reports
    - Includes state of residence
    - Panel data, 2004-2018
- IRS Migration Data
    - Based on tax filings
    - Aggregated flows of state-to-state migration

Fact #1

Migration is rare



Comparison of interstate migration rates in IRS and GCCP

Fact #2

Migration follows a gravity pattern

Poisson regression:

$$\log m_{i\to j} = \beta \log \text{distance}_{ij} + \alpha \log p_i + \gamma \log p_j + \epsilon_{ij}$$

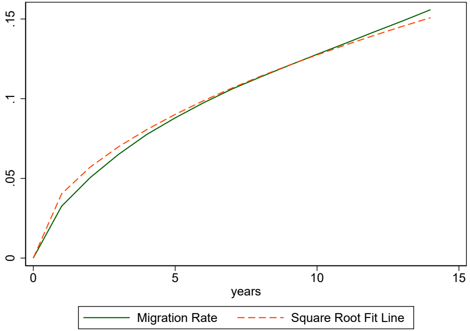
	(1) Migration (IRS)	(2) Migration (Credit)
Log Distance	-0.736***	-0.744***
	(0.0572)	(0.0515)
Log Origin Population	0.900***	0.923***
	(0.0832)	(0.0797)
Log Destination Population	0.822***	0.893***
	(0.0976)	(0.0799)
Observations	2550	2550

Standard Errors are two-way clustered by origin and destination states

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Fact #3 (New)

t-year interstate migration rate is proportional to $\sqrt{t}$



- Implies a high rate of return or onward migration
- Suggestive of persistent preferences

The SPACE Model

Model

I locations indexed by i, continuum of individuals indexed by n, and discrete time indexed by t:

- Agents choose location that maximizes utility

$$u_{nt} = \max_i u_{int} = \max_i v_{it} + \epsilon_{int}$$

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- Spatially and Persistently Auto-Correlated Epsilons (SPACE)

Covariance matrix

Why $\Sigma_{ij} = \exp(-A \text{ distance}_{ij})$?

Proposition 1

Σ is positive definite

- Proof uses Schoenberg Interpolation Theorem
- Requires $\Sigma_{ij} = f(\text{distance})$ to be completely monotone and non-constant

- Model can be extended to other settings

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- Square root fact

Proposition 2

As $\rho \to 1$, the t-year migration rate is proportional to $\sqrt{t}$

Parameterization

- Two parameters: persistence ρ, and spatial correlation A
- Target: migration rate, gravity equation
- Simulate 10 million people for two periods, fifty U.S. states and D.C.
  - v_i matches population

Matching the Facts Quantitatively

- Persistence: $\rho = .9996$,
- Spatial correlation: $A = .000299 \text{ km}^{-1}$
- Hits 3.34 percent migration rate

	(1) Migration (IRS)	(2) Migration (Credit)	(3) Simulated Migration
Log Distance	-0.736***	-0.744***	-0.744***
	(0.0572)	(0.0515)	(0.0396)
Log Origin Population	0.900***	0.923***	0.892***
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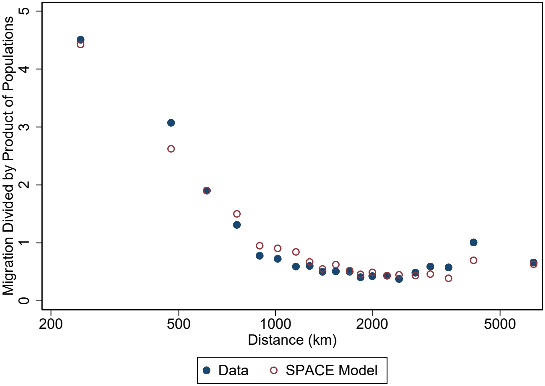
Gravity



- Curvature is untargeted

Square Root Fact

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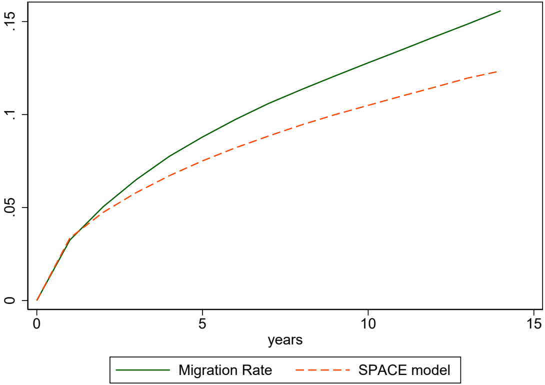
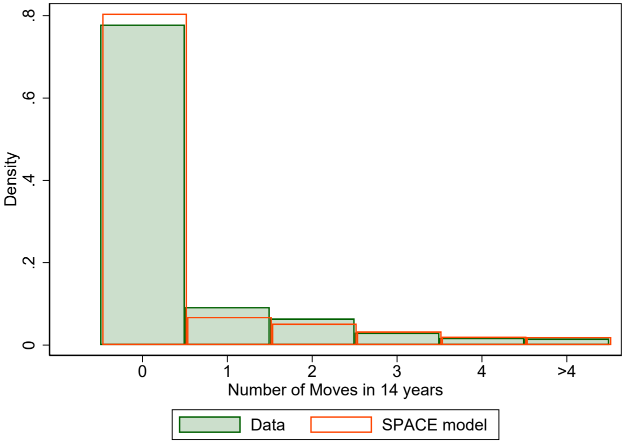


5-year Calibration

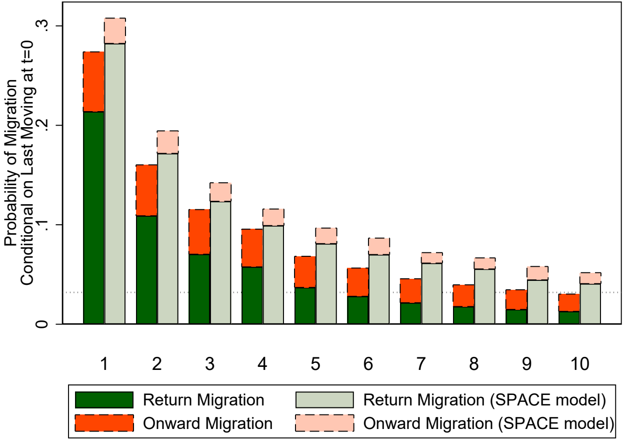
Frequency of Migration



5-year Calibration

Return Migration

- Conditional probability of moving after previous move



5-year Calibration

Implications of the Model

Is the model useful?

- Population elasticities critical for a variety of questions in the literature
- One reason for skepticism: multinomial probits do not have a closed-form solution for these elasticities as a function of parameters

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Proposition 3

As $\rho \to 1$, the semi-elasticity of the population in i with respect to u_j is

$$\frac{\partial \log p_i}{\partial v_j} = -\lim_{\rho \to 1} \frac{m_{i\to j}}{p_i} \frac{1}{\sqrt{1-\Sigma_{ij}}} \sqrt{\frac{\pi}{1-\rho^2}}$$

- If you know migration, distance, and the parameters, sufficient to calculate these elasticities

Why do we care about Population Elasticities?

1. Counterfactuals:
   - How much adjustment is there to the China shock? (Caliendo et al., 2019)
   - Where will people move in response to global warming? (Cruz and Rossi-Hansberg, 2021)

- Answers from these elasticities:

$$\frac{\partial \log p_i}{\partial v_j} = -\lim_{\rho \to 1} \frac{m_{i \to j}}{p_i} \frac{1}{\sqrt{1 - \Sigma_{ij}}} \sqrt{\frac{\pi}{1-\rho^2}}$$

$$\frac{\partial \log p_i}{\partial v_i} = \lim_{\rho \to 1} \sum_{j \neq i} \left[\frac{m_{i \to j}}{p_i} \frac{1}{\sqrt{1 - \Sigma_{ij}}} \sqrt{\frac{\pi}{1-\rho^2}} \right]$$

- More gross migration = more elastic population
- Higher migration rate i to j = higher cross-elasticity

Why do we care about Population Elasticities?

2. Speed of adjustment
    - How fast does the economy react? (Liu et al., 2021)

- Population reacts immediately; short-run and long-run elasticities are the same

Why do we care about Population Elasticities?

3. Welfare:

- To second order:

$$d\mathbb{E}u \approx \underbrace{p \cdot dv}_{\text{Direct effect}} + \underbrace{\frac{1}{2} dv^T \frac{\partial p}{\partial v} dv}_{\text{Migratory insurance}}$$

- High gross migration of shocked places = more insurance
- Higher migration between shocked places = less insurance

- Quantitative analysis in paper: 25% less insurance from the Rust Belt decline because it occurred in states between which there was a lot of migration

Comparison to the Standard Model

2 types of comparison

- Comparison based on simplicity
  - Fewer state variables
  - Naturally hits dynamics
  - Naturally matches short-run migration elasticities

  - Argument for model being more feasible to compute
  - Argument for the truth of the model only from Occam's Razor

- Comparison of implications
  - Misallocation
  - Dynamics
  - Long-run population elasticities

  - Could be used to falsify one model or the other
  - If these were easy to measure, would not need spatial dynamic models

Compare to Dynamic Logit

I locations indexed by i, N individuals indexed by n, and discrete time indexed by t:

- Agents choose location that maximizes utility

$$u_{nt}(i) = \max_j v_{jt} - \delta_{ij} + \epsilon_{jnt}$$

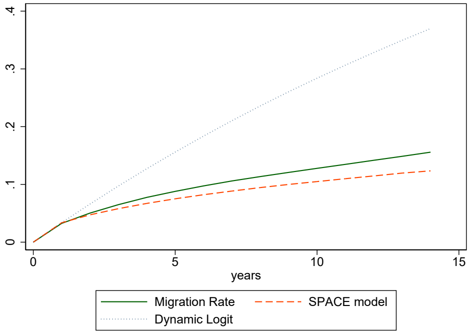
- ϵ_{jnt} is i.i.d. and has an extreme value distribution

Advantages of SPACE model

1. No state variables
    - Dynamic logit requires keeping track of the populations in each region

Advantages of SPACE model

2. Naturally hits dynamic moments Frequency of Moves Return Migration



- Matching dynamic moments in the dynamic logit increases the number of state variables exponentially

Advantages of SPACE model

3. Short-run migration elasticities

Proposition 4

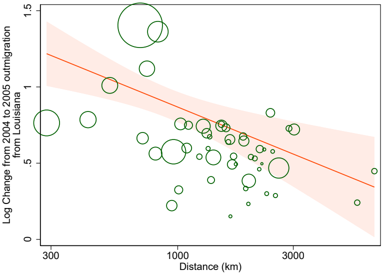
In steady-state, as $\rho \to 1$, the short-run local semi-elasticity of migration from i to j to utility in i is

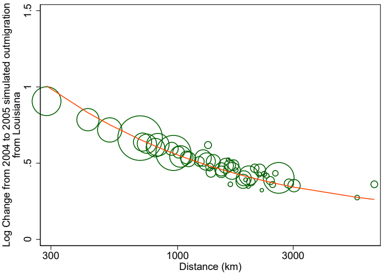
$$\lim_{\rho \to 1} \sqrt{1-\rho^2} \frac{\partial \log m_{i \to j,t}}{\partial v_{j,t}} = \frac{\sqrt{\pi}}{\sqrt{1-\Sigma_{ij}}}$$

- Migration elasticity is decreasing in distance
- Can arguably check this in the data

Advantages of SPACE model

- In the data, need a shock to a specific location (not spatially correlated)
  - Hurricane Katrina





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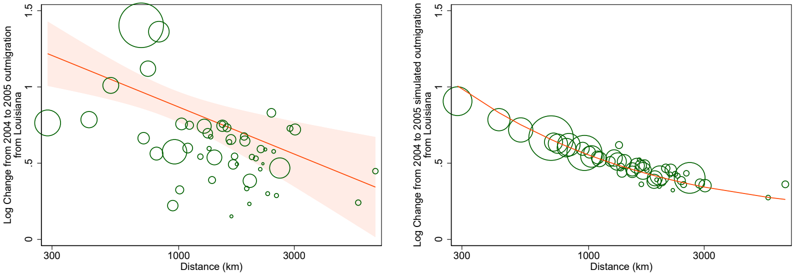


- Matching this fact makes the dynamic logit model more complicated

Different Implications of SPACE and Dynamic Logit

1. Moving costs need not be large
2. Aggregate dynamics
3. Long-run Population Elasticities

Moving Costs Need Not Be Large

- Kennan and Walker (2011): average moving cost is $312,146 (in 2010 USD)
- Common counterfactual is to consider reducing moving costs to get faster population adjustments (Kennan and Walker, 2011; Schubert, 2021)

Aggregate Dynamics

- In dynamic logit, permanent utility increase in j increases the migration rate into j, population adjusts very slowly
- In SPACE, permanent utility increase in j raises population immediately
- How does SPACE interpret persistent migration flows?
  - Persistent utility changes from feedback from the housing market, labor market adjustments, search, etc.

Long-Run Population Elasticities

- In a static logit,

$$\frac{\partial \log p_j}{\partial v_i} = \begin{cases} -p_j & \text{if } i \neq j \\ 1 - p_j & \text{if } i = j \end{cases}$$

- Dynamic logit approximately converges to static logit in the long-run (correlation>0.9999)
- None of the implications of the SPACE model discussed previously hold for the dynamic logit in the long-run.
  - More elastic populations in high migration areas?
  - Cross-elasticities depend on migration?
  - Long-run insurance depends on spatial correlation of shocks?

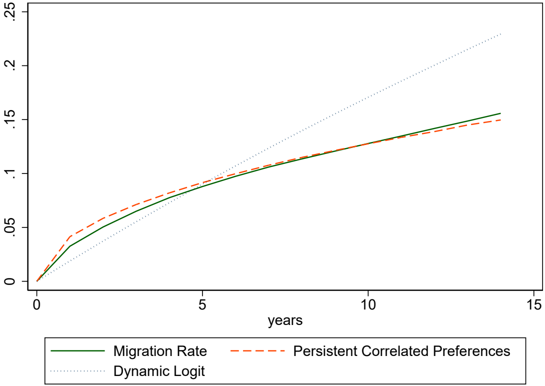
Conclusion

- Persistent preferences help to match dynamic moments of migration *and* gravity
- SPACE model has important implications for counterfactuals and welfare
- SPACE model has several advantages over dynamic logit and different implications

Square Root Rule, 5-year calibration

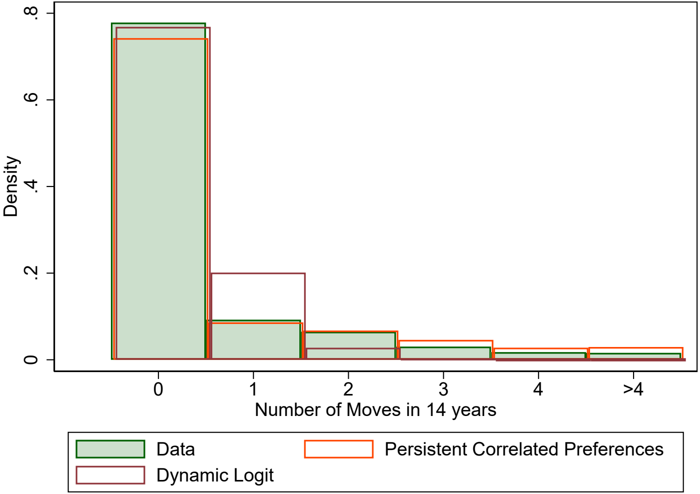
Proposition 2

As $\rho \to 1$, the t-year migration rate is proportional to $\sqrt{t}$.



Return

Frequency of Migration, 5-year calibration



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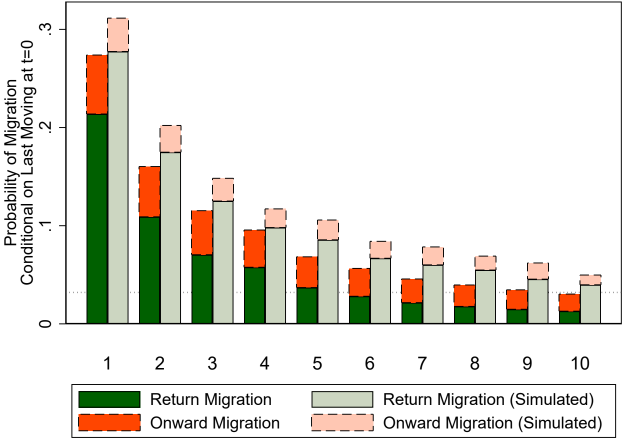
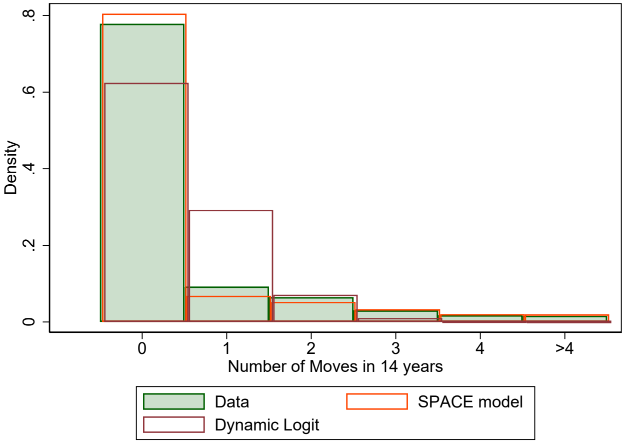
Return Migration, 5-year calibration

- Conditional probability of moving after previous move



Return

Frequency of Moves, Dynamic Logit Model



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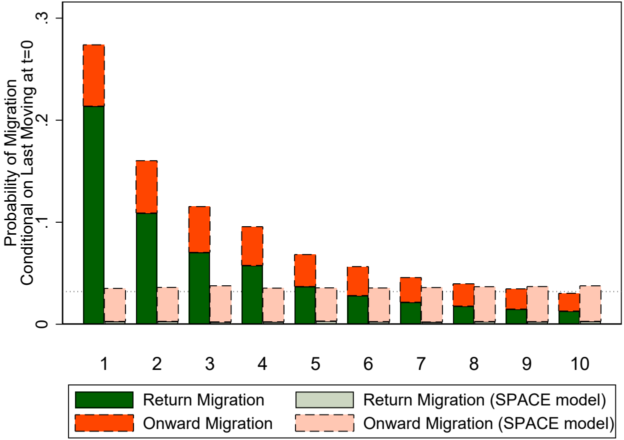

Return

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