The Dynamics of Internal Migration: A New Fact and its Implications

Greg Howard   Hansen Shao

University of Illinois

UEA 2024

Two facts about internal migration

1. Internal migration is rare
2. People move to nearby and populous places (gravity)

Two facts about internal migration

1. Internal migration is rare
2. People move to nearby and populous places (gravity)

How should we understand these two facts?

(a) Moving costs?

(b) Persistent preferences?

Two facts about internal migration

1. Internal migration is rare
2. People move to nearby and populous places (gravity)

How should we understand these two facts?

(a) Moving costs?

(b) Persistent preferences?

Does it matter how we understand these two facts?

- Literature has emphasized moving costs
  - Tractable
  - Easily matches both facts
  - Natural extension of the trade literature

- Persistent preferences is consistent with a new fact about the dynamics of migration:
    3. t-year migration rate is proportional to $\sqrt{t}$

- Persistent preferences is consistent with a new fact about the dynamics of migration:
  3. t-year migration rate is proportional to $\sqrt{t}$

- This Paper:
  - Document new fact
  - Propose a model that can match the fact
  - Show it has different (and important) implications than the standard moving cost model

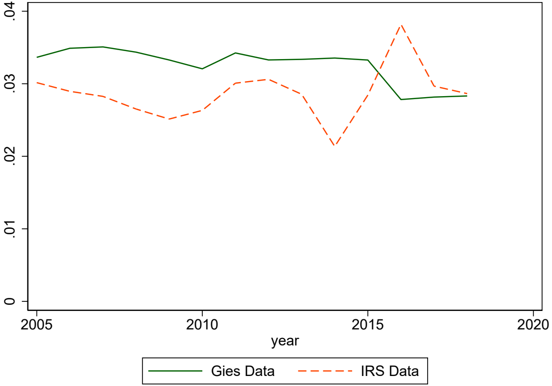
3 Facts about Internal Migration

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

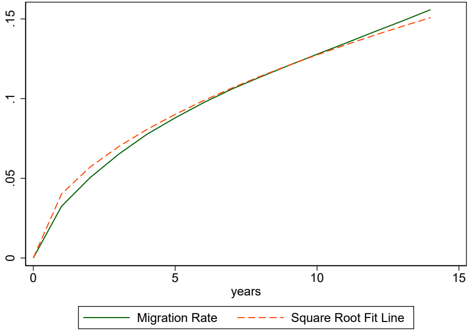
Standard Errors are two-way clustered by origin and destination states

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

- Define t-year interstate migration rate as the share of people who live in a different state than they did t years ago

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 PSID

Does the Standard Dynamic Logit Match this Fact?

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

- Agents choose location that maximizes utility

$$V_{nt}(i) = \max_j v_{jt} - \delta_{ij} + \epsilon_{jnt} + \mathbb{E}[V_{nt+1}(j)]$$

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

Does the Standard Dynamic Logit Match this Fact? Not easily

- In standard model, migration is Markov
  - State variable is current location
  - When migration is rare, t-year migration proportional to t
- Can be reconciled...
  - ...with flexible tenure-dependent moving costs
  - ...or with location attachment
  - ...but requires many fine-tuned parameters

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

$$V_{nt}(\vec{\epsilon}_{nt}) = \max_i \{v_{it} + \epsilon_{int}\} + \beta \mathbb{E}[V_{nt+1}(\vec{\epsilon}_{nt+1}) | \vec{\epsilon}_{nt}]$$

  - No moving costs
  - State variable is match-specific idiosyncratic preference for every location—current location is not

Model

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

- Agents choose location that maximizes utility

$$V_{nt}(\vec{\epsilon}_{nt}) = \max_i \{v_{it} + \epsilon_{int}\} + \beta \mathbb{E}[V_{nt+1}(\vec{\epsilon}_{nt+1}) | \vec{\epsilon}_{nt}]$$

  - No moving costs
  - State variable is match-specific idiosyncratic preference for every location—current location is not
- Personal utility is correlated over both time and space

Model

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

- Agents choose location that maximizes utility

$$V_{nt}(\vec{\epsilon}_{nt}) = \max_i \{v_{it} + \epsilon_{int}\} + \beta \mathbb{E}[V_{nt+1}(\vec{\epsilon}_{nt+1}) | \vec{\epsilon}_{nt}]$$

  - No moving costs
  - State variable is match-specific idiosyncratic preference for every location—current location is not
- Personal utility is correlated over both time and space
- Spatially and Persistently Auto-Correlated Epsilons (SPACE)

Model

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

- Agents choose location that maximizes utility

$$V_{nt}(\vec{\epsilon}_{nt}) = \max_i \{v_{it} + \epsilon_{int}\} + \beta \mathbb{E}[V_{nt+1}(\vec{\epsilon}_{nt+1}) | \vec{\epsilon}_{nt}]$$

  - No moving costs
  - State variable is match-specific idiosyncratic preference for every location—current location is not
- Personal utility is correlated over both time and space
- Spatially and Persistently Auto-Correlated Epsilons (SPACE)

Two ways to model correlation

SPACE 1 Tractable for analyzing individuals:

- Assume ϵ is multivariate normal
- $\epsilon_{nt} = \rho\epsilon_{n,t-1} + \eta_{nt}$
- $\eta_{nt} \sim N(0, \Sigma)$ where $\Sigma_{ij} = \exp(-A \text{ distance}_{ij})$
- More in paper...

SPACE 2 Tractable for aggregation (QSMs):

- Assume ϵ is generalized multivariate Gumbel
- $\epsilon \sim F(\cdot)$

$$F(\epsilon) = \exp(-G(H(e^{-\epsilon_{11}}, ..., e^{-\epsilon_{1t}}, ...), ..., H(e^{-\epsilon_{n1}}, ..., e^{-\epsilon_{nt}}, ...), ...)$$

- $G \circ H$ must be a correlation function (McFadden 1978)
  - G manages correlations across space
  - H manages correlations across time

$$H(0, ..., 0, x_t, 0, ..., 0, x_s, 0, ..., 0) = \left(x_t^{\frac{1}{\gamma_{st}}} + x_s^{\frac{1}{\gamma_{st}}}\right)^{1-\gamma_{st}}$$

where $\gamma_{st} = \sqrt{1 - \rho^{|s-t|}}$ mimics the autocorrelation of the AR(1)

Model can match all three facts

- Migration is rare
  - When autocorrelation is high, the migration rate is low

Model can match all three facts

- Migration is rare
  - When autocorrelation is high, the migration rate is low
- Gravity
  - When the spatial correlation between an individual's ϵ_i and ϵ_j are high, then people who live in i are more likely to be close to indifferent about living in j

Model can match all three facts

- Migration is rare
  - When autocorrelation is high, the migration rate is low
- Gravity
  - When the spatial correlation between an individual's ϵ_i and ϵ_j are high, then people who live in i are more likely to be close to indifferent about living in j
- Square root fact

Proposition

In SPACE Model 2, the t-year migration rate is proportional to $\sqrt{1-\rho^t}$, which is approximately proportional to $\sqrt{t}$ when ρ is large

Parameterization in SPACE model 2

- Population:

$$p_i = e^{v_i} \frac{G_i}{G}$$

  - G_i is the ith partial derivative
  - Functions are evaluated at $(e^{v_1}, ...e^{v_i}, ...)$

- Migration

$$m^t_{i \to j} = p_i p_j \sqrt{1 - \rho^t}(1 + \tau_{ij})$$

where $\tau_{ij} \equiv -\frac{G_{ij} G}{G_i G_j} e^{v_i + v_j}$

  - τ_{ij} higher for more correlated states
  - Pick G to match population and migration in the data
  - Dynamics are naturally hit because the model matches the square root fact
  - One particularly tractable G is in the paper, based on a cross-nested logit

Implications of the Model

1. Population elasticities
2. Population dynamics
3. Moving Costs

Is the model useful for counterfactuals and welfare?

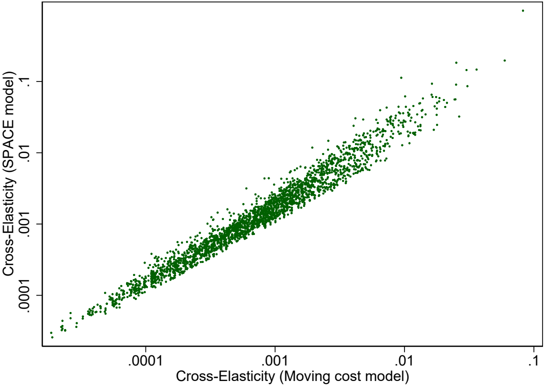
Proposition

In SPACE Model 2, the semi-elasticity of the population in i with respect to v_j is

$$\frac{\partial \log p_i}{\partial v_j} = -\sqrt{\frac{1}{1-\rho}}\frac{m_{i\to j}}{p_i}$$

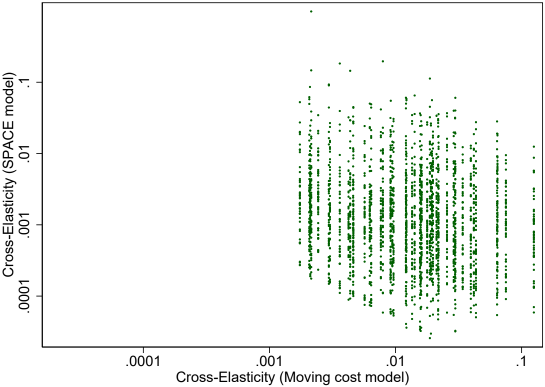
Short-run Population Cross-elasticity

- In the short-run, elasticities from moving cost model and SPACE model are quite similar
- Both primarily depend on gross migration

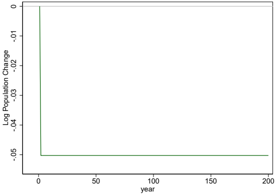


Long-run Population Cross-elasticity

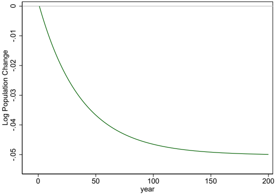
- In the long-run, very different
- Dynamic logit converges to static logit
  - Cross-elasticities proportional to population of shocked state



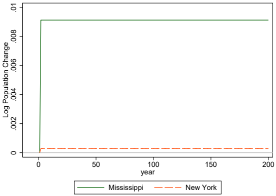
Population dynamics after a one-time permanent change in $v_{\text{Louisiana}}$



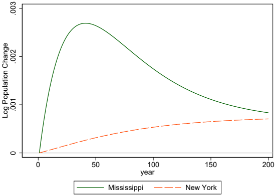
(a) Louisiana, SPACE model



(b) Louisiana, Dynamic Logit model



(c) Mississippi and New York, SPACE model



(d) Mississippi and New York, Dynamic Logit model

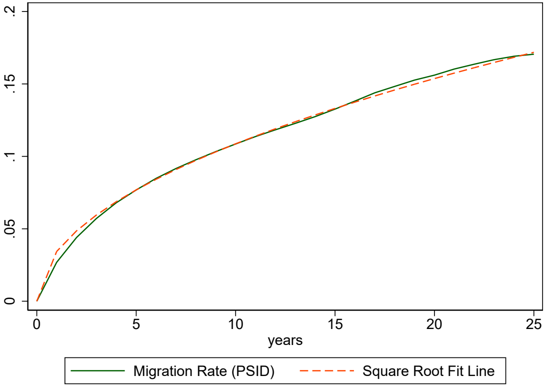
Moving Costs Need Not Be Large

- Kennan and Walker (2011): average moving cost is \$312,146 (in 2010 USD)
- \$0 in SPACE model

Takeaways

1. New fact: t-year internal migration rates are proportional to $\sqrt{t}$
2. Persistent preferences match dynamic moments of migration *and* gravity
3. Persistent preferences has different implications for long-run adjustments, population dynamics, and estimates of moving costs

Square Root Rule, PSID

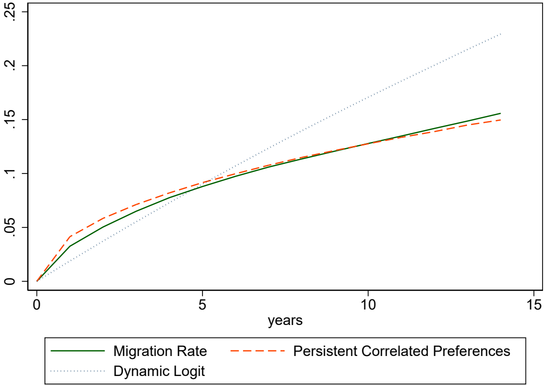


Return

Square Root Rule, 5-year calibration

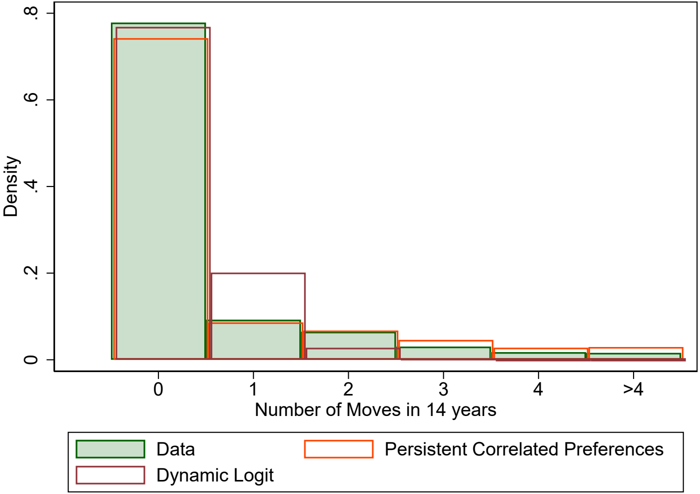
Proposition 2

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



Return

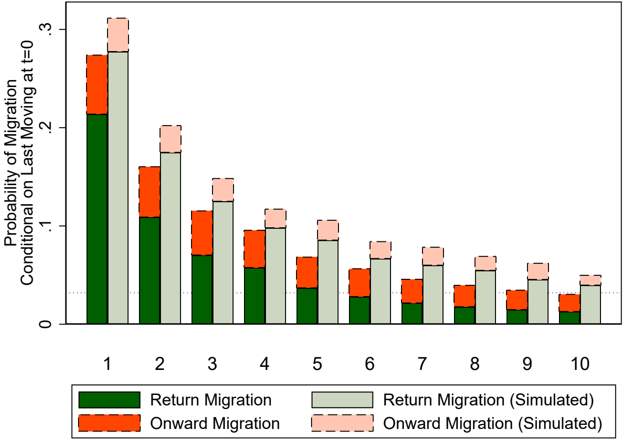
Frequency of Migration, 5-year calibration



Return

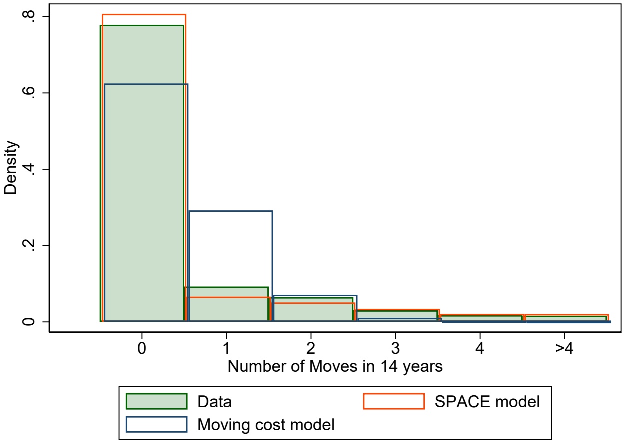
Return Migration, 5-year calibration

- Conditional probability of moving after previous move



Return

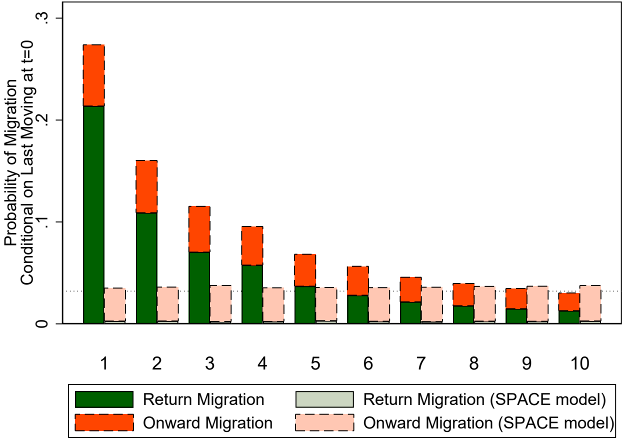
Frequency of Moves, Dynamic Logit Model



Return

Return Migration, Dynamic Logit Model

- Conditional probability of moving after previous move



Return

Bibliography

Kennan, John and James R Walker, "The effect of expected income on individual migration decisions," *Econometrica*, 2011, *79* (1), 211–251.