HOUSING MARKET AND MIGRATION REVISITED

A multilevel gravity model for Dutch municipalities

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Background: two different cultures (Breiman, 2001)

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- causal impact of x on y
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In economics:

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Outside economics:

- model performance
- focuses on $\hat{y}$
- prediction of total effect

Background empirical application

- Aggregate home-ownership has negative impact on labour market performance, because of increased moving costs (Oswald, 1996, 1999)
- Large empirical literature (mostly on individual choices)
- Literature on impact of social renting on migration flows is scarce (De Graaff et al., 2009)
  - Social renting rights only valid within city (but Boyle, 1998)
  - Social renting is an urban phenomenon ($\approx$ 40% in Amsterdam)

This paper

Does what? Revisits the impact of housing market structure (home-ownership and social renting rates) on within-country migration flows using a Bayesian multilevel gravity model (Congdon, 2010)

Aim To predict all changes in incoming and outcoming migration flows of, e.g., Amsterdam, when housing market structure changes whilst accounting for origin and destination specific effects (Ranjan and Tobias, 2007)

Gravity model data structure

$\textsc{City}_1$

$\textsc{City}_2$

$\textsc{City}_3$

$\vdots$

$\textsc{City}_i$

$\vdots$

$\textsc{City}_I$

Gravity model data structure

$\textsc{Origin}_1$	$\textsc{Destination}_1$
$\textsc{Origin}_2$	$\textsc{Destination}_2$
$\textsc{Origin}_3$	$\textsc{Destination}_3$
$\vdots$	$\vdots$
$\textsc{Origin}_i$	$\textsc{Destination}_j$
$\vdots$	$\vdots$
$\textsc{Origin}_I$	$\textsc{Destination}_J$

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  - No two-stage models anymore
- Many definitions (in a Bayesian context):
  - mixed effects, varying intercept/parameter, shrinkage, partial pooling models
- Estimates the level effects from a distribution, usually $(o_i, d_j) \sim \text{Normal}(\alpha, \sigma)$
  - $\sigma \longrightarrow 0$: complete pooling
  - $\sigma \longrightarrow \infty$: no pooling (fixed effects)

Data: migrations flows

- Migration flows between 393 Dutch municipalities in 2015($\approx 150,000$)
- Variance is 4 times expectation: dispersion

Data: municipal housing structure

- Positive correlation between city size and social renting (0.4)
- Negative correlation between social renting and home-ownership (-0.84)

Modeling framework: traditional gravity modeling

$$\log(\text{migrants}_{ij}) = o_i + d_j + \gamma \log(\text{dist}_{ij}) + \epsilon_{ij}$$

Adopting fixed effects for multilateral resistance (Anderson and Van Wincoop, 2003), but:

- what about zeros?
- how to incorporate municipal housing structure?
- dispersion and heteroskedasticity (Silva and Tenreyro, 2006)

Modeling framework: multilevel gravity modeling

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\log(\lambda_{ij}) =& \alpha + o_{\text{mun}[i]} + d_{\text{mun}[j]} + \\
& \beta_1 \log(\text{pop}_i) + \beta_2 \log(\text{pop}_j) + \\
& \beta_3 \log(\text{home}_i) + \beta_4 \log(\text{home}_j) + \\
& \beta_5 \log(\text{soc}_i) + \beta_6 \log(\text{soc}_j) + \\
& \beta_7 \log(\text{dist}_{ij}) && \text{(linear model)}
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o_{\text{mun}} &\sim \text{Normal}(0, \sigma_o) && \text{(origin effects)} \\
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d_{\text{mun}} &\sim \text{Normal}(0, \sigma_d) && \text{(destination effects)} \\
\alpha, \beta_1, \ldots, \beta_7 &\sim \text{Normal}(0, 2) && \text{(priors)} \\
\sigma_o, \sigma_d &\sim \text{HalfCauchy}(0, 1) && \text{(priors)} \\
\tau &\sim \text{Gamma}(0.01, 0.01) && \text{(prior)}
\end{aligned}
$$

Hamiltonian Monte Carlo (HMC) estimation results

Parameter	mean	sd
Intercept	-0.74	0.04
$\log(\text{pop}_i)$	0.89	0.03
$\log(\text{pop}_j)$	0.88	0.04
$\log(\text{home}_i)$	-1.48	0.19
$\log(\text{home}_j)$	-1.27	0.25
$\log(\text{soc}_i)$	-0.04	0.04
$\log(\text{soc}_j)$	-0.06	0.03
$\log(\text{dist}_{ij})$	-1.96	0.01
σ_o	0.45	0.02
σ_d	0.61	0.02
τ	1.22	0.01

d_{mun} as measure of attractivity?

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Home-ownership rate in Amsterdam decreases with 10%?

Conclusions

With respect to migration flows:

- homeownership has an elasticity well below -1
- social renting has negative elasticity as well, but close to zero
- most migration dynamics outside the most popular areas

Multilevel gravity framework

- flexible and powerful
- suitable for predictions within and outside sample
- with good model specification, estimation runs smoothly
- not very scalable; 154,056 obs. $\approx$ 6 hrs. of estimation

Supplementary materials

Paper, data and code can be retrieved from the project's GitHub page:

`https://github.com/Thdegraaff/migration_gravity`

Questions?

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