Drs. Muth and Mills meet Dr. Tiebout: Integrating Location-Specific Amenities into Multi-Community Equilibrium Models

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Prepared for the 50th Anniversary Conferences of the JRS
Held at the Federal Reserve Bank of New York: April 23-24

April 21, 2009

Two Paradigms for Explaining Sorting

- Alonso/Muth/Mills Hypothesis: Households or firms sort themselves within an urban area taking into consideration differences in spatial amenities (such as proximity to a central business district) and local housing market conditions.
- Tiebout Conjecture: Household preferences for location are primarily driven by differences in publicly provided goods and tax rates across jurisdictions in a metropolitan area.
- Tiebout models typically ignore spatial heterogeneity while most spatial models ignore the importance of competition among jurisdictions.
- These abstractions are naturally of concern.

Spatial Amenities and Locational Equilibrium

- We consider the problem of integrating spatial amenities into locational equilibrium models with multiple jurisdictions.
- We provide sufficient conditions under which models that assume a single housing price in each community continue to apply in the presence of location-specific amenities that vary both within and across communities.
- If these conditions are satisfied, the models, estimation methods, and results in Epple and Sieg (1999) are valid in the presence of (potentially unobserved) location-specific amenities.

Measuring Spatial Amenities

- We also show how to construct sufficient statistics that capture location specific spatial heterogeneity.
- The measures are base on recent innovations in estimating housing production function discussed in Epple, Gordon, and Sieg (2009).
- We apply these techniques using data from the Pittsburgh metropolitan area.
- We find that these amenity measures capture proximity to important local employment centers as well as heterogeneity in school quality within a given school district.

A Sorting Model

- Take a standard locational equilibrium model with J communities.
- Each community provides a local public good g_j which is financed by property taxes t_j.
- Assume there are I_j geographic areas (e.g., blocks, neighborhoods), indexed by i, within municipality j.
- Each neighborhood is characterized by a vector of amenities $A_{i,j}$, a price for housing $p^q_{i,j}$, and a housing supply function $Q^s_{ij}(p^q_{ij})$.
- The household preferences take the form $U(\alpha, g, q, a, b)$, which implies an indirect utility function $V(\alpha, y; g_j, p^q_{ij}\ (1 + t_j), A_{i,j})$.

An Aggregation Result

Under assumptions 1-3, the consumer choice problem can be expressed in terms of a single price, p_j^h, per community that is invariant to location specific amenities within the community, i.e, preferences over communities can be expressed as $V(\alpha, y; g_j, p_j^h)$.

The result directly follows from a "no-arbitrage" condition that has to hold in equilibrium.

The main implication of the result is then that the empirical approaches such as Epple and Sieg (1999) are valid in the presence of location-specific amenities.

Assumptions

1. The bundle of amenities can be mapped into a uni-dimensional index, $a(A)$, common across households, with utility increasing in the value of the index: $U_a(\alpha, g, q, a, b) > 0$.
2. The household utility function can be written $U(\alpha, g, q, a, b) = U(\alpha, g, h(q, a), b)$.
3. The index of housing services is multiplicatively separable: $h = q \cdot a(A)$.

Note that these are sufficient, and not necessary assumptions for the aggregation result to go through.

Measuring Location-Specific Amenities

Can we construct a uni-dimensional measure of location-specific amenities ($a(A)$) even if amenities and housing prices are not observed?

Under CRS, Epple, Gordon and Sieg (2009) show that

$$\frac{V}{L} \;=\; v \;=\; p_q \; q_s(p_q) \;=\; w(p_q)$$

Under the assumptions above, equilibrium requires: $p_q = p_h \; a$. Hence:

$$a = \frac{w^{-1}(v)}{p_h}$$

We can recover the unobserved amenities, up to a constant of proportionality.

	Full Sample		Post-1995	
Amenity	Coefficient	Std Err	Coefficient	Std Err
Travel Time	-0.01603	0.00019	-0.00411	0.00037
Brashear	0.09606	0.00188	0.23545	0.01998
Oliver	0.01325	0.00209	0.11045	0.02768
Schenley	0.07471	0.00243	0.15881	0.04155
Langley	0.01300	0.00243	-0.09123	0.04572
Peabody	0.21198	0.00216	0.29649	0.03027
Allderdice	0.22537	0.00204	0.15307	0.04061
Westinghouse	0.06711	0.00291	0.02414	0.04061
Constant	-0.00846	0.00265	-0.25800	0.01163
Adj-R^2	0.2123		0.1023	
Obs.	91,767		6,362	

Future Research or the "Usual Suspects"

- New and better data.
- Peer, neighborhood effects, and social interactions.
- More realistic models of housing markets.
- Institutional features and urban housing market policies.
- Housing and land supply.
- Political institutions and political economy.
- Dynamics.