Neighborhood Change and the Valuation of Urban Amenities: Incorporating Dynamic Behavior into the Hedonic Model

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What is Neighborhood Change?

- "The term gentrification inevitably generates controversy and disagreement. People disagree about its definition, its causes, and, above all, its consequences. All seem to agree, however, that whatever gentrification is, it is becoming more prevalent in U.S. cities." (Ellen and Ding, 2016)
- We are thinking about a world where neighborhood amenities are changing, and these changes signal something about:
  - contemporaneous amenities flows and housing costs
  - future amenity flows and housing costs
  - implications for future housing wealth

How Does Neighborhood Change Impact Valuation?

- Think about the "Starbucks Effect"
  - Imagine a world where we find a large positive willingness to pay to be within walking distance of a Starbucks
  - How much do people value proximate access to caffeinated beverages?
- We want to disentangle the impacts of:
  - preferences for the consumption of amenities, which are key for policy
  - the predictive power of amenities
- Our framework can be used to explore sorting and heterogeneous housing-wealth accumulation associated with gentrification.

Our Goals

- Develop a dynamic housing/amenity choice model that will:
  - allow one to disentangle separate impacts of amenities
  - be relatively simple and computationally light
- Construct a detailed panel dataset describing the LA Metro Area
- Estimate WTPs for time-varying neighborhood amenities that are a priori thought to have predictive power
  - x is comprised of block-group income, education, and homeownership rate
  - while additionally controlling for an amenity index
- Analyze implications for neighborhood change and wealth accumulation

Our Methodology

We begin with the continuous-choice model of Rosen (1974) and the intuition that households satisfy a first-order condition when choosing where to live

- Our model retains the simple intuition of the Rosen framework
- It has a relatively low computational burden

We propose a fully-dynamic model where households face moving costs, are forward-looking, and can re-optimize in each period.

- A discrete choice over whether to move (re-optimize)
- A continuous choice of quantity of each amenity (FOC)

Our Methodology

- Bishop and Murphy (P&P 2011) presents a simplified continuous-choice model. Here, our fully-dynamic model additionally allows for:
  - multiple time-varying amenities
  - unobserved house/neighborhood amenities
  - household-specific unobserved heterogeneity
  - endogenous use-cost rate of housing
- Bishop (WP) and Bayer et al. (ECMA 2015) are discrete-choice models
- Bishop and Murphy (REStat 2018) presents a reduced-form approximation

The Model - flow utility

The household receives choice-specific flow utility in each period:

- If they do not move: $u(x^e_{i,t}, z_{i,t}, \eta_{i,t}; \alpha) - r(x^e_{i,t}; \gamma_t)$

  They consume their "endowment" amenities, over which they have idiosyncratic preferences, and pay a user-cost

- If they move: $u(x_{i,t}, z_{i,t}, \eta_{i,t}; \alpha) - r(x_{i,t}; \gamma_t) - MC(z_{i,t}, x^e_{i,t}; \delta) + \epsilon_{i,t}$

  They consume their choice amenities, pay a user-cost, and pay an idiosyncratic moving cost

The Model - lifetime utility

- Lifetime utility is defined as the present, discounted sum of flow utilities
- The household chooses to move if the lifetime utility associated with moving is greater than the lifetime utility associated with not moving
- The optimal choice of amenities maximizes the following:

$$\begin{aligned} v_{1,t} &= u(x_t, z_t, \eta_t; \alpha) - r(x_t; \gamma_t) - MC(z_t, x_t^e; \delta) + \epsilon_t \\ &\quad + \beta E[max\{v_{0,t+1}, v_{1,t+1} + \epsilon_{t+1}\} | s_t, x_t] \end{aligned}$$

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- FOC: $u'(\cdot) - r'(\cdot) - \beta EMC_1'(\cdot) - \beta\sigma_\epsilon ELP_1'(\cdot) = 0$

Dynamic Model - first order condition

- FOC is reduced to the familiar Rosen FOC *plus* two "extra" terms:

$$u'(x_t, z_t, \eta_t; \alpha) - r'(x_t; \gamma^r) - \beta EMC_1'(s_t, x_t) - \beta\sigma_\epsilon ELP_1'(s_t, x_t) = 0$$

$$r'(x_t; \gamma^r) = u'(x_t, z_t, \eta_t; \alpha) + \beta EMC_1'(s_t, x_t) + \beta\sigma_\epsilon ELP_1'(s_t, x_t)$$

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$$\widehat{r}'(x_t; \gamma^r) = u'(x_t, z_t, \eta_t; \alpha) + \beta\widehat{EMC}_1'(s_t, x_t) + \beta\sigma_\epsilon\widehat{ELP}_1'(s_t, x_t)$$

Dynamic Model - estimation

First stage:

- Use house sales to estimate the parameters of rental function by market
- Use amenity data to estimate transition probabilities
- Estimate change in ELP and EMC

Second stage:

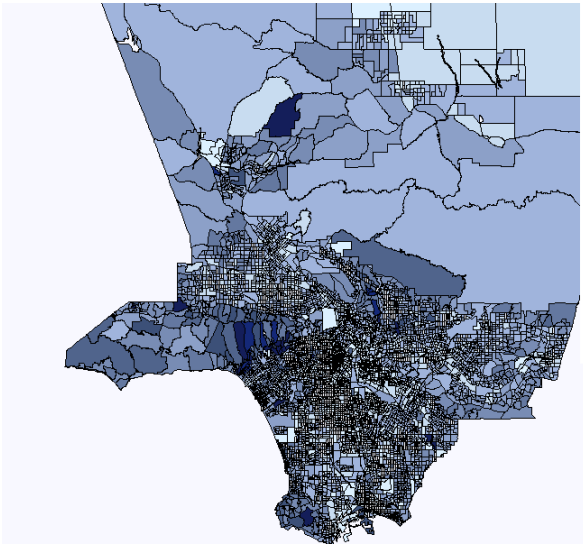
- Plug first-stage estimates into first-order condition
- Estimate via Maximum Likelihood

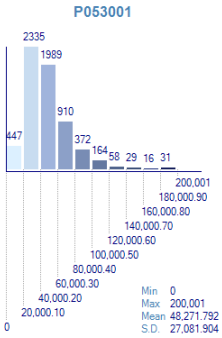
Panel Data for Los Angeles, 1990-2008

LA, Orange, Riverside, San Bernadino, and Ventura counties

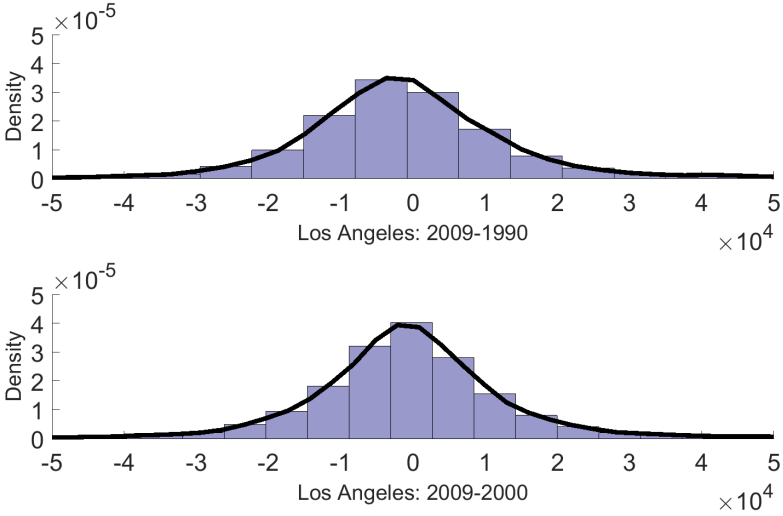
1. Housing transactions data (CoreLogic) - 1,242,464 transactions
   - Sales price, year, attributes, and coordinates (including block group and tract)
2. Mortgage application data (HMDA) - 855,845 households
   - $\mathbf{z}_{i,t}$: Race and income
3. Amenity data (GeoLytics: 1990 Census, 2000 Census, ACS 2009)
   - Block Group Household Median Income
   - Block Group College Degree Rate
   - Block Group Owner-Occupied Rate
   - Composite house/neighborhood amenity index

Cross-Sectional Variation in Amenities - median income





Time Series Variation in Amenities - median income



Estimation Results

	Estimate	*Annual WTP for $\frac{1}{2}$sd increase*
BG Median Income - mean($\mathbf{z}'_{i,t}\boldsymbol{\alpha}_1$)	37.47	
- α_{Income}	0.22	
BG College Degree - mean($\mathbf{z}'_{i,t}\boldsymbol{\alpha}_1$)	62.40	
- α_{Income}	0.12	
BG Owner-Occupied - mean($\mathbf{z}'_{i,t}\boldsymbol{\alpha}_1$)	7.12	
- α_{Income}	0.08	
House Amenity Index - mean($\mathbf{z}'_{i,t}\boldsymbol{\alpha}_1$)	24,976	
- α_{Income}	143	
N	855,845	

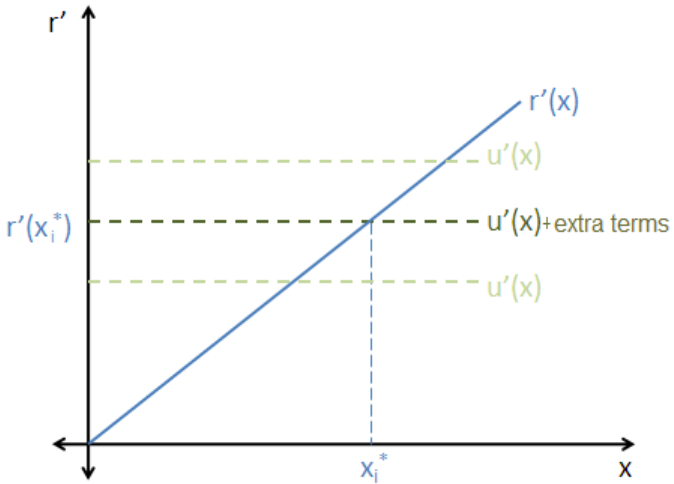
Estimation Results

	Estimate	*Annual WTP for $\frac{1}{2}$sd increase*
BG Median Income - mean($\mathbf{z}'_{i,t}\boldsymbol{\alpha}_1$)	37.47	\$354
- α_{Income}	0.22	
BG College Degree - mean($\mathbf{z}'_{i,t}\boldsymbol{\alpha}_1$)	62.40	\$483
- α_{Income}	0.12	
BG Owner-Occupied - mean($\mathbf{z}'_{i,t}\boldsymbol{\alpha}_1$)	7.12	\$69
- α_{Income}	0.08	
House Amenity Index - mean($\mathbf{z}'_{i,t}\boldsymbol{\alpha}_1$)	24,976	\$5,154
- α_{Income}	143	
N	855,845	

Estimation Results

	Estimate	*Annual WTP for* $\frac{1}{2}$*sd increase*
BG Median Income - mean($\mathbf{z}'_{i,t}\boldsymbol{\alpha}_1$)	37.47	\$354
- α_{Income}	0.22	elasticity of 0.50 (at \$86k)
BG College Degree - mean($\mathbf{z}'_{i,t}\boldsymbol{\alpha}_1$)	62.40	\$483
- α_{Income}	0.12	elasticity of 0.17 (at \$86k)
BG Owner-Occupied - mean($\mathbf{z}'_{i,t}\boldsymbol{\alpha}_1$)	7.12	\$69
- α_{Income}	0.08	elasticity of 1.00 (at \$86k)
House Amenity Index - mean($\mathbf{z}'_{i,t}\boldsymbol{\alpha}_1$)	24,976	\$5,154
- α_{Income}	143	elasticity of 0.49 (at \$86k)
N	855,845	

Simple Linear Representation of the Model



Decomposing the WTP for $\frac{1}{2}$ Standard Deviation Increase

	Combined Effect $r'(x_t)$	Preferences for Consumption $u'(x_t)$
BG Median Income	\$384	\$354
BG College Degree	\$289	\$483
BG Owner-Occupied	\$164	\$69
House Amenity Index	\$4,124	\$5,145

Conclusion

- Develop a model that incorporates moving costs and dynamic behavior into the traditional Rosen framework
- Estimate the WTP for neighborhood amenities
- Isolate the role of household preferences from predictive ability of amenities
- Find substantial heterogeneity along observed and unobserved dimensions

Thank you! kelly.bishop@asu.edu