Intro to Quantitative Spatial Models

Urban Economics

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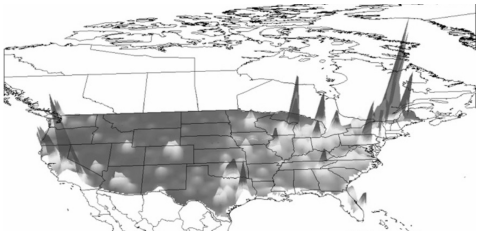
Spatial Distribution

- Why do we see such a remarkable clustering of human activity in a small number of urban areas?
- Cities exist because they are areas with high levels of productivity, which might occur because people come to places that are innately more productive or because density itself enhances productivity because of agglomeration economies



Evidence of Agglomeration Economies

- Three strategies to identify agglomeration economies
  1. Show there is too much spatial concentration to be random (Duranton and Overman, 2005)
  2. Compare productivity over space (Greenstone, 2010)
  3. Compare wages and rents across space (Quantitative Spatial Models, Ahlfeldt et al, 2015)

Spatial Distribution: TFP

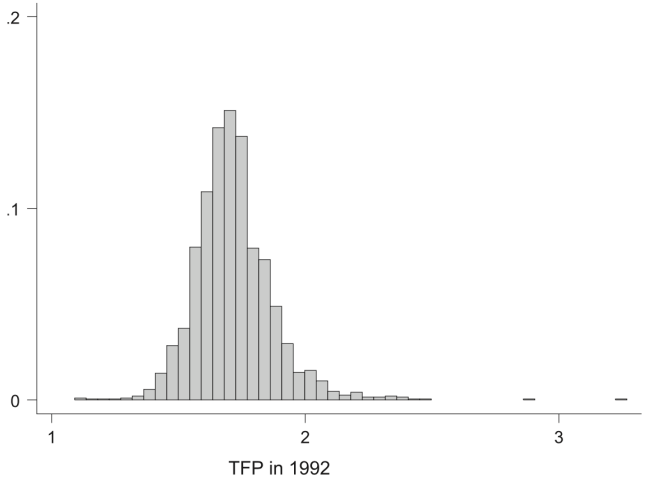


Figure 5 ***Distribution of total factor productivity in manufacturing establishments, by county.***

Spatial Distribution: Wages

Table 1 Metropolitan areas with the highest and lowest hourly wage of high school graduates in 2000.

Metropolitan area	Average hourly wage
Metropolitan areas with the highest wage	
Stamford, CT	20.21
San Jose, CA	19.70
Danbury, CT	19.13
San Francisco-Oakland-Vallejo, CA	18.97
New York-Northeastern NJ	18.86
Monmouth-Ocean, NJ	18.30
Santa Cruz, CA	18.24
Santa Rosa-Petaluma, CA	18.23
Ventura-Oxnard-Simi Valley, CA	17.72
Seattle-Everett, WA	17.71

Spatial Distribution

Metropolitan areas with the lowest wage	
Ocala, FL	12.12
Dothan, AL	12.11
Amarillo, TX	12.10
Danville, VA	12.08
Jacksonville, NC	12.02
Kileen-Temple, TX	11.98
El Paso, TX	11.96
Abilene, TX	11.87
Brownsville-Harlingen-San Benito, TX	11.23
McAllen-Edinburg-Pharr-Mission, TX	10.65

The sample includes all full-time US born workers between the age of 25 and 60 with a high school degree who worked at least 48 weeks in the previous year. Data are from the 2000 Census of Population.

Quantitative Spatial Models

- They have several advantages :
  - They easily accommodate many regions and a rich mobility structure
  - They can rationalize data as equilibria of the model
  - They are usually exactly identified
- Types of research questions
  - What explains the difference in income across locations?
  - Welfare/distribution of welfare when a location gets a productivity shock?
  - Welfare/distribution of welfare when roads are built?

Introduction to a basic quantitative spatial model

- We begin with a twist to Rosen-Roback
  - We'll work through n = 2 case to develop intuition, but it can be easily extended to n locations
  - Can be used for other applications (trade, commuting, etc.)

Introduction to a basic quantitative spatial model

- Why aren't wages equalized across space?
  - People maximize utility, not wages
  - Places may have different levels of amenities
  - Places may have different costs of living
  - Places may have differently skilled workers (selection)
  - People also usually differ over their individual preferences for locations
  - Additionally, may have frictions
    - Migration costs
    - Trade costs
    - Housing

Rosen-Roback model: Exogenous Prices

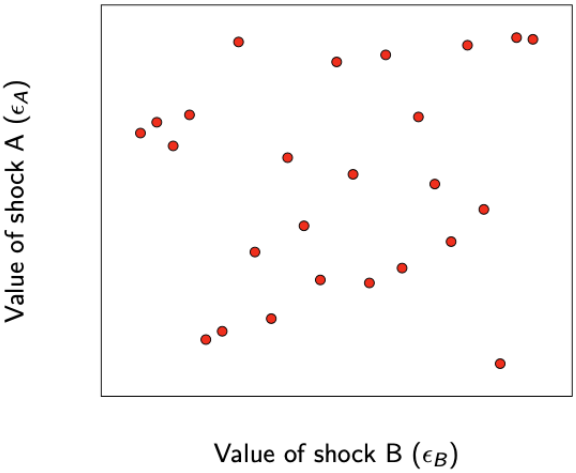
- Assume wages, rents, amenities are exogenous
- Person i's indirect utility of being in A:

$$V_A^i = w_A - r_A + A_A + \epsilon_A^i \tag{1}$$

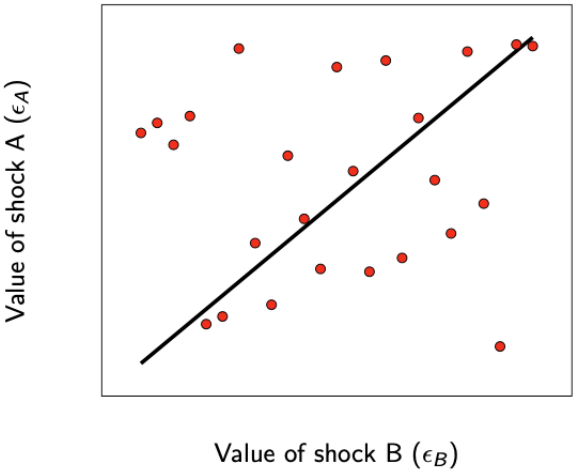
- Person i's indirect utility of being in B:

$$V_B^i = w_B - r_B + A_B + \epsilon_B^i \tag{2}$$

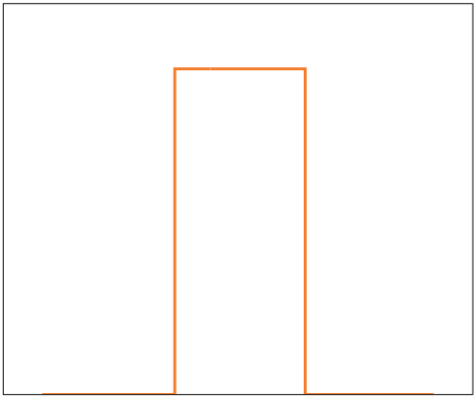
Rosen-Roback model: Exogenous Prices



Rosen-Roback model: Exogenous Prices

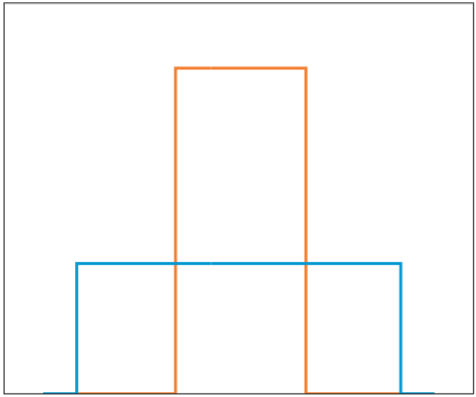


Rosen-Roback model: Exogenous Prices



$\epsilon_A - \epsilon_B$

Rosen-Roback model: Exogenous Prices



$\epsilon_A - \epsilon_B$