Urban Economics

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Lecture 8

Chapter 5

Economic Functions of Cities

Urban Size and Function

- Ranking of top 23 urban areas (Table 5.1)
- Ranking of top urban areas has changed; gainers and losers
- Theory of rank change: "sunbelt" – liberally interpreted
- Geographic theory of hierarchy
- Economic functions
  - Diversified service centers
  - Production centers
  - Specialized service centers

Theory of Urban Hierarchy

Central Place Theory

- Lösch (1954)
- Assumption: Initially, featureless plain, evenly distributed population; transportaion costs equal in all directions; two types of firms (one with significant scale economies); ubiquitous inputs
- Firms have an incentive to locate together because of shared infrastructure
- Example based on gas stations with market areas of 1,000 people and department stores with market areas of 7,000 people
- Result: urban hierarchy

Economic Functions of Cities and Central Place Theory

Uses *scale economies* and location decisions of *market-oriented* firms to show how location decisions of different industries merge to from a regional system of cities

- How many cities will develop?
- Why are some cities larger than others?
- Patterns of trade between industries

Simple Example: 3 Products

- Hospital – optimal scale serves population of 80,000
- Restaurant – optimal scale serves population of 20,000
- Gas station optimal scale serves population of 5,000
- Total population in region is 80,000
- All inputs are ubiquitous – location decisions determined entirely by location of customers

Location Decision: Large Firms

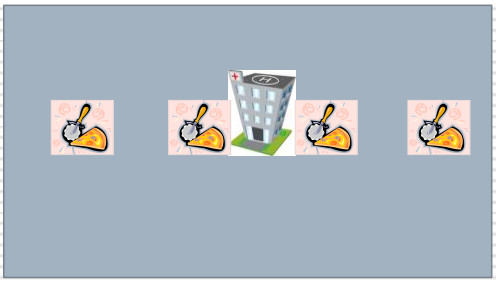
- Hospital – locate in the center of the region to minimize commuting costs
- A "city" develops around hospital workers. Hospital workers locate nearby, increasing population density in the area.

Large Firm in Center of Region

Location Decisions: Medium Firms

- If population density were uniform, would spread themselves evenly across region.
- But large firm – the hospital – increases nearby population density
- Suppose the area around large firm holds enough people to serve two medium firms, i.e., some serving local residents, others serving nearby region
- Then have 2 restaurants in center, remaining 2 divide the surrounding region evenly.

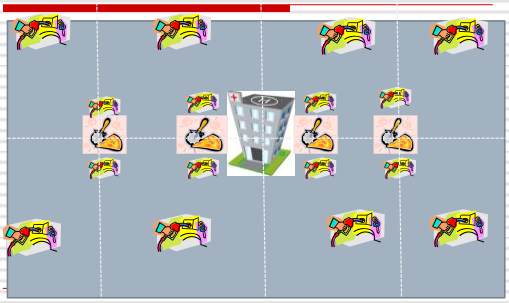
Large Firm in Center, Two Medium Firms in Center, Two Elsewhere



Location Decisions: Small Firms

- If population density were uniform, would spread themselves evenly across region.
- But large firm and medium firms increase nearby density
- Suppose the area around large firm holds enough people to serve 4 small firms (4x5,000) = 20,000
- Suppose the area around medium firms hold enough to serve 2 small firms (2x5,000) = 10,000 each, or 20,000 total
- Then have 4 restaurants in large-firm location, 2 in each medium, 8 dividing the rest of the region evenly.

Region – Large Central City, Two Medium Cities, Four Small Cities



City Size Determined by Number of Small Firms

- 1 Large City (20,000 residents)
  - One Hospital, Serves Region (80,000)
  - Two Restaurants, Serve Large City and four nearby small towns (2x20,000 = 40,000)
  - Four Gas Stations, Serve Large City Only (4x5,000 = 20,000)
- 2 Medium Cities (10,000 residents each)
  - Each as 1 restaurant serving medium city and 2 small towns
  - Each has 2 gas stations, serving medium city only
- 8 Small Cities (5,000 residents each)
  - Each has 1 gas station serving local residents only

Hierarchical System of Cities

- Larger cities have industries with large scale economies
- Larger cities have more diverse employment bases
- Pattern of trade – smaller cities are more likely to buy products from large cities than vice-versa
- Small number of large cities because few are needed to provide goods with largest scale economies

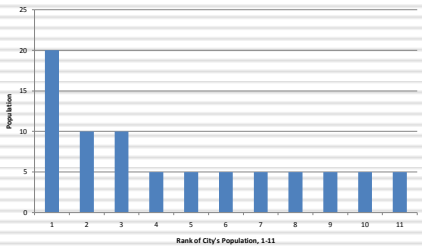
Rank Size Rule

- 1xLargest city = 1x20,000 = 20,000
- 2xNext Largest City = 2x10,000 = 20,000
  - Applies to ranks 2 and 3, a tie
- 4x Next Largest city = 4x5,000 = 20,000
  - Applies to ranks 4-11, 8 small city ties
- General Rule is Population x Rank = Population of Largest City

Rank-Size Rule for Urban Areas

- Rank x Size = constant
- Does it work? For NY, Rank x Size = 19. For LA, Rank x Size = 32.8. For Chicago, Rank x Size = 27.
- Why Rank-Size Rule?
  - Small town: $p_1=k(r+p_1)$ implies $p_1=rk/(1-k)$ which is approximately $p_1=rk$
  - Large town: $7kr+6kp_1+kp_2$ (workers in department store); approx. $p_2=8kr$
  - Ratio $p_1/p_2=kr/8kr=1/8$

City-Size Distribution



Rank Size Rule (Zipf's Law)

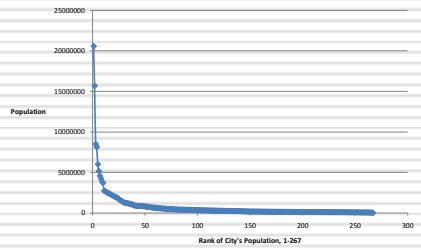
$$Population = \frac{Const}{Rank^{\beta}}$$

$$Population\, x\, Rank = Cons$$

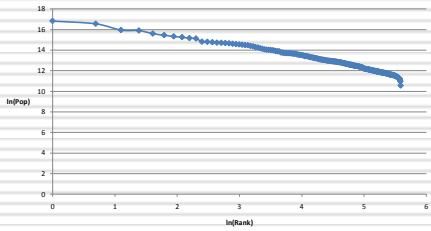
Rank-Size rule is special case with β = 1

20 mil x 1 = 20 mil
10 mil x 2 = 20 mil
6.67 mil x 3 = 20 mil
5 mil x 4 = 20 mil

Population by City Rank, 2000



Rank Size Rule Empirically
267 US Metro Areas in 2000
ln(Population) = ln(const) – βln(Rank)



Limitations of Urban Hierarchy Model

- OK for retailing, consumer services, and manufacturing – if market-oriented rather than input-oriented
- Driven by scale economies (e.g., shared infrastructure)
- Driven by specialization (discussion p. 60); Adam Smith, *Wealth of Nations*; pin factory example
- Not OK for
  - resource-oriented firms (e.g., steel)
  - ports and transshipment points (geography generally)
  - localization economies not accounted for
  - governmental centers (state capitals, etc.)

Location Quotients

- Idea is to identify industries in which an urban area specializes
- Use Location Quotient, defined as

$$LQ = (e^*/e)/(E^*/E)$$

e* = employment in an industry in an urban area
e = total employment in the urban area
E*= employment in the same industry in the nation (reference economy)
E = total employment in the nation

Industry Clusters

- Manufacturing
- Financial and Legal Services
- Business and Professional Services
- Distribution
- Health, Social Services, and Education
- Retail Trade
- Recreation Services
- Government

Example: DesMoines in 2008

Industry	Location Quotient
Manufacturing	0.62
Wholesale Trade	1.29
Retail Trade	1.01
Transportation and utilities	0.87
Information	1.35
Financial activities	2.67 (Insurance, 3.33)
Prof. and business services	0.89
Education, health, soc. serv.	0.88
Leisure and hospitality	0.93
Government	0.78

Industry Clusters in Urban Areas
continued

Location Quotients - How to define (to what degree of refinement) the "industry"?

Location Quotient Calculator

http://www.bls.gov/cew/cewlq.htm

LIVE DEMO

Occasional Assignment #1

Compute Location Quotients for one of the following areas:

San Jose
Oakland
San Francisco