Course Information

Instructor: Guillermo Ordonez (guilord@ucla.edu)
Lecture hours: MW 1:00 3:05 pm, Dodd 175.
Office hours: MW 3:30 4:30 pm, Bunche 2265.
By appointment.
Midterm: August 27th, 2007 (Monday of 4th week).
Final Exam: September 12th, 2007 (Last class).
Course Webpage: http://www.sscnet.ucla.edu/071/econ137_1/
Grading

- Midterm (1 hour) 25% (Replaceable grade!)
- Individual Essay 15%
- Group Essay 10%
- Final (2 hours) 50%
Readings

  E-reserve: College Library Circulation Desk
  http://www2.library.ucla.edu/service/student.cfm

- [LN] Lecture Notes:
  http://www.sscnet.ucla.edu/071/econ137-1/linkpage.php
  Print free from the printing kiosks (Public Policy)
  Print them right before class!

- [AR] Additional readings
  - News articles and papers given in class.
  - [H&G] Hoover and Giarratani, Regional Economics, Online Edition
    http://www.rri.wvu.edu/WebBook/Giarratani/contents.htm
## Plan for the Course

<table>
<thead>
<tr>
<th>Week 1</th>
<th>Introduction</th>
<th>Cities and Clusters</th>
<th>[O] Ch. 1, 2, 3</th>
</tr>
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<tbody>
<tr>
<td></td>
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<td>[H&amp;G] Ch. 1, 2</td>
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<tr>
<td>Week 2</td>
<td>Cities over space (Size, Shape)</td>
<td>Cities over time (Growth)</td>
<td>[O] Ch. 4, 5</td>
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<td></td>
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<td>[H&amp;G] Ch. 7, 8</td>
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<tr>
<td>Week 3</td>
<td>Land use pattern</td>
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<td>[O] Ch. 6, 7</td>
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<td>[H&amp;G] Ch. 6</td>
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<tr>
<td>Week 4</td>
<td>08/27 - Midterm</td>
<td>Urban Transportation, Housing</td>
<td>[O] Ch. 10, 11, 13, 14</td>
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<tr>
<td>Week 5</td>
<td>09/03 - Labor Day (No Class)</td>
<td>Education, Crime.</td>
<td>[O] Ch. 12</td>
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<tr>
<td>Week 6</td>
<td>Local Government Economics</td>
<td>09/10 - Essays are due 09/12 - Final Exam</td>
<td>[O] Ch. 15, 16</td>
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</table>
What is this course about?

Why do cities exist? What determines the location, size, shape and growth of cities? We’ll explain it by studying utility-maximizing households and profit-maximizing firms.

Once we understand this, we can see inside a city!

Land use, industry clusters and population distribution

Urban Problems: Crime, Education, Transportation, Housing

- Cities are important because they facilitate growth
- Cities exist because benefits (innovation, production and trade) exceed costs (cities are noisy, dirty and crowded)
What is this course about?

Businessmen: Where to locate firms? How big the market will be?

Real estate investors: Patterns of land use and population distribution

Policy makers: Policies that combat urban problems will increase the vitality of cities, helping them to grow.

and hopefully YOU!
Questions for Lecture Notes I

- What is a City?
- Why do cities exist?
- Why do cities became so important in the last century?
- Why do we observe industry clusters?
- What determines city size?
- Why are there different types of cities?
Tools to answer our questions
Economic Models

- Mathematics as a tool
  - Exogenous vs. Endogenous variables
  - Parameters

- Equilibrium
  - Partial Equilibrium
  - General Equilibrium

For review:

Have you ever played SimCity?
Tools to answer our questions
Golden rules of optimization

- Marginal Benefit = Marginal Cost
- Average Benefit >= Average Cost
Tools to answer our questions

Average vs. Marginal Effects

\[ g(x) > 0 \]

\[ A = \frac{g(x)}{x} > 0 \]  

(Average contribution of all units)

\[ M = \frac{\partial g(x)}{\partial x} \]  

(Contribution of the last unit)

\[ \frac{\partial A}{\partial x} = \frac{\partial g(x)/\partial x}{x} - \frac{g(x)}{x^2} = \frac{1}{x} \left[ M - A \right] \geq < 0 \]

- If Average decreases, \( M < A \)
- If Average is constant, \( M = A \)
- If Average increases, \( M > A \)
Tools to answer our questions
Economies of scale in production

From Production functions to cost properties
- DRS = AC < MC
- IRS = AC > MC
- CRS = AC = MC
What is a city? Census Bureau definitions

- Census block: Smallest geographical unit. Area bounded by streets, property lines, political boundaries, etc.

- Urban and Rural areas:
  - Urbanized Area (UA): Densely settled core of blocks and surrounding blocks such that pop. density > 1000 people per mile$^2$ & N>50,000
  - Urbanized Cluster (UC): Small version of urbanized area. Pop. density > 500 people per mile$^2$ & 2,500<N<50,000
  - Rural area (RA): Not UAs or UCs
What is a city? Census Bureau definitions

- **Metro(micro)politan areas (MSA).**
  - Metropolitan area (MeA): Includes at least one urbanized area (UA) such that \( N > 50,000 \)
  - Micropolitan area (MiA): Includes at least one urbanized cluster (UC) such that \( 10,000 > N > 50,000 \)

- **Principal City**
  - Principal city is the largest place (municipality) in each MSA.
  - Possibly many principal cities in a given MSA.
  - Minimum requirements
    - Population size: At least 250,000 people.
    - Employment size: At least 100,000 workers.
Examples of MSAs

TABLE 1–1 Largest Metropolitan Areas in the United States, 2000

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>New York-Northern New Jersey-Long Island, NY-NJ-PA</td>
<td>18,323,002</td>
<td>8.8</td>
</tr>
<tr>
<td>Los Angeles-Long Beach-Santa Ana, CA</td>
<td>12,365,627</td>
<td>9.7</td>
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<tr>
<td>Chicago-Naperville-Joliet, IL-IN-WI</td>
<td>9,098,316</td>
<td>11.2</td>
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<tr>
<td>Philadelphia-Camden-Wilmington, PA-NJ-DE</td>
<td>5,687,147</td>
<td>4.6</td>
</tr>
<tr>
<td>Dallas-Fort Worth-Arlington, TX</td>
<td>5,161,544</td>
<td>29.4</td>
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<tr>
<td>Miami-Fort Lauderdale-Miami Beach, FL</td>
<td>5,007,564</td>
<td>23.5</td>
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<tr>
<td>Washington-Arlington-Alexandria, DC-VA-MD</td>
<td>4,796,183</td>
<td>16.3</td>
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<tr>
<td>Houston-Baytown-Sugar Land, TX</td>
<td>4,715,407</td>
<td>25.2</td>
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<tr>
<td>Detroit-Warren-Livonia, MI</td>
<td>4,452,557</td>
<td>4.8</td>
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<tr>
<td>Boston-Cambridge-Quincy, MA-NH</td>
<td>4,391,344</td>
<td>6.2</td>
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<tr>
<td>Atlanta-Sandy Springs-Marietta, GA</td>
<td>4,247,981</td>
<td>38.4</td>
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<tr>
<td>San Francisco-Oakland-Fremont, CA</td>
<td>4,123,740</td>
<td>11.9</td>
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<tr>
<td>Riverside-San Bernardino-Ontario, CA</td>
<td>3,254,821</td>
<td>25.7</td>
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<tr>
<td>Phoenix-Mesa-Scottsdale, AZ</td>
<td>3,251,876</td>
<td>45.3</td>
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<tr>
<td>Seattle-Tacoma-Bellevue, WA</td>
<td>3,043,878</td>
<td>18.9</td>
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<tr>
<td>Minneapolis-St. Paul-Bloomington, MN-WI</td>
<td>2,968,806</td>
<td>16.9</td>
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<tr>
<td>San Diego-Carlsbad-San Marcos, CA</td>
<td>2,813,833</td>
<td>12.6</td>
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<tr>
<td>St. Louis, MO-IL</td>
<td>2,698,687</td>
<td>4.6</td>
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<tr>
<td>Baltimore-Towson, MD</td>
<td>2,552,994</td>
<td>7.2</td>
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<tr>
<td>Pittsburgh, PA</td>
<td>2,431,087</td>
<td>−1.5</td>
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<tr>
<td>Tampa-St. Petersburg-Clearwater, FL</td>
<td>2,395,997</td>
<td>15.9</td>
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<td>Denver-Aurora, CO</td>
<td>2,179,240</td>
<td>30.7</td>
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<tr>
<td>Cleveland-Elyria-Mentor, OH</td>
<td>2,148,143</td>
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<tr>
<td>Cincinnati-Middletown, OH-KY-IN</td>
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<tr>
<td>Portland-Vancouver-Beaverton, OR-WA</td>
<td>1,927,881</td>
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<tr>
<td>Kansas City, MO-KS</td>
<td>1,836,038</td>
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<tr>
<td>Sacramento-Arden-Arcade-Roseville, CA</td>
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<tr>
<td>San Jose-Sunnyvale-Santa Clara, CA</td>
<td>1,735,819</td>
<td>13.1</td>
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<td>San Antonio, TX</td>
<td>1,711,703</td>
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<tr>
<td>Orlando, FL</td>
<td>1,644,561</td>
<td>34.3</td>
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</table>

<table>
<thead>
<tr>
<th>Alhambra city, CA</th>
<th>Fullerton city, CA</th>
<th>Orange city, CA</th>
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</thead>
<tbody>
<tr>
<td>Anaheim city, CA</td>
<td>Gardena city, CA</td>
<td>Paramount city, CA</td>
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<tr>
<td>Arcadia city, CA</td>
<td>Garden Grove city, CA</td>
<td>Pasadena city, CA</td>
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<td>Baldwin Park city, CA</td>
<td>Glendale city, CA</td>
<td>Pico Rivera city, CA</td>
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<tr>
<td>Bellflower city, CA</td>
<td>Hacienda Heights CDP, CA</td>
<td>Pomona city, CA</td>
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<tr>
<td>Buena Park city, CA</td>
<td>Hawthorne city, CA</td>
<td>Rancho Cucamonga city, CA</td>
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<tr>
<td>Burbank city, CA</td>
<td>Huntington Beach city, CA</td>
<td>Redondo Beach city, CA</td>
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<tr>
<td>Carson city, CA</td>
<td>Huntington Park city, CA</td>
<td>Rosemead city, CA</td>
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<td>Cerritos city, CA</td>
<td>Inglewood city, CA</td>
<td>Santa Ana city, CA</td>
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<tr>
<td>Chino city, CA</td>
<td>Irvine city, CA</td>
<td>Santa Monica city, CA</td>
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<tr>
<td>Chino Hills city, CA</td>
<td>La Habra city, CA</td>
<td>South Gate city, CA</td>
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<tr>
<td>Compton city, CA</td>
<td>Lakewood city, CA</td>
<td>South Whittier CDP, CA</td>
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<td>Costa Mesa city, CA</td>
<td>Long Beach city, CA</td>
<td>Torrance city, CA</td>
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<td>Diamond Bar city, CA</td>
<td>Los Angeles city, CA</td>
<td>Tustin city, CA</td>
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<tr>
<td>Downey city, CA</td>
<td>Lynwood city, CA</td>
<td>Upland city, CA</td>
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<tr>
<td>East Los Angeles CDP, CA</td>
<td>Montebello city, CA</td>
<td>West Covina city, CA</td>
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<tr>
<td>El Monte city, CA</td>
<td>Monterey Park city, CA</td>
<td>Westminster city, CA</td>
</tr>
<tr>
<td>Florence-Graham CDP, CA</td>
<td>Newport Beach city, CA</td>
<td>Whittier city, CA</td>
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<tr>
<td>Fontana city, CA</td>
<td>Norwalk city, CA</td>
<td>Yorba Linda city, CA</td>
</tr>
<tr>
<td>Fountain Valley city, CA</td>
<td>Ontario city, CA</td>
<td></td>
</tr>
</tbody>
</table>
What is a city?

- **Economic City**: Area with a relatively high population density that contains a set of closely related and economically integrated activities (flow of workers, money, etc...). Using Census Bureau definitions this roughly refers to UA, MeA or City.

- **Political City**: Area over which a municipal corporation exercises political authority, providing local government services and collecting taxes. Using CB definitions central city or municipality where a municipal corporation exercises political authority and provides local services.
Census Bureau: More definitions

Geographic entities

- Administrative or Legal:
  State, County, Consolidated City, School District, Voting District, ZIP codes, etc…

- Statistical:
  MSA, UA, UC, Census Tract, Blocks, etc..
Urban Population Growth

Size of the U.S. Population
Millions of people

Urban and Rural
Percentage of total population

Population Growth Rate
Percentage increase over previous year

Population Living in the Suburbs
Percentage of total population
Urban Population Distribution

Percent of Total Population Living in Cities, 1790–1980

- Percent of population living in urban areas
- Percent of population living in cities of over 100,000 persons
Why do cities exist?

Three facts of life (real imperfections) that make cities desirable

- Imperfect factor mobility (impeding the elimination of natural resources advantages).
- Imperfect input divisibility (generating scale and agglomeration economies).
- Imperfect mobility of good and services (it’s better to be close to producers)
Why do cities exist?

Three basic conditions

(that have been getting more important over time)

- Agricultural surplus (to feed cities)
- Urban production (to buy food)
- Transportation (to exchange food and urban production)
Why do cities exist?

First, let’s think the conditions under which cities won’t arise (backyard production).

A region **WILL NOT HAVE** cities when:

1) Equal productivity across areas.
2) No scale economies in exchange.
3) No scale economies in production.
4) Equal preferences across areas.
Why do cities exist?

- We will focus on two types of cities and the conditions under which they arise.
  - Trading cities: Cities specialized in trade services.
  - Factory cities: Cities specialized in good or services production.
Trading Cities

Relax 1): Comparative advantages in production
+ Time and transport cost not too big
______________________________
Specialization and trade

Is that enough?

NO!!!, TRADE does NOT mean a TRADING CITY
Example: Absolute vs. comparative advantages

2 goods (Shirts and Bread)

<table>
<thead>
<tr>
<th></th>
<th>Output per hour</th>
<th>Opportunity Cost</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>North</td>
<td>South</td>
</tr>
<tr>
<td>Bread</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Shirts</td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

South region has absolute advantage in both goods, but comparative advantage in Shirts.
Example: Autarky situation

Endowment: 24 hours

AUTARKY
Production = Consumption

Prices of bread in autarky
- 1 shirt in the North
- 3 shirts in the South
Example: Trading costs and Specialization

- Assume Price is $P = 2$ shirts per loaf:
  Specialization pays +1 loaf of bread to South and +1 shirt to North!!!

- Is this enough to have trade?
  NO
  It depends on the transport and trading cost
  $t = 1$ hour: NO specialization or trade
  $t = \frac{1}{2}$ hour: Specialization and trade

- Why?
Example: Trading costs and Specialization

- Assume \( P = 2 \) shirts per loaf and \( t = \frac{1}{2} \) hour per trade

- South
  - If trade: +6s 2b = +6s 4$ = 2s gain = 1 bread gain
  - If transport cost: - 1/2 hour = 1 bread lose

- North
  - If trade: +1b 1s = +2s 1$ = 1 shirt gain
  - If transport cost: - 1/2 hour = 1/2 shirt lose

South is indifferent and North gains from trade

Is this enough to have a Trading city? NO
Example: Gains from Trade

South specializes in producing shirts
North specializes in producing bread

This graph assumes TC=0.
How it changes with TC=1/2 hour
Trading Cities

- Relax 2): $T'(q) > 0 - T''(q) < 0$

- Specialization in Trade:
  - Middlemen (trading firms)
  - Trading cities along rivers, railroads, ports, etc.

Comparative Advantages (Relax 1)
+ savings in production cost > transport cost = TRADE
Trading Cities

- Relax 3): \( T'(q) > 0 - T''(q) < 0 \)

- Specialization in Trade:
  - Middlemen (trading firms)
  - Trading cities along rivers, railroads, ports, etc.

Comparative Advantages (Relax 1)
+ savings in production cost > transport cost = TRADE
+ Economies of scale in Transport (Relax 2) = TRADING CITY

AND economies of scale should be enough to compensate for higher cost of living faced by the workers (commuting, house rent)
Factory Cities

Recall….

A region **WILL NOT HAVE** cities when:

1) Equal productivity across areas.

2) No scale economies in production.

3) No scale economies in transportation.

4) Equal preferences across areas.
Factory Cities

Relax 3): Economies of scale in production of one good
+ Time and transport cost not too big

Specialization and trade

Is that enough?

Economies of scale should be enough to compensate for higher cost of living faced by the workers (commuting, house rent)
Factory cities: Market Area of a Shirt Factory

Assumptions:

- Home production: 1 shirt or 1 loaf of bread per hour.
- Factory production
  - A worker is 8 times more productive producing shirts in a factory than at home (8 shirts/hour).
  - Cost of indivisible input (e.g. capital) = ½ loaf per hour
- Workers extra costs
  - Cost of urban living (e.g. higher land price) = ½ loaf per hour
- Consumers extra costs
  - Linear travel cost [walking, 8 miles per hour].
- How big is the market area?
Factory cities: Market Area of a Shirt Factory

- Wages = 3/2 loaves/hour (otherwise they will work in rural area)
  - Cost from working at the factory and not at home = 1 loaf/hour
  - + Cost of urban living = ½ loaf/hour
- Hourly Cost of producing shirts = 2 loaves/hour.
  - Cost of workers (wages) = 3/2 loaves/hour
  - Cost of indivisible input (e.g. capital) = ½ loaf/hour
- Cost per shirt = 1/4 loaf (since the factory produces 8 shirts per hour and the hourly cost is 2 loaves).
- In equilibrium the Price per shirt is the cost per shirt.
Factory cities: Market Area of a Shirt Factory

Cost of factory cloth
Cost of homemade cloth
Slope = 0.25 = 2*(1/8)

Net cost of cloth (hours)

Factory
Factory cities:
How we obtained the market area of 3 miles?

- Indifferent consumer lives $x$ miles from factory. Recall the worker loss 1/8 hours walking 1 mile, hence $t=1/8$

  cost of shirt at home = total cost from factory

$$1 = 0.25 + 2tx$$

$$0.75 = 2\frac{1}{8}x$$

$$x = 3$$

The limit to economies of scale in production is given by the market area (and hence by transport costs !)
Factory cities: Size Limits

Workers will live close to the factory to economize commuting costs

Effects of More Workers

- Price decreases (widening market area)
  - More efficiency and lower AC.

- Price Increases (shrinking market area)
  - Workers live farther away, commuting costs increase, higher salaries needed and increases in hourly costs of production.
  - Higher density in cities, higher urban costs, higher salaries needed and increases in hourly costs of production.
Factory cities: Size Limits

City size is limited by transport costs because

- Transport costs limit market area (limiting production and the possibilities of economies of scale)
- Commuting costs increase costs of production, compensating the effects of economies of scale.
Factory Cities (with a single factory)

- No specialization
  - shirts are produced in factories,
  - bread at home [surplus sold to workers, no need to set up bread factory]
Factory cities: Comparative Statics

Can this model account for the steady growth in urban population along time?

- Innovations in manufacturing
  - Productivity shock that shift average labor costs. (e.g. sewing machines, interchangeable parts for manufacturing, etc).

- Innovations in transportation
  - Turnpikes, railroads, steamships, etc.

- Innovations in agriculture.
  - Steel plow, agricultural science, fertilizers, etc.
Market Area: Innovation in manufacturing

Worker productivity increases from 8 shirts/hour to 20 shirts/hour.
Market Area: Innovation in transportation

Transportation costs reduce from 8 miles/hour to 12 miles/hour

Cost of factory cloth
Cost of homemade cloth

Net cost of cloth (bread)

Miles from Factory

4.5 miles

<table>
<thead>
<tr>
<th>Miles from Factory</th>
<th>Cost of homemade cloth</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1.00</td>
</tr>
<tr>
<td>1</td>
<td>0.75</td>
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<tr>
<td>2</td>
<td>0.50</td>
</tr>
<tr>
<td>3</td>
<td>0.25</td>
</tr>
<tr>
<td>4</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Transportation costs reduce from 8 miles/hour to 12 miles/hour.
Market Area: Innovation in agriculture

Shock in agriculture from 1 bread/hour to 1.25 bread/hour
Factory cities: Material oriented firms

The same logic applies in cases in which the final output can be easily transported but the raw materials have a high transportation cost. In these cases firms will locate around raw materials plants (instead of locating around consumers). Workers of firms then will locate in that area to save on commuting costs, generating factory cities.
Cities: Historic Perspective

- First Cities:
  - Defensive city (ES in storage of surplus)
  - Religious city (ES in worship)
- Greek and Roman Cities (trading cities—Parasitopolis)
- Feudal Cities
- Mercantile Cities
- Factory Cities
Cities: Industrial Revolution

Innovations:

- Agricultural (K/L)
- Manufacturing (SE and specialization)
- Transportation (steamship and railroad)
- Construction
- The location pattern started to depend also on energy sources.
Summary Ch. 2 O’Sullivan

- Employment opportunities are concentrated in cities because some activities are subject to economies of scale.
- A trading city will develop if a) the differences in productivity underlying comparative advantage are large relative to transportation costs and b) there are scale economies in transportation.
- A factory city will develop if scale economies in production are large relative to transporting goods (freight costs) and the cost of transporting workers within the city (commuting costs).
- The first cities developed for defensive and religious reasons.
- The centralization of power during the mercantile period caused the development of administrative cities and reduced trade barriers. Combined with efficient ocean travel, this resulted in the development of trading cities.
- The rapid urbanization in the nineteenth and twentieth centuries was caused by the industrial revolution and the associated innovations in agriculture, transportation, and manufacturing.
BUT....

Scale economies in production and transport help to explain trading or factory cities where just one activity exists (more if we consider more goods, but just one producer of that good at a city).

Why do we observe big cities with a diverse collection of economic activities?

Why similar industries locate close together instead of having their own market area?

Answer: AGGLOMERATION ECONOMIES
## Some industrial clusters in US

<table>
<thead>
<tr>
<th>Product</th>
<th>Metropolitan Area</th>
<th>2001 Employment</th>
<th>National Share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information technology</td>
<td>San Jose, CA</td>
<td>92,453</td>
<td>10.15</td>
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<td></td>
<td>Boston, MA</td>
<td>54,811</td>
<td>6.02</td>
</tr>
<tr>
<td></td>
<td>Dallas, TX</td>
<td>38,570</td>
<td>4.24</td>
</tr>
<tr>
<td></td>
<td>Seattle, WA</td>
<td>37,469</td>
<td>4.12</td>
</tr>
<tr>
<td>Aerospace engines</td>
<td>Hartford, CT</td>
<td>14,207</td>
<td>15.81</td>
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<tr>
<td></td>
<td>Cincinnati, OH</td>
<td>7,805</td>
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<td>Indianapolis, IN</td>
<td>7,745</td>
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<td>Phoenix, AZ</td>
<td>7,560</td>
<td>8.41</td>
</tr>
<tr>
<td>Financial services</td>
<td>New York, NY</td>
<td>316,922</td>
<td>9.36</td>
</tr>
<tr>
<td></td>
<td>Boston, MA</td>
<td>158,727</td>
<td>4.69</td>
</tr>
<tr>
<td>Furniture</td>
<td>Hickory, NC</td>
<td>31,714</td>
<td>8.92</td>
</tr>
<tr>
<td></td>
<td>Greensboro, NC</td>
<td>20,121</td>
<td>5.66</td>
</tr>
<tr>
<td>Biopharmaceuticals</td>
<td>Newark, NJ</td>
<td>21,619</td>
<td>8.23</td>
</tr>
<tr>
<td></td>
<td>Middlesex, NJ</td>
<td>16,757</td>
<td>6.38</td>
</tr>
<tr>
<td>Jewelry and precious metals</td>
<td>New York, NY</td>
<td>29,807</td>
<td>24.55</td>
</tr>
<tr>
<td></td>
<td>Providence, RI</td>
<td>11,850</td>
<td>9.76</td>
</tr>
<tr>
<td>Chemical products</td>
<td>Augusta, GA</td>
<td>20,053</td>
<td>4.77</td>
</tr>
<tr>
<td></td>
<td>Chicago, IL</td>
<td>16,206</td>
<td>3.85</td>
</tr>
<tr>
<td></td>
<td>Houston, TX</td>
<td>15,189</td>
<td>3.61</td>
</tr>
<tr>
<td>Analytical instruments</td>
<td>Boston, MA</td>
<td>77,637</td>
<td>10.38</td>
</tr>
<tr>
<td></td>
<td>San Jose, CA</td>
<td>48,569</td>
<td>6.49</td>
</tr>
<tr>
<td>Hospitality and tourism</td>
<td>Las Vegas, NV</td>
<td>182,681</td>
<td>7.16</td>
</tr>
<tr>
<td></td>
<td>Orlando, FL</td>
<td>93,850</td>
<td>3.68</td>
</tr>
<tr>
<td></td>
<td>Atlantic City, NJ</td>
<td>43,002</td>
<td>1.68</td>
</tr>
</tbody>
</table>

*Source: Author’s calculations based on data from Cluster Mapping Project, Harvard Business School.*
Agglomeration Economies

External Economies of Scale

- (LE) Localization Economies [industry level]
- (UE) Urban Economies [metropolitan level]
Localization Economies (LE)

- Sharing Input Suppliers
  - Minimum demand level to exploit Economies of Scale in the production of intermediate input
  - Reduce Transport costs

- Sharing a Labor Pool
  - Varying Demand [job search + switching costs]
  - Matching [variety]

- Knowledge Spillover
LE – Sharing Input Suppliers

A cluster of several firms:

- Generate sufficient demand to allow intermediate input producers to exploit scale economies.
- Reduce face2face time and transport costs.
- Allow intermediate suppliers to produce a wide variety.

In fact, you can think in a cluster as a market area for intermediate inputs factories.
LE - Labor Pooling [Switching Costs]

- Shocks on product demand (50% probability of good times or high demand)
- Firm’s labor demand in good (high) and bad (low) times:
  \[ w^h = 60 - \frac{1}{4}L \quad \quad w^l = 40 - \frac{1}{4}L \]
- Fixed labor supply (120 in isolated site (the only firm) and 240 in clustered site (with another firm)).
- Assume shock correlation \(-1\) when clustered. Total Demand?
  \[ L^h + L^l = L^{\text{Cluster}} = 400 - 8w \]

Total demand and wages fixed
LE - Labor Pooling [Switching Costs]

Isolated Place

Clustered Site

Corr = -1

Econ 137 - Summer 2007
LE - Labor Pooling [Switching Costs]

Relative Benefits of Clustered Site = \( \frac{1}{2} (1400) + \frac{1}{2} (-1000) = 200 \)

Gains in good times (lower salary) = \( 120 \times 10 + 40 \times 10/2 = 1400 \)

Loss in bad times (higher salary) = \( 80 \times 10 + 40 \times 10/2 = 1000 \)
LE - Labor Pooling [Switching Costs]

What if correlation is not -1

Probability Matrix

<table>
<thead>
<tr>
<th>Firm I</th>
<th>L</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm II</td>
<td>0.15</td>
<td>0.35</td>
</tr>
<tr>
<td>L</td>
<td>0.15</td>
<td>0.35</td>
</tr>
<tr>
<td>H</td>
<td>0.35</td>
<td>0.15</td>
</tr>
</tbody>
</table>

\[
\begin{align*}
  w^{HH} &= (480 - L) / 8 \\
  w^{LL} &= (320 - L) / 8 \\
  w^{LH} &= w^{HL} = (400 - L) / 8 \\
  E[w] &= ?
\end{align*}
\]

Pr(\(H\)) = 0.5

Pr(\(H / L\)) = Pr(\(L / H\)) = 0.7

\[
E[w] = 0.15 \cdot w^{HH} + 0.15 \cdot w^{LL} + 0.35 \cdot w^{LH} + 0.35 \cdot w^{HL} = 50 - 0.125L
\]
LE - Labor Pooling [Switching Costs]

Probability Matrix

<table>
<thead>
<tr>
<th>Firm I</th>
<th>L</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm II</td>
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<td></td>
</tr>
<tr>
<td>L</td>
<td>0.15</td>
<td>0.35</td>
</tr>
<tr>
<td>H</td>
<td>0.35</td>
<td>0.15</td>
</tr>
</tbody>
</table>

Wage, $\]

\[
\begin{align*}
\text{w}^{HH} &= (480 - L) / 8 \\
\text{w}^{LL} &= (320 - L) / 8 \\
\text{w}^{LH} &= \text{w}^{HL} = (400 - L) / 8 \\
E[w] &= 50 - 0.125L
\end{align*}
\]
LE - Labor Pooling [Switching Costs]

Isolated Place

W, $

W, $

Each firm in Clustered Site [firm demand]

W, $

W, $

Labor units

Labor units

120

80 120 160

120

30

30

20

20

10

10

10

10

DL

HH

HH

LH

HL

LL

DL

DH

DH
LE - Labor Pooling [Switching Costs]

- Expected gains in clustered site \([-1 < \text{corr} < 1]\)

\[
\begin{align*}
GHH &= 0 \\
GLL &= 0 \\
GHL &= (30 - 20) \times 120 + (30 - 20) \times 40 / 2 = $1400 \\
GLH &= -(20 - 10) \times 80 - (20 - 10) \times 40 / 2 = -$1000
\end{align*}
\]

\[
EG = 0.15GHH + 0.35GHL + 0.35GLH + 0.15GLL = 0.35 \times 400 = $140
\]

What if correlation=1?
LE - Labor Pooling [Matching]

FIGURE 3-3 Skills Matching

A: Four Skill Types

With four skill types, worker addresses are \{0, 2/8, 4/8, 6/8\}. There are two workers per firm, so two firms will enter with skill requirements \{1/8, 5/8\}, and the mismatch per worker is 1/8.

B: Six Skill Types

With six skill types, worker addresses are \{0, 2/12, 4/12, 6/12, 8/12, 10/12\}. There are two workers per firm, so three firms will enter the market with skill requirements \{1/12, 5/12, 9/12\}, and the mismatch per worker is 1/12.
LE - Labor Pooling [Matching]

- Assume optimal size of the firm is 2 workers, net profits per worker are $12 and unit training costs are $24

- Four workers
  - Profits per worker = $12 - $24/8 = $9 (wages under competition)

- Six workers
  - Profits per worker = $12 - $24/12 = $10 (wages under competition)

- What happens as the number of workers goes to infinity?

- MUTUAL ATTRACTION BETWEEN FIRMS AND WORKERS
Localization Economies - Examples

- **Sharing Input Suppliers**
  - Minimum demand level to exploit SE in production of intermediate input
    - Headquarters demand Legal Services, Advertising, Economic advising, etc..
  - Transport costs
    - Face to face contact with input suppliers

- **Sharing a Labor Pool**
  - Varying Demand [job search + switching costs]
    - TV industry in LA and NY
    - Hi Tech industries
  - Matching [variety]

- **Knowledge Spillover**
  - Innovation is correlated with industry clusters [Dumais, Ellison and Glaeser (2001)].
Localization Economies – Empirical tests

- Worker Productivity:
  - Elasticity of Output per worker with respect to Industry Output:
    \[ \varepsilon_{q_i / L_i, Q_i} = \frac{\partial (q_i / L_i)}{\partial Q_i} \frac{Q_i}{q_i / L_i} \]
    Office sector = 0.27

- Plant Births:
  - Location choice by new firms:
    \[ \varepsilon_{B_i, Q_i} = \frac{\partial B_i}{\partial Q_i} \frac{Q_i}{B_i} \]
    Electronics = 0.43

- Employment Growth: [Rosenthal and Strange (2000)]

<table>
<thead>
<tr>
<th>Add 1000 Software Jobs in</th>
<th>Jobs in New Establishments in Zip-Code Area Increase by</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-mile radius around zip code area</td>
<td>11.7 jobs</td>
</tr>
<tr>
<td>1-5 miles from zip-code area</td>
<td>0.8</td>
</tr>
<tr>
<td>6-10 miles from zip-code area</td>
<td>0.8</td>
</tr>
</tbody>
</table>
Urbanization Economies

- Intra-industry share of inputs.
- Intermediate inputs: banking, insurance, hotels, public services, etc.
- Labor Pooling [negative correlation makes more sense now]
- Spillovers of information [product design and methods]
- Joint labor supply, learning and social opportunities
Urbanization Economies - Evidence

- In the last decades shift in specialization of cities. Large ones are specialized in managerial activities while small cities specialize in production (laboratory cities).

- A doubling in population increases output per worker by between 3 and 8 per cent.

- Diversity promotes employment and firm growth
Typical cases of industrial clustering
Silicon Valley and Route 128

- **Network approach** to external economies. Saxenian (1996)
- Silicon Valley
  - Area of Northern California (30 mile by 10 mile strip of land in Santa Clara county, between San Francisco and San Jose)
- Route 128
  - 65 mile highway surrounding Boston and Cambridge
- Both of them are technological concentrations that have been devoted to the creation of new information technology and electronics.
- Silicon Valley has been more successful than Route 128
Typical cases of industrial clustering
Silicon Valley and Route 128

Number of companies

<table>
<thead>
<tr>
<th>Year</th>
<th>Silicon Valley</th>
<th>Route 128</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985</td>
<td>22</td>
<td>14</td>
</tr>
<tr>
<td>1986</td>
<td>25</td>
<td>15</td>
</tr>
<tr>
<td>1987</td>
<td>25</td>
<td>14</td>
</tr>
<tr>
<td>1988</td>
<td>26</td>
<td>10</td>
</tr>
<tr>
<td>1989</td>
<td>33</td>
<td>7</td>
</tr>
<tr>
<td>1990</td>
<td>39</td>
<td>4</td>
</tr>
</tbody>
</table>
Typical cases of industrial clustering
Silicon Valley and Route 128

- Silicon Valley
  - Regional advantages
    - World class academic institutions (Stanford and Berkeley)
    - Defense agencies in California (Lockheed in 1956)
    - Nice weather !!!
  - Agglomeration economies
    - Professional and social networks
    - High turnover (35%). Average job tenure (2 years)
    - Good jobs search and matching
    - Flat hierarchies (entrepreneurship and experimentation)
    - Collective learning (encourages innovation)
Typical cases of industrial clustering
Silicon Valley and Route 128

- Route128
  - Regional advantages
    - World class academic institutions (MIT)
    - Federal government. Department of Defense has accounted for over 60% of federal R&D in the state.
  - Agglomeration economies (compared to Silicon Valley)
    - More government contracts and secrecy (less entrepreneurship)
    - Less social networks
    - Less job turnover and more average tenure.
    - Vertical hierarchies

This may explain why Silicon Valley has been more successful.
Summary Ch. 3 O’Sullivan

- Location Economies (lower production costs as industry wide output increases) occur because firms in an industry cluster benefit from sharing (1) the suppliers of intermediate inputs, (2) a labor pool, and (3) information.

- Urbanization economies occur if the production cost of a particular firm decreases as the total output of the urban area increases.

- Agglomeration economies cause self-reinforcing changes in location: the movement of one firm to a city increases the incentives for other firms to move to the city.

- Networks may be very important external economies.
Questions for Lecture Notes I

- What is a City?
- Why do cities exist?
- Why do cities become so important in the last century?
- Why do we observe industry clusters?
- What determines city size?
- Why are there different types of cities?
Practice Exercises - Lecture Notes I

- All exercises in O’Sullivan - Chapters 2 and 3