Econ 137
Urban Economics

Lecture Notes I

Guillermo Ordonez, UCLA

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

- **[O]** O'Sullivan, Urban Economics, Sixth Edition, McGraw-Hill 2006

  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!

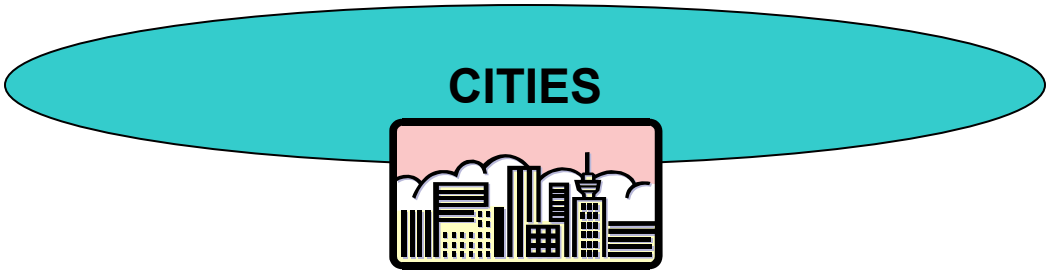
- **[AR]** Additional readings
  - News articles and papers given in class.
  - **[H&G]** Hoover and Giarratani, Regional Economics, Online Edition

    http://www.rri.wvu.edu/WebBook/Giarratani/contents.htm

Plan for the Course

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

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?

Who cares?

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 Have you ever played SimCity?

For review:

- Nicholson, *Microeconomic Theory*, Chapter 2
- O'Sullivan, "Urban Economics", Appendix.

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

$$g(x) > 0$$

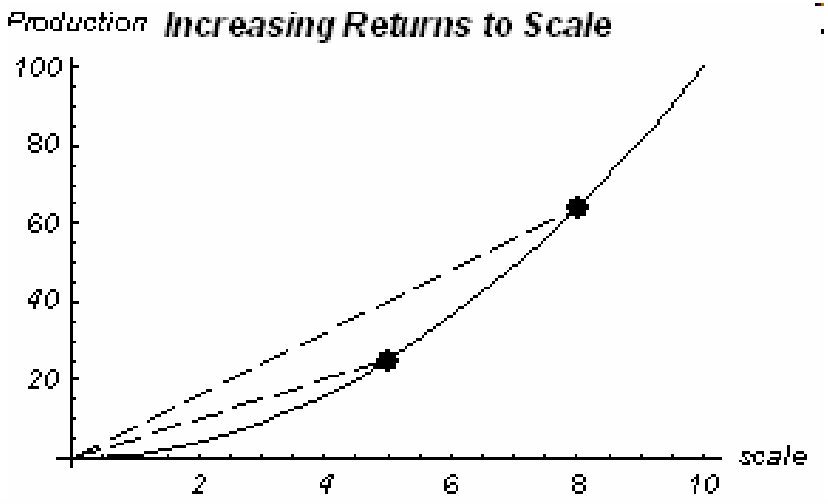
$$A = \frac{g(x)}{x} > 0 \qquad \text{(Average contribution of all units)}$$

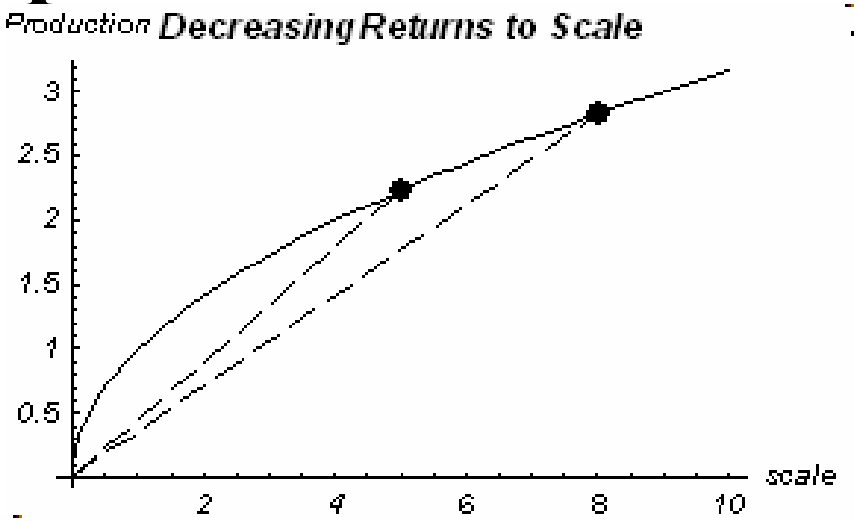
$$M = \frac{\partial g(x)}{\partial x} \qquad \text{(Contribution of the last unit)}$$

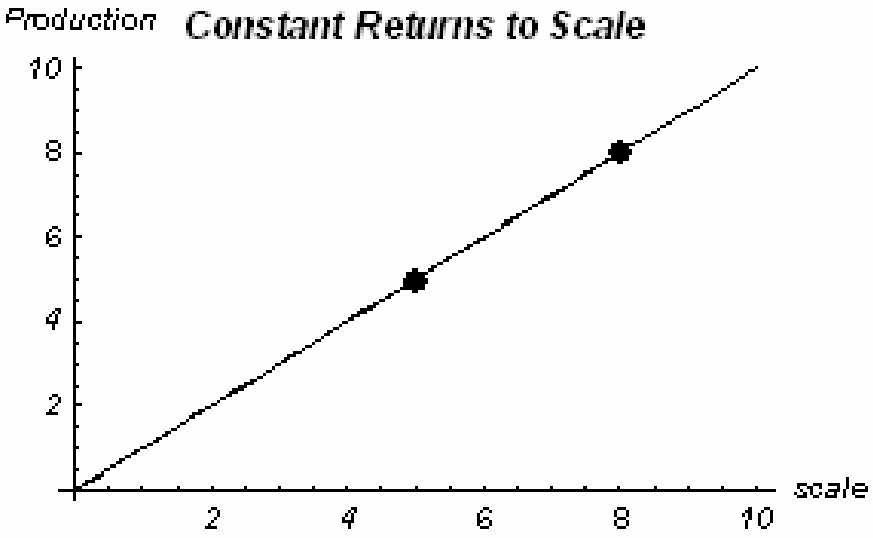
$$\frac{\partial A}{\partial x} = \frac{\partial g(x)/\partial x}{x} - \frac{g(x)}{x^2} = \frac{1}{x}\left[M - A\right] >=< 0$$

- 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

Metropolitan Area	Population 2000	Percent Change 1990–2000
New York-Northern New Jersey-Long Island, NY-NJ-PA	18,323,002	8.8
Los Angeles-Long Beach-Santa Ana, CA	12,365,627	9.7
Chicago-Naperville-Joliet, IL-IN-WI	9,098,316	11.2
Philadelphia-Camden-Wilmington, PA-NJ-DE	5,687,147	4.6
Dallas-Fort Worth-Arlington, TX	5,161,544	29.4
Miami-Fort Lauderdale-Miami Beach, FL	5,007,564	23.5
Washington-Arlington-Alexandria, DC-VA-MD	4,796,183	16.3
Houston-Baytown-Sugar Land, TX	4,715,407	25.2
Detroit-Warren-Livonia, MI	4,452,557	4.8
Boston-Cambridge-Quincy, MA-NH	4,391,344	6.2
Atlanta-Sandy Springs-Marietta, GA	4,247,981	38.4
San Francisco-Oakland-Fremont, CA	4,123,740	11.9
Riverside-San Bernardino-Ontario, CA	3,254,821	25.7
Phoenix-Mesa-Scottsdale, AZ	3,251,876	45.3
Seattle-Tacoma-Bellevue, WA	3,043,878	18.9
Minneapolis-St. Paul-Bloomington, MN-WI	2,968,806	16.9
San Diego-Carlsbad-San Marcos, CA	2,813,833	12.6
St. Louis, MO-IL	2,698,687	4.6
Baltimore-Towson, MD	2,552,994	7.2
Pittsburgh, PA	2,431,087	−1.5
Tampa-St. Petersburg-Clearwater, FL	2,395,997	15.9
Denver-Aurora, CO	2,179,240	30.7
Cleveland-Elyria-Mentor, OH	2,148,143	2.2
Cincinnati-Middletown, OH-KY-IN	2,009,632	8.9
Portland-Vancouver-Beaverton, OR-WA	1,927,881	26.5
Kansas City, MO-KS	1,836,038	12.2
Sacramento-Arden–Arcade-Roseville, CA	1,796,857	21.3
San Jose-Sunnyvale-Santa Clara, CA	1,735,819	13.1
San Antonio, TX	1,711,703	21.6
Orlando, FL	1,644,561	34.3

Source: U.S. Census Bureau, Census 2000 and 1990 Census.

Principal cities in Los Angeles--Long Beach--Santa Ana, CA UA

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

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

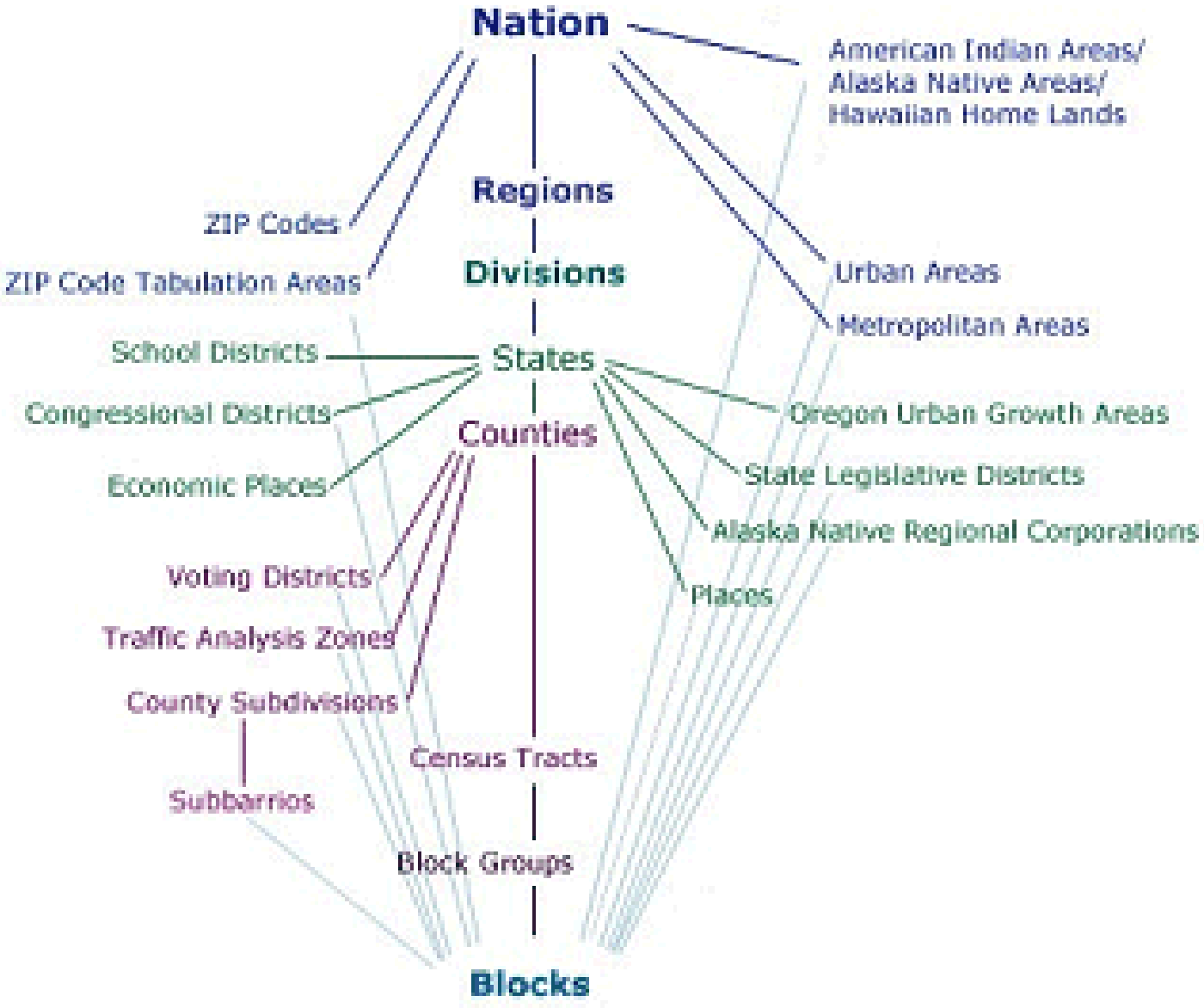
Geographic entities

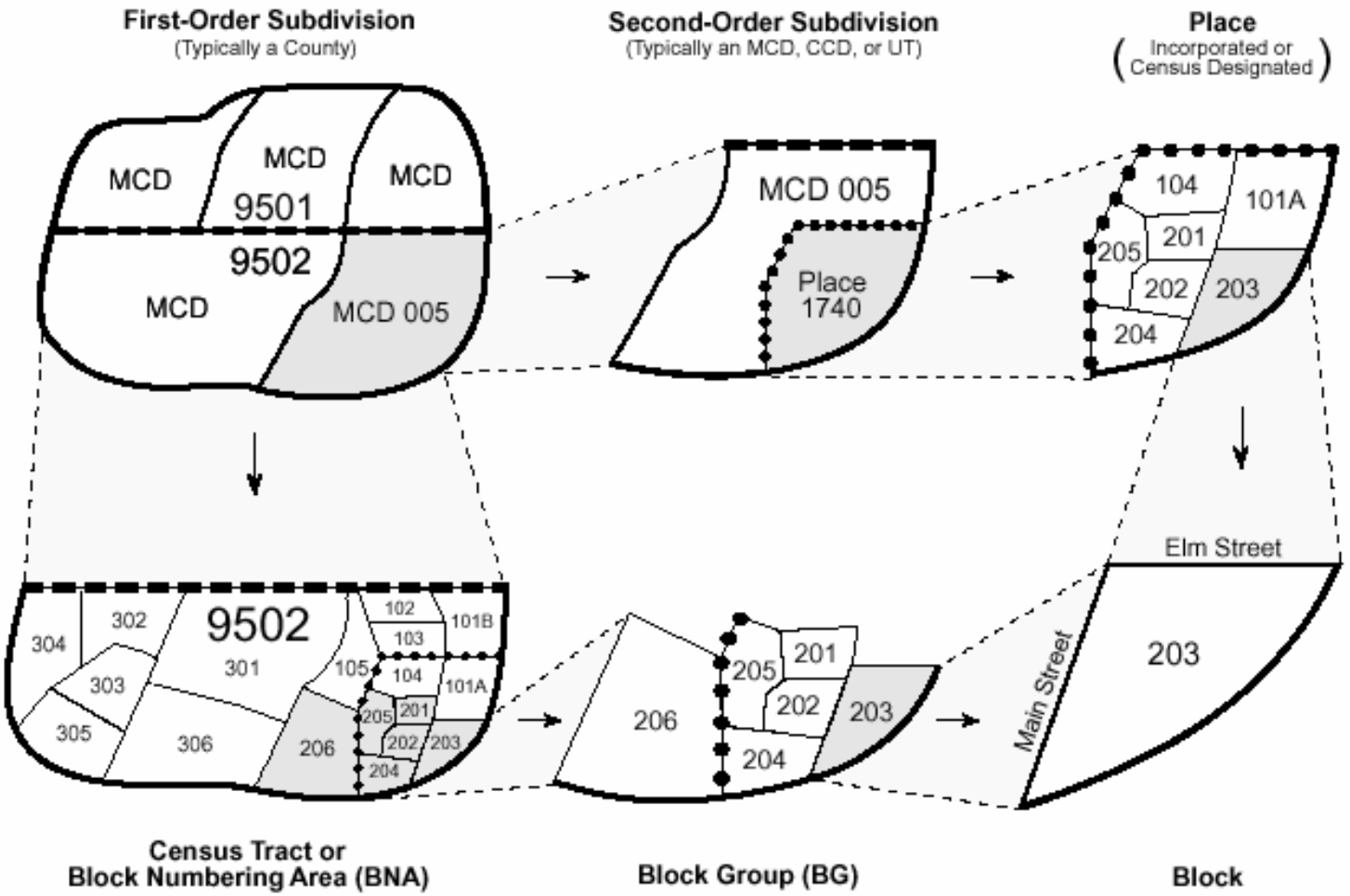
- Administrative or Legal:

  State, County, Consolidated City, School District, Voting District, ZIP codes, etc…

- Statistical:

  MSA, UA, UC, Census Tract, Blocks, etc..


Nation
American Indian Areas/
Alaska Native Areas/
Hawaiian Home Lands
Regions
ZIP Codes
Divisions
ZIP Code Tabulation Areas
Urban Areas
Metropolitan Areas
School Districts
States
Congressional Districts
Oregon Urban Growth Areas
Counties
Economic Places
State Legislative Districts
Alaska Native Regional Corporations
Voting Districts
Places
Traffic Analysis Zones
County Subdivisions
Census Tracts
Subbarrios
Block Groups
Blocks


First-Order Subdivision
(Typically a County)
Second-Order Subdivision
(Typically an MCD, CCD, or UT)
Place
(Incorporated or Census Designated)
MCD
MCD
MCD
9501
9502
MCD
MCD 005
MCD 005
Place 1740
104
101A
201
205
202
203
204
Elm Street
Main Street
9502
302
304
303
305
301
306
102
101B
103
105
104
101A
205
201
206
202
203
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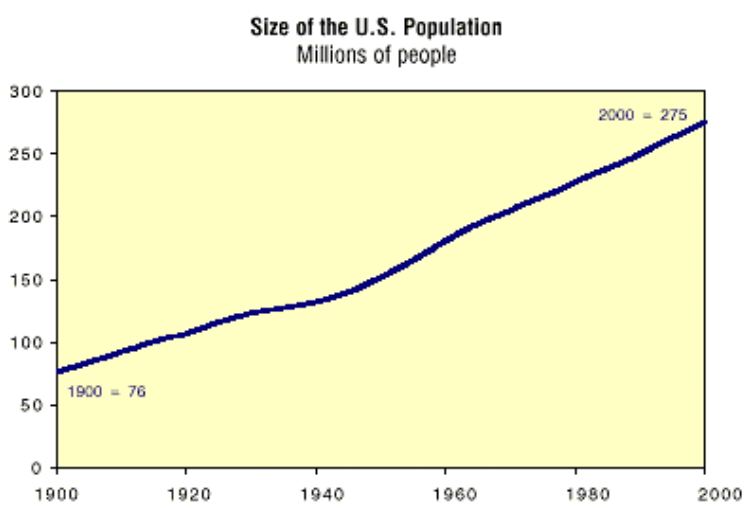
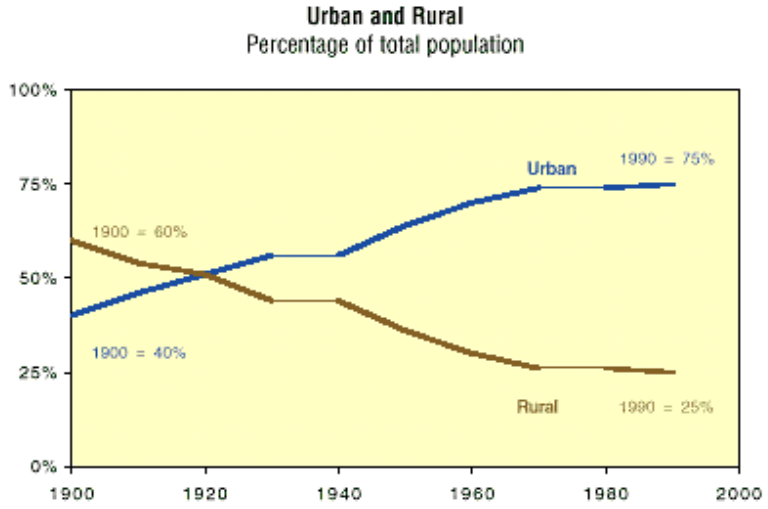
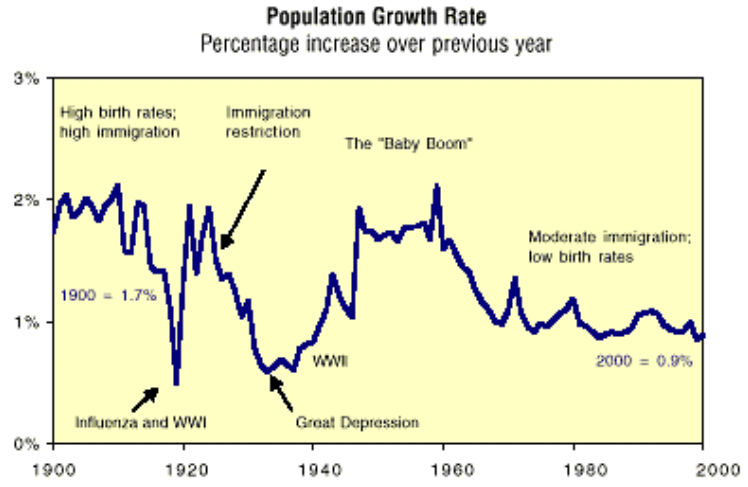
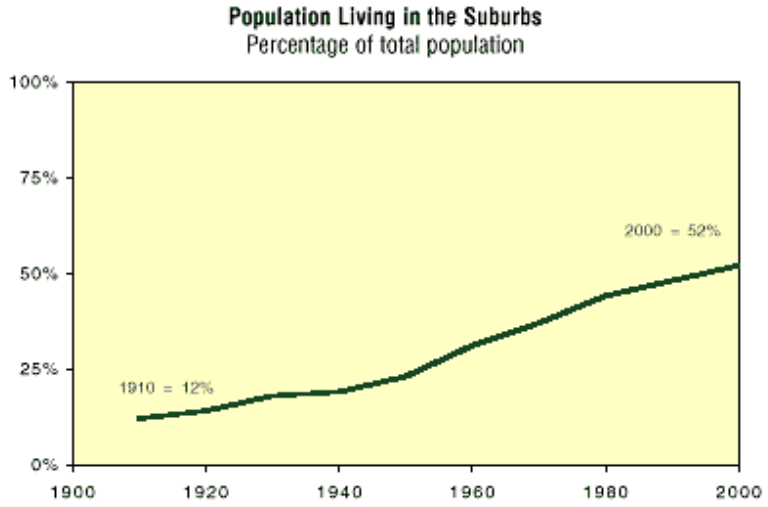
204
203
Census Tract or
Block Numbering Area (BNA)
Block Group (BG)
Block

Urban Population Growth

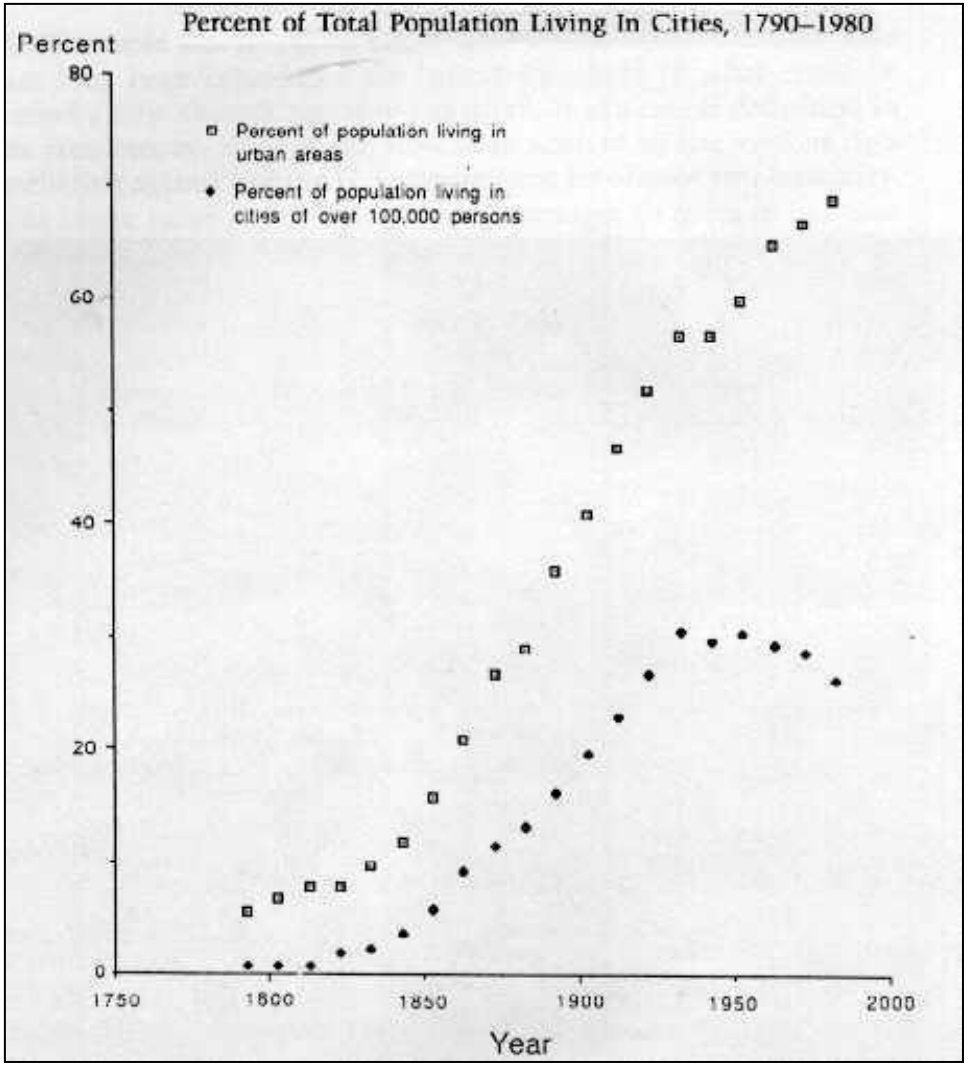








Urban Population Distribution



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

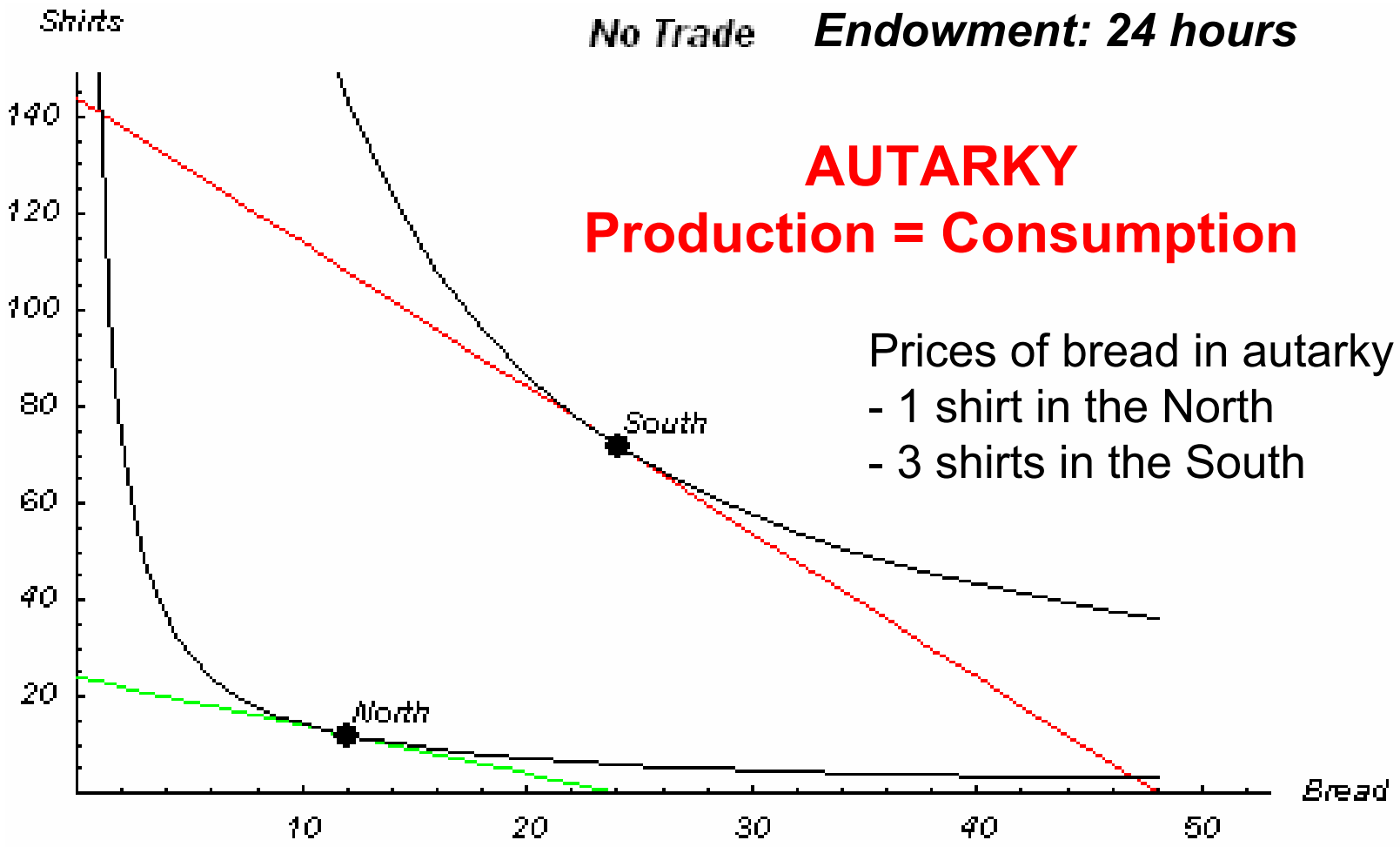
Example: Absolute vs. comparative advantages

2 goods (Shirts and Bread)

Comparative Advantage				
	Output per hour		Opportunity Cost	
	North	South	North	South
Bread	1	2	1 shirt	3 shirts
Shirts	1	6	1 loaf	1/3 loaf

South region has absolute advantage in both goods, but comparative advantage in Shirts

Example: Autarky situation



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 = ½ hour: Specialization and trade

- Why?

Example: Trading costs and Specialization

- Assume P = 2 shirts per loaf and t= ½ hour per trade
- South
  - If trade: +6s 2b=+6s 4s=2s gain = 1 bread gain
  - If transport cost: - 1/2 hour = 1 bread lose
- North
  - If trade: +1b 1s=+2s 1s= 1 shirt gain
  - If transport cost: - 1/2 hour = 1/2 shirt lose

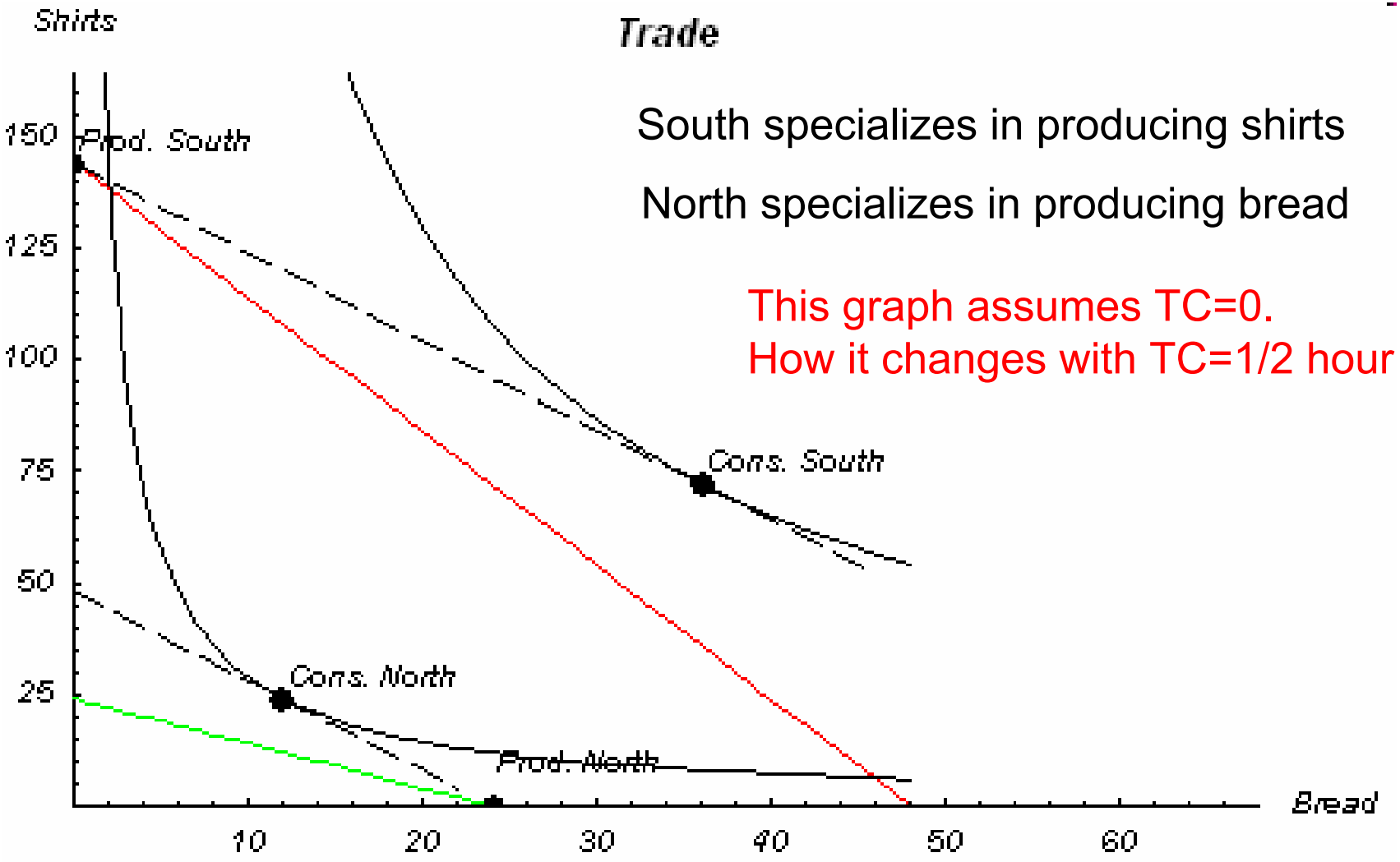
Transform hours into the good that you'd produce if no trade (the one you resign)

South is indifferent and North gains from trade

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

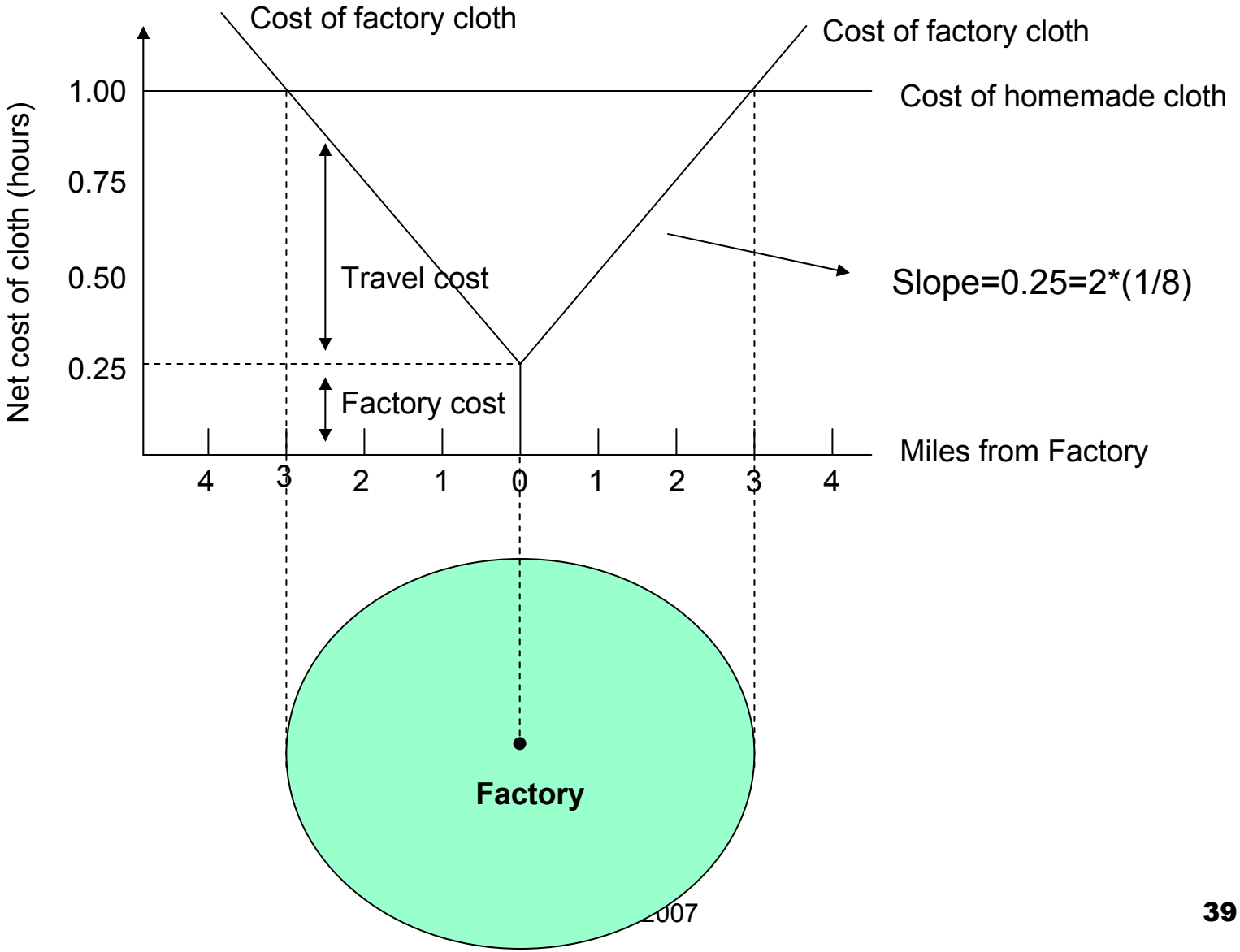
Assumptions:

- 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



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

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

$$\text{cost of shirt at home} = \text{total cost from factory}$$

$$1 = 0.25 + 2tx$$

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

$$x = 3$$

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.

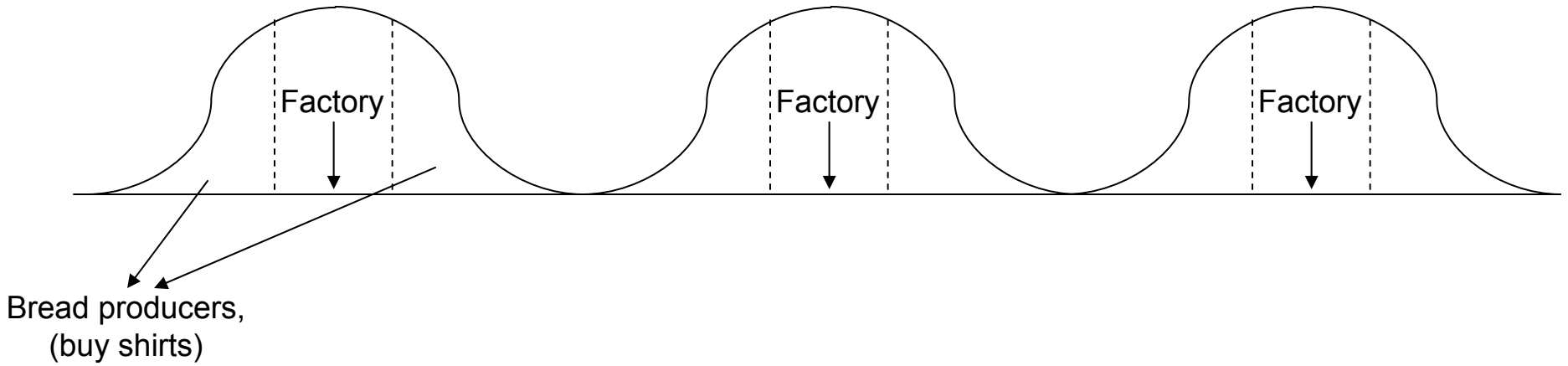
Factory cities: Size Limits

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]

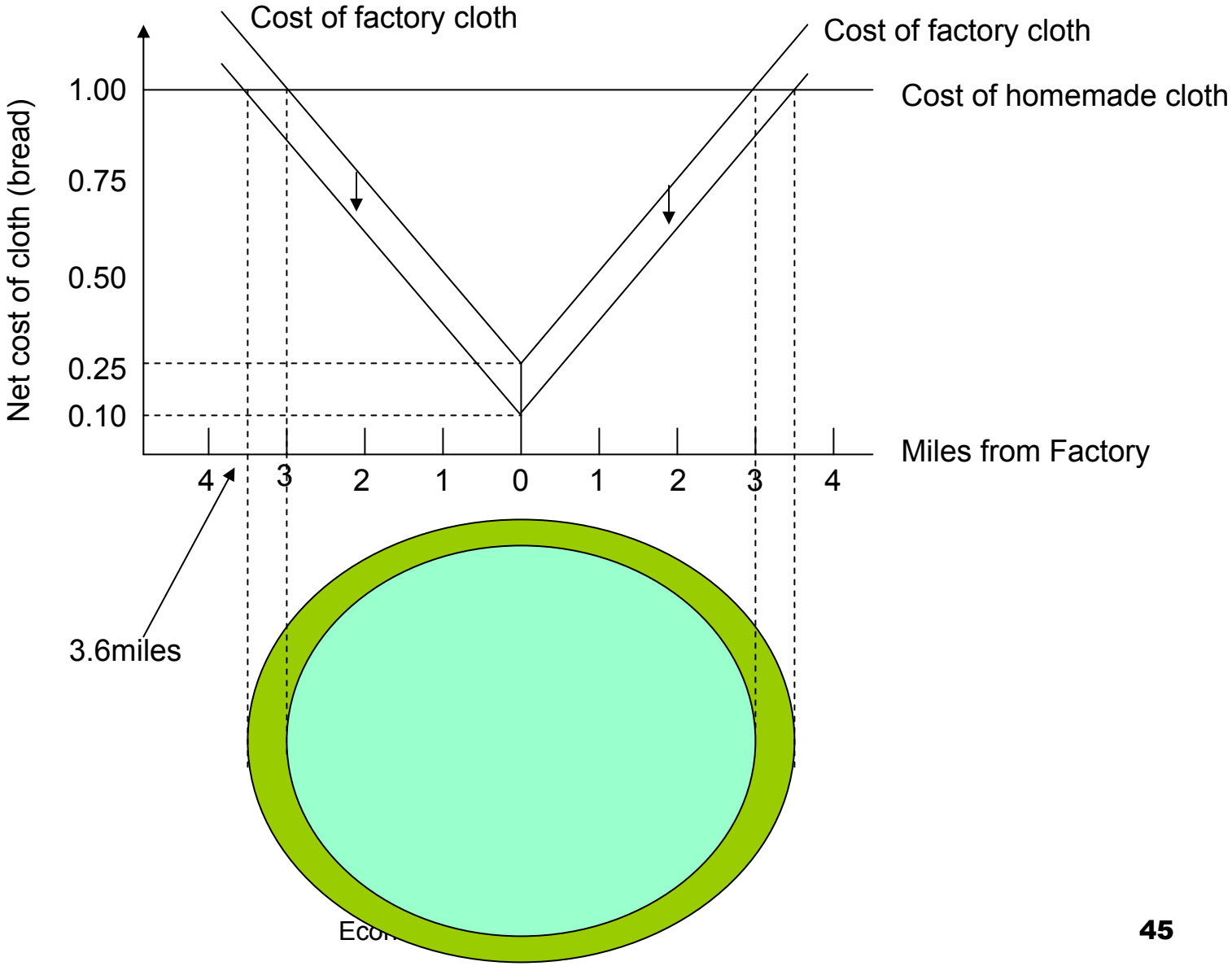


Factory cities: Comparative Statics

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

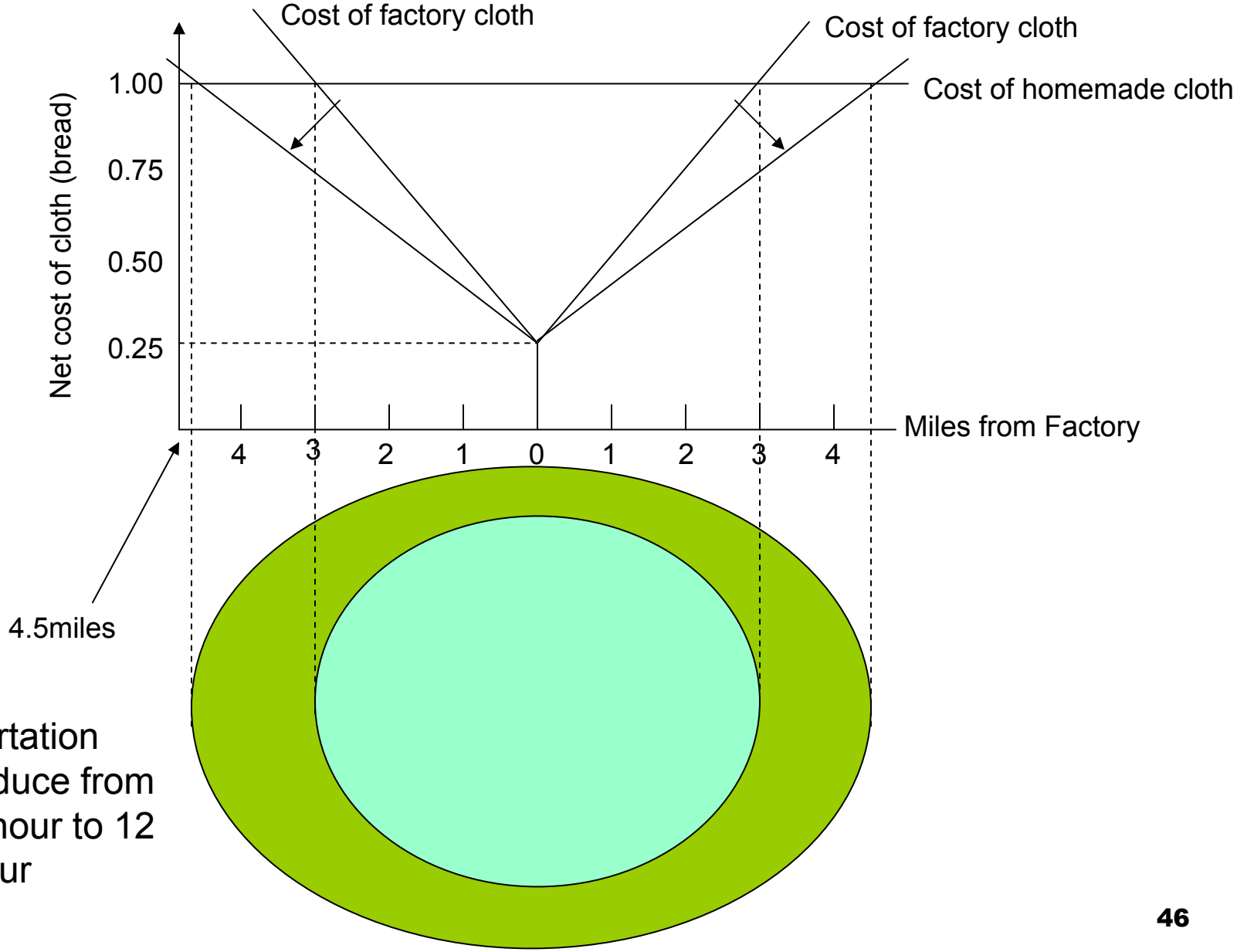
- Innovations in manufacturing
  - Productivity shock that shift average labor costs. (e.g sewing machines, interchangeable parts for manufacturing, etc).
- Innovations in transportation
  - Turnpikes, railroads, steamships, etc.
- Innovations in agriculture.
  - Steel plow, agricultural science, fertilizers, etc.

Market Area: Innovation in manufacturing



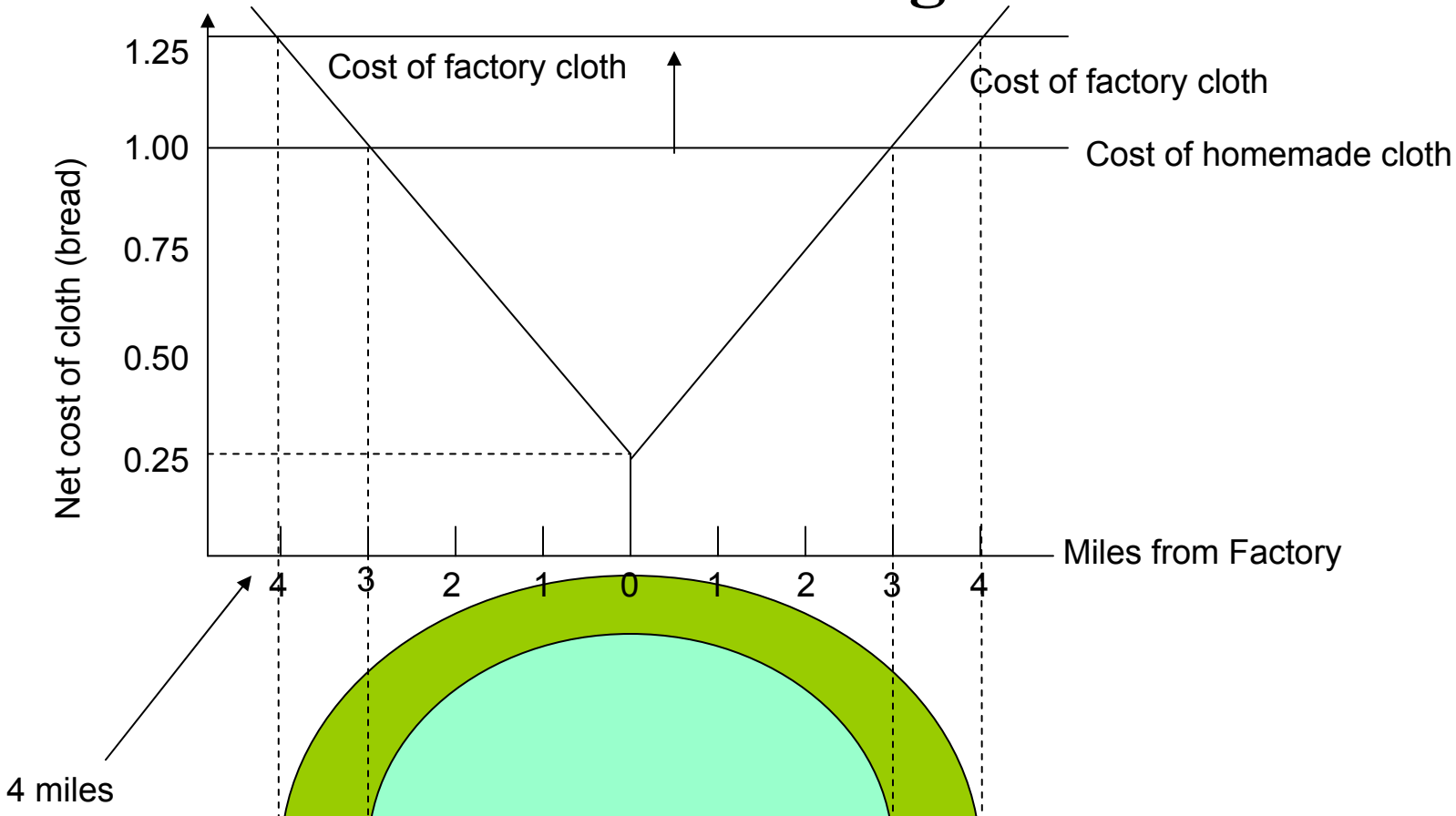
Worker productivity increases from 8 shirts/hour to 20 shirts/hour

Market Area: Innovation in transportation



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

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 3–1 Select Industrial Clusters in U.S. Metropolitan Areas, 2001

Product	Metropolitan Area	2001 Employment	National Share (%)
Information technology	San Jose, CA	92,453	10.15
	Boston, MA	54,811	6.02
	Dallas, TX	38,570	4.24
	Seattle, WA	37,469	4.12
Aerospace engines	Hartford, CT	14,207	15.81
	Cincinnati, OH	7,805	8.68
	Indianapolis, IN	7,745	8.62
	Phoenix, AZ	7,560	8.41
Financial services	New York, NY	316,922	9.36
	Boston, MA	158,727	4.69
Furniture	Hickory, NC	31,714	8.92
	Greensboro, NC	20,121	5.66
Biopharmaceuticals	Newark, NJ	21,619	8.23
	Middlesex, NJ	16,757	6.38
Jewelry and precious metals	New York, NY	29,807	24.55
	Providence, RI	11,850	9.76
Chemical products	Augusta, GA	20,053	4.77
	Chicago, IL	16,206	3.85
	Houston, TX	15,189	3.61
Analytical instruments	Boston, MA	77,637	10.38
	San Jose, CA	48,569	6.49
Hospitality and tourism	Las Vegas, NV	182,681	7.16
	Orlando, FL	93,850	3.68
	Atlantic City, NJ	43,002	1.68

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:

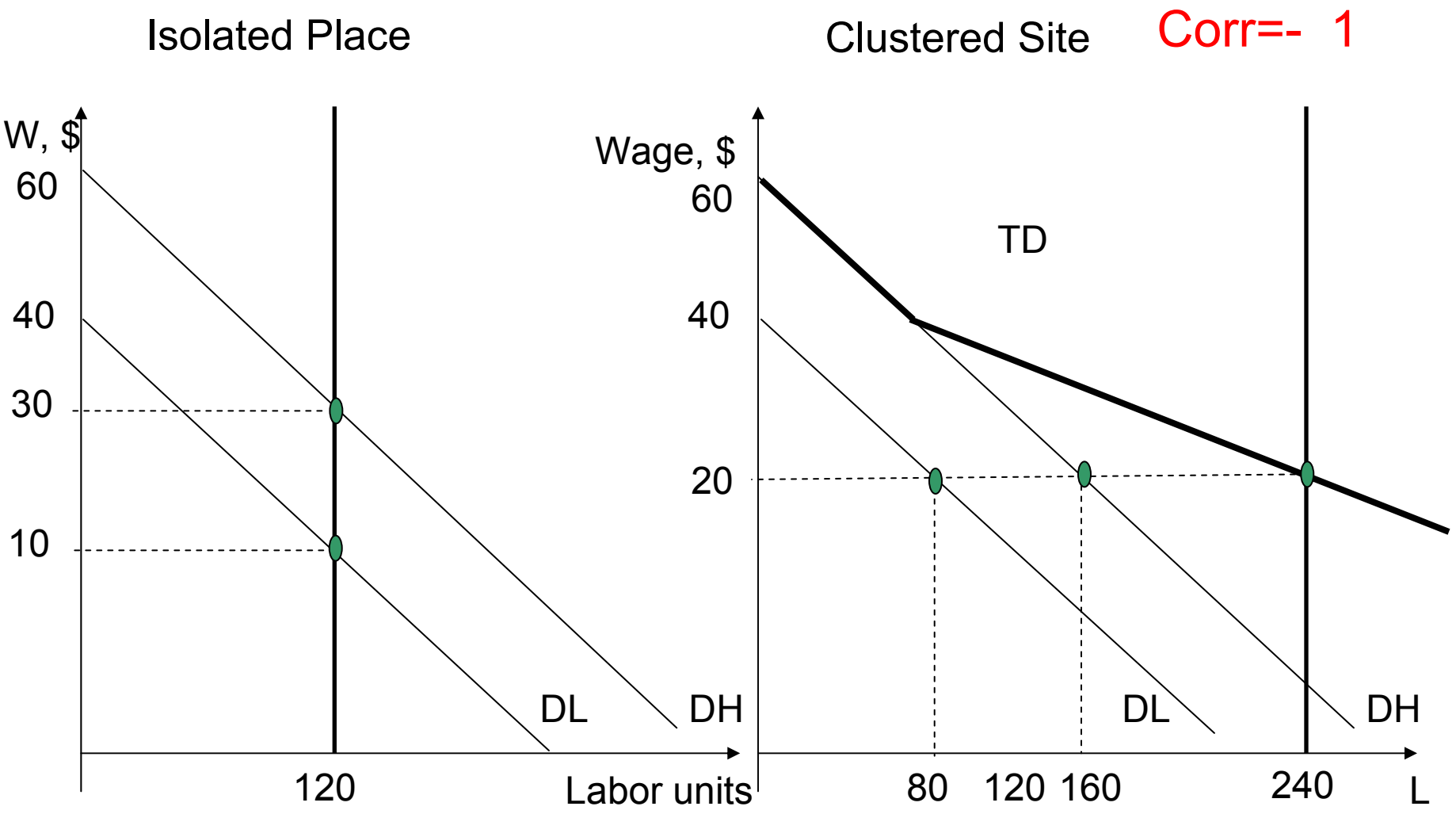
$$w^h = 60 - \frac{1}{4}L \qquad w^l = 40 - \frac{1}{4}L$$

- Fixed labor supply (120 in isolated site (the only firm) and 240 in clustered site (with another firm)).
- Assume shock correlation =- 1when clustered. Total Demand? $L^h + L^l = L^{Cluster} = 400 - 8w$

$$w = \frac{400 - L}{8}$$

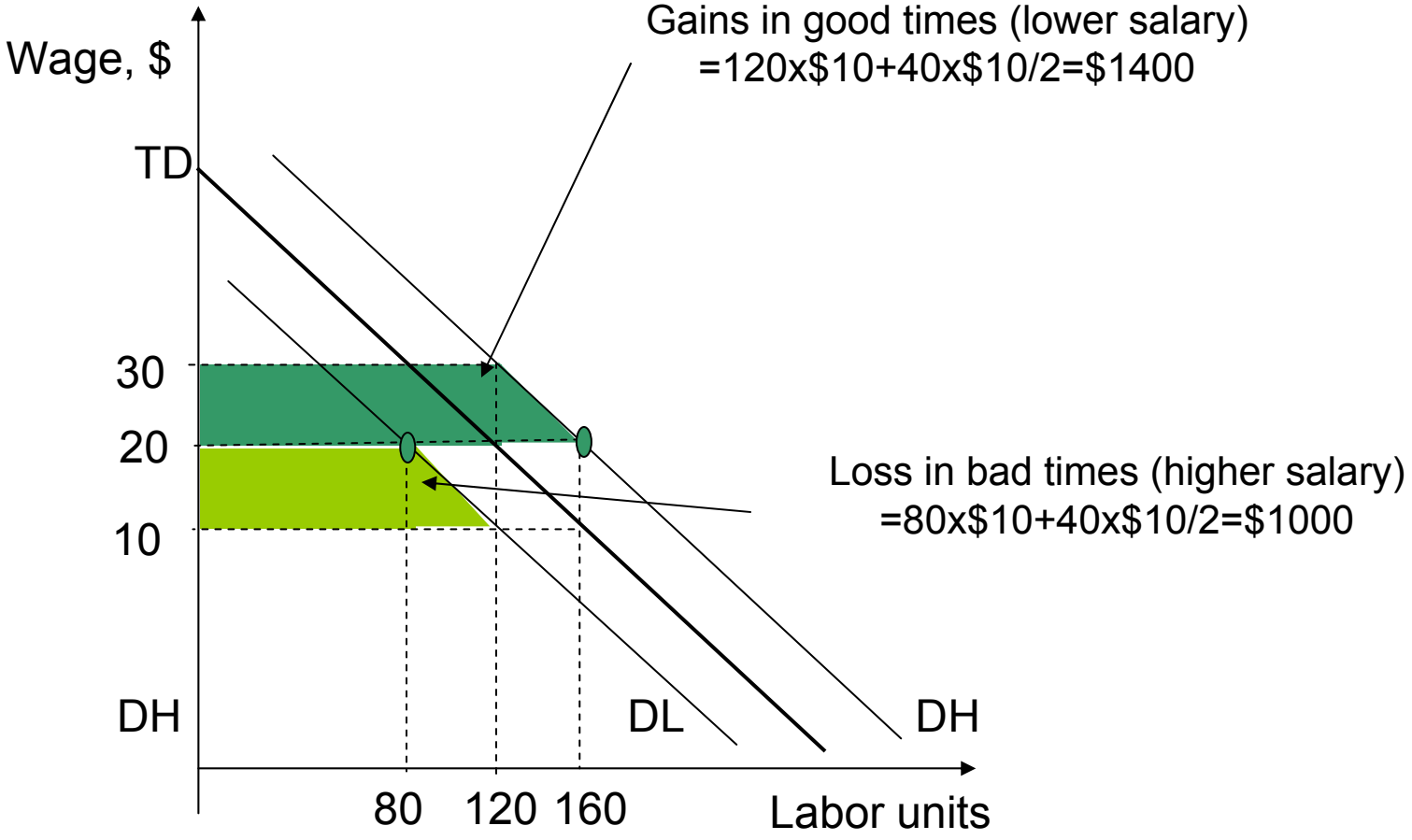
→ **Total demand and wages fixed**

LE - Labor Pooling [Switching Costs]



LE - Labor Pooling [Switching Costs]

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



LE - Labor Pooling [Switching Costs]

What if correlation is not -1

Probability Matrix

Firm I ---------- Firm II	L	H
L	0.15	0.35
H	0.35	0.15

$$w^{HH} = (480 - L)/8$$

$$w^{LL} = (320 - L)/8$$

$$w^{LH} = w^{HL} = (400 - L)/8$$

$$E[w] = ?$$

$$\Pr(H) = 0.5$$

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

$$E[w] = 0.15 \cdot w^{HH} + 0.15 \cdot w^{LL} + 0.35 \cdot w^{LH} + 0.35 \cdot w^{HL}$$
$$= 50 - 0.125L$$

LE - Labor Pooling [Switching Costs]

Probability Matrix

Firm I ---------- Firm II	L	H
L	0.15	0.35
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$$w^{HH} = (480 - L)/8$$

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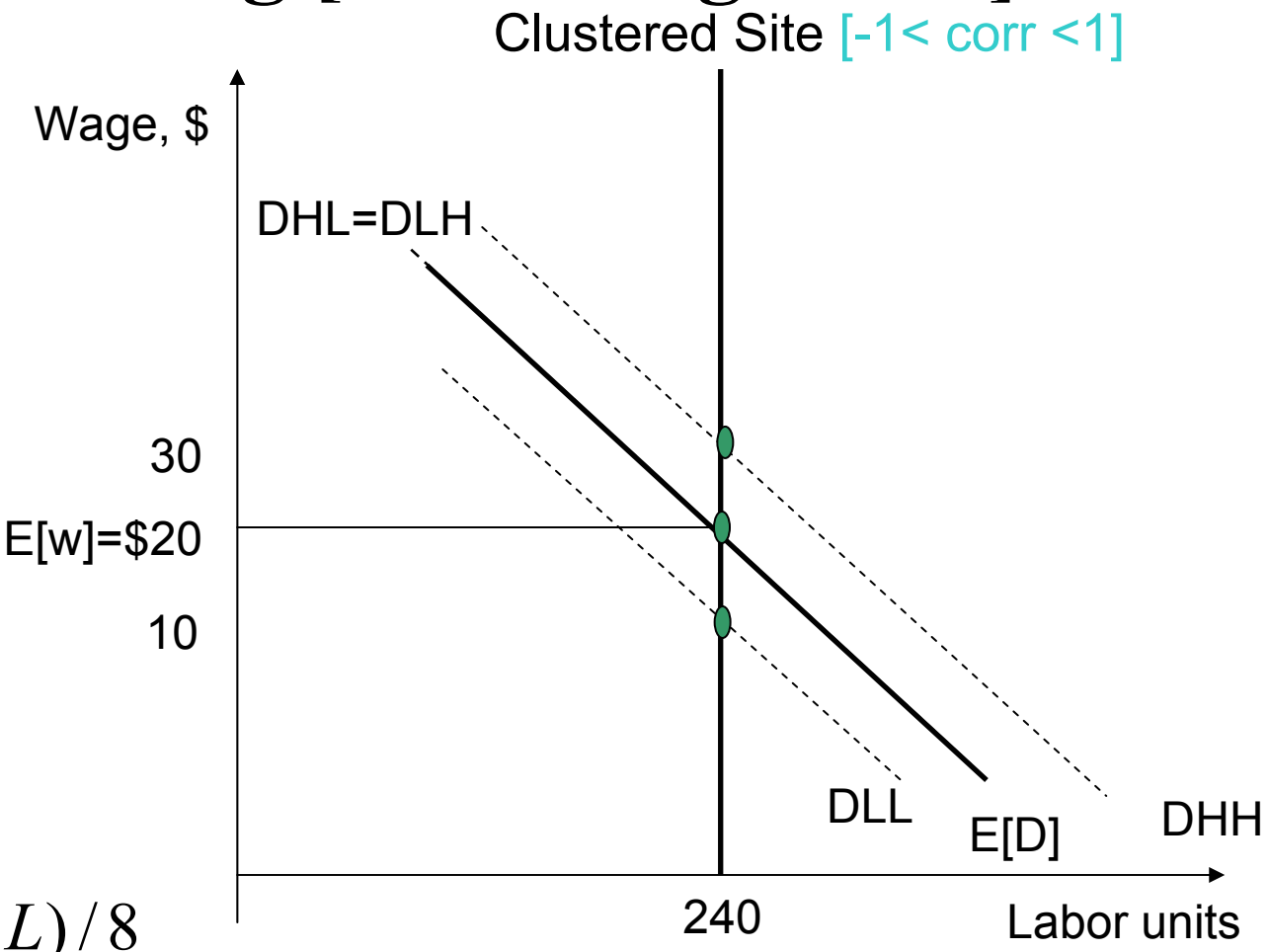
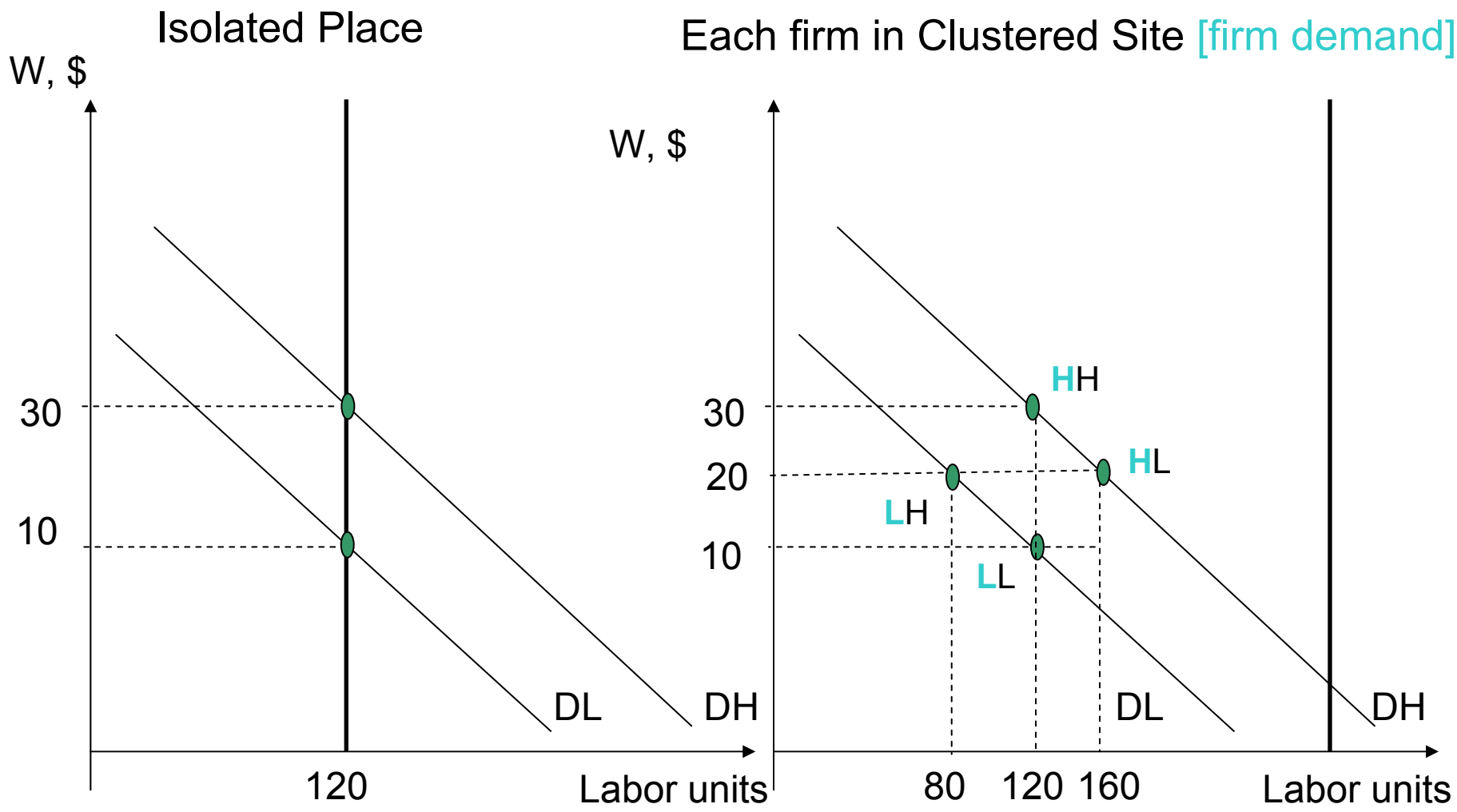
$$w^{LH} = w^{HL} = (400 - L)/8$$

$$E[w] = 50 - 0.125L$$



LE - Labor Pooling [Switching Costs]



LE - Labor Pooling [Switching Costs]

- Expected gains in clustered site [- ≤ corr < 1]

$$GHH = 0$$

$$GLL = 0$$

$$GHL = (30-20)*120 + (30-20)*40/2 = \$1400$$

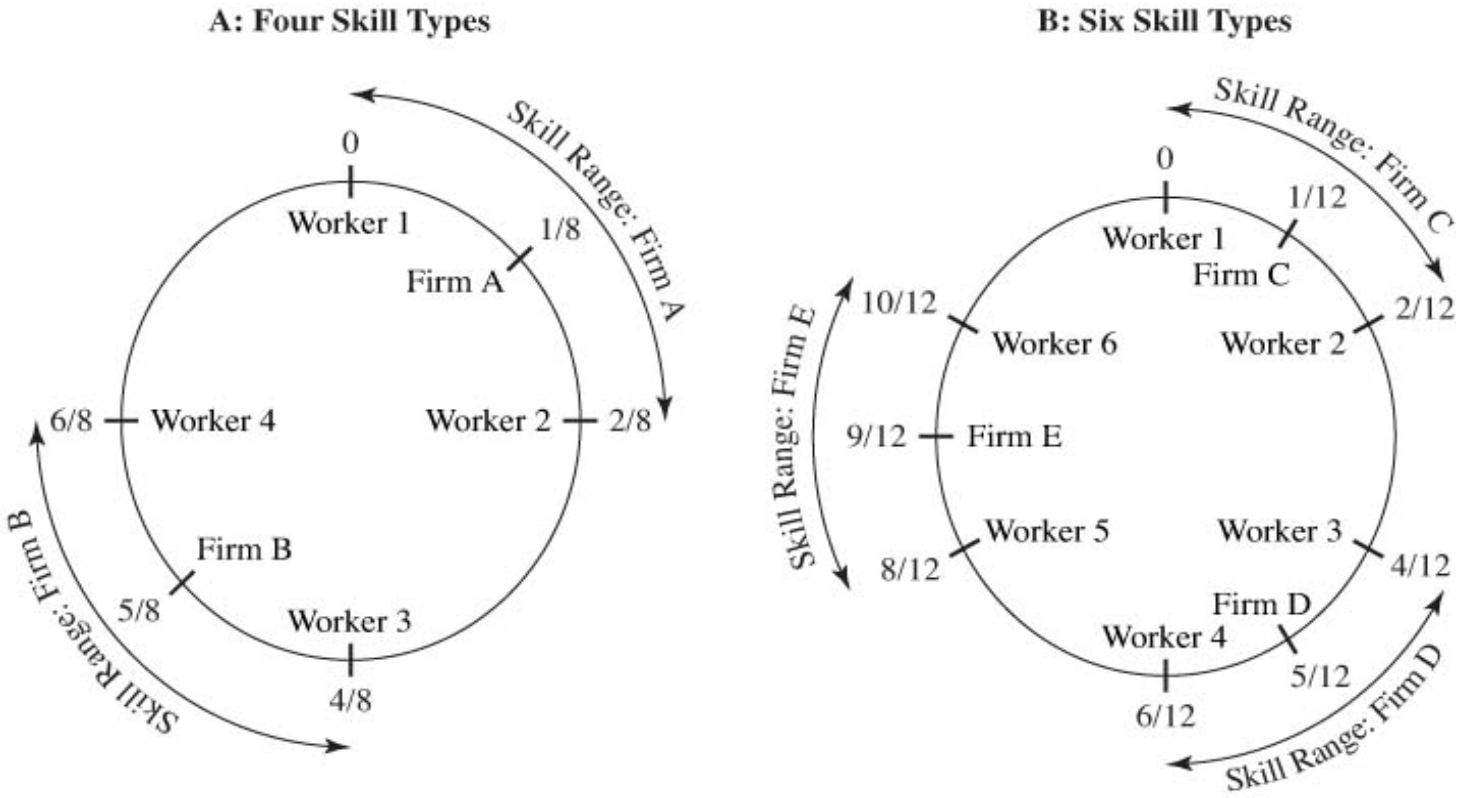
$$GLH = -(20-10)*80 - (20-10)*40/2 = -\$1000$$

$$EG = 0.15GHH + 0.35GHL + 0.35GLH + 0.15GLL = 0.35*400 = \$140$$

What if correlation=1?

LE - Labor Pooling [Matching]

FIGURE 3–3 Skills Matching



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.

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:

$$\varepsilon_{q_I/L_I,Q_I} = \frac{\partial\left(q_I / L_I\right)}{\partial Q_I}\frac{Q_I}{q_I / L_I}$$

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)

Add 1000 Software Jobs in	Jobs in New Establishments in Zip-Code Area Increase by
1-mile radius around zip code area	11.7 jobs
1-5 miles from zip-code area	0.8
6-10 miles from zip-code area	0.8

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

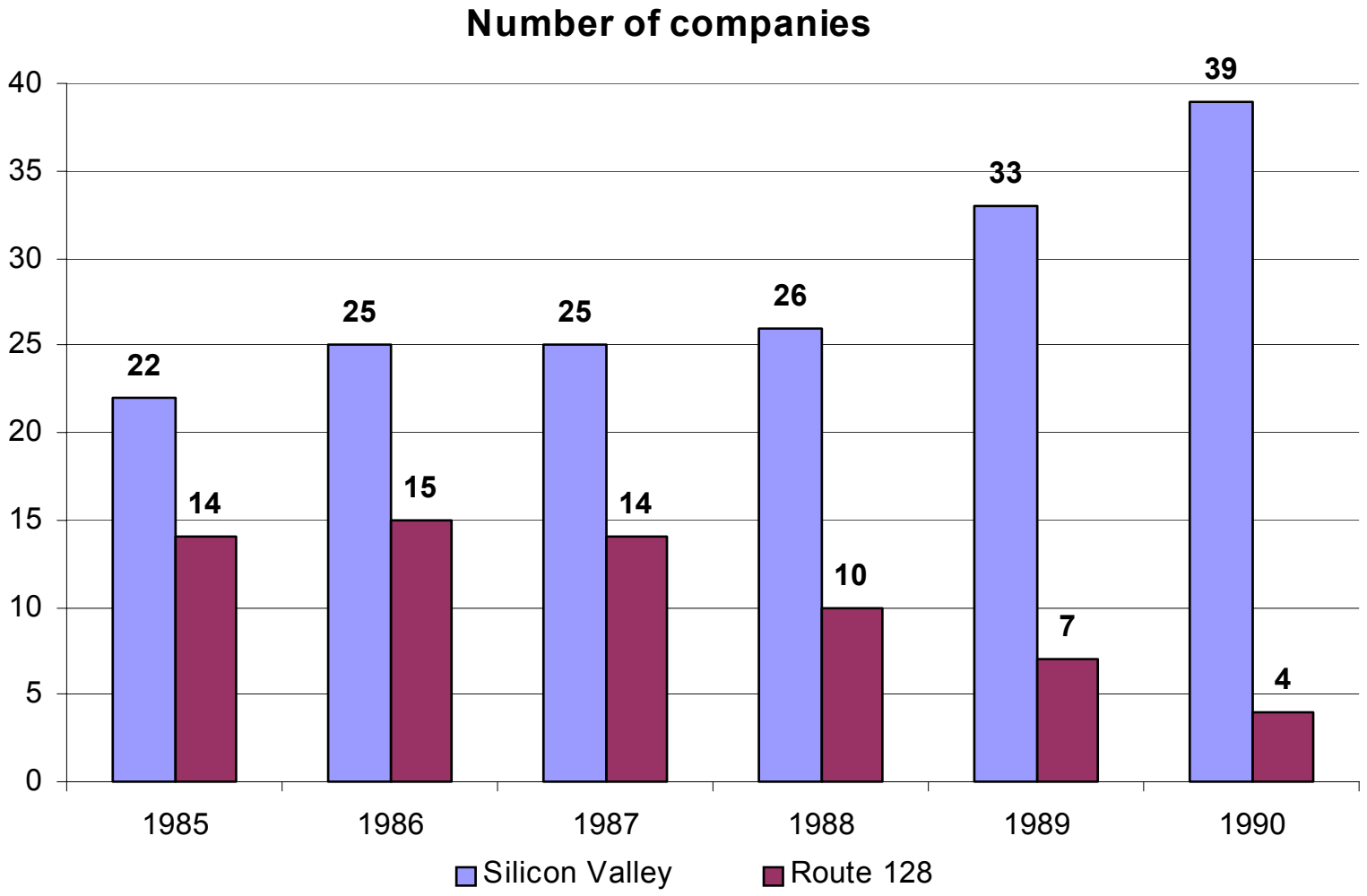
Urbanization Economies - Evidence

- 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



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