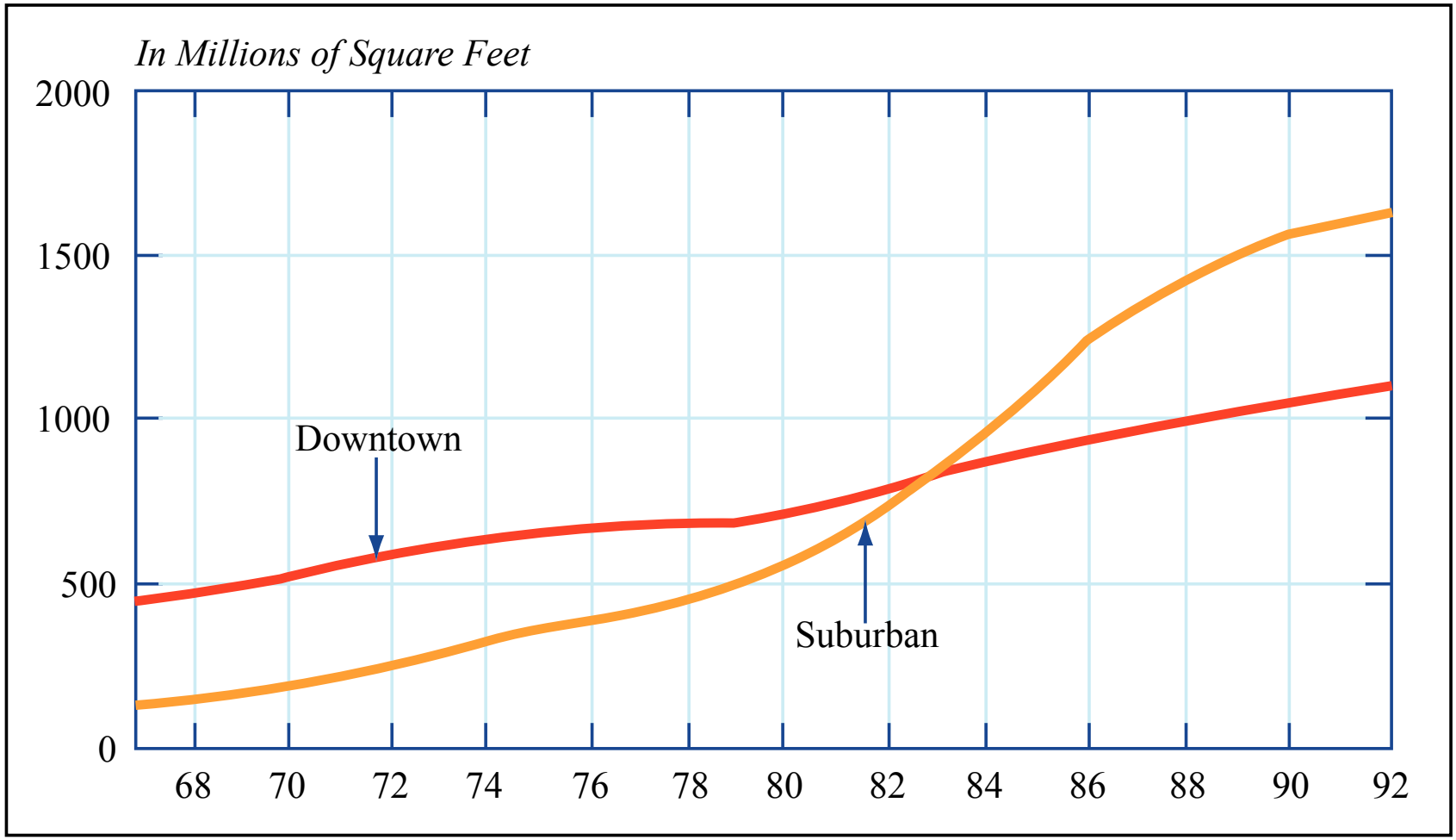
11.433J / 15.021J Real Estate Economics
Fall 2008

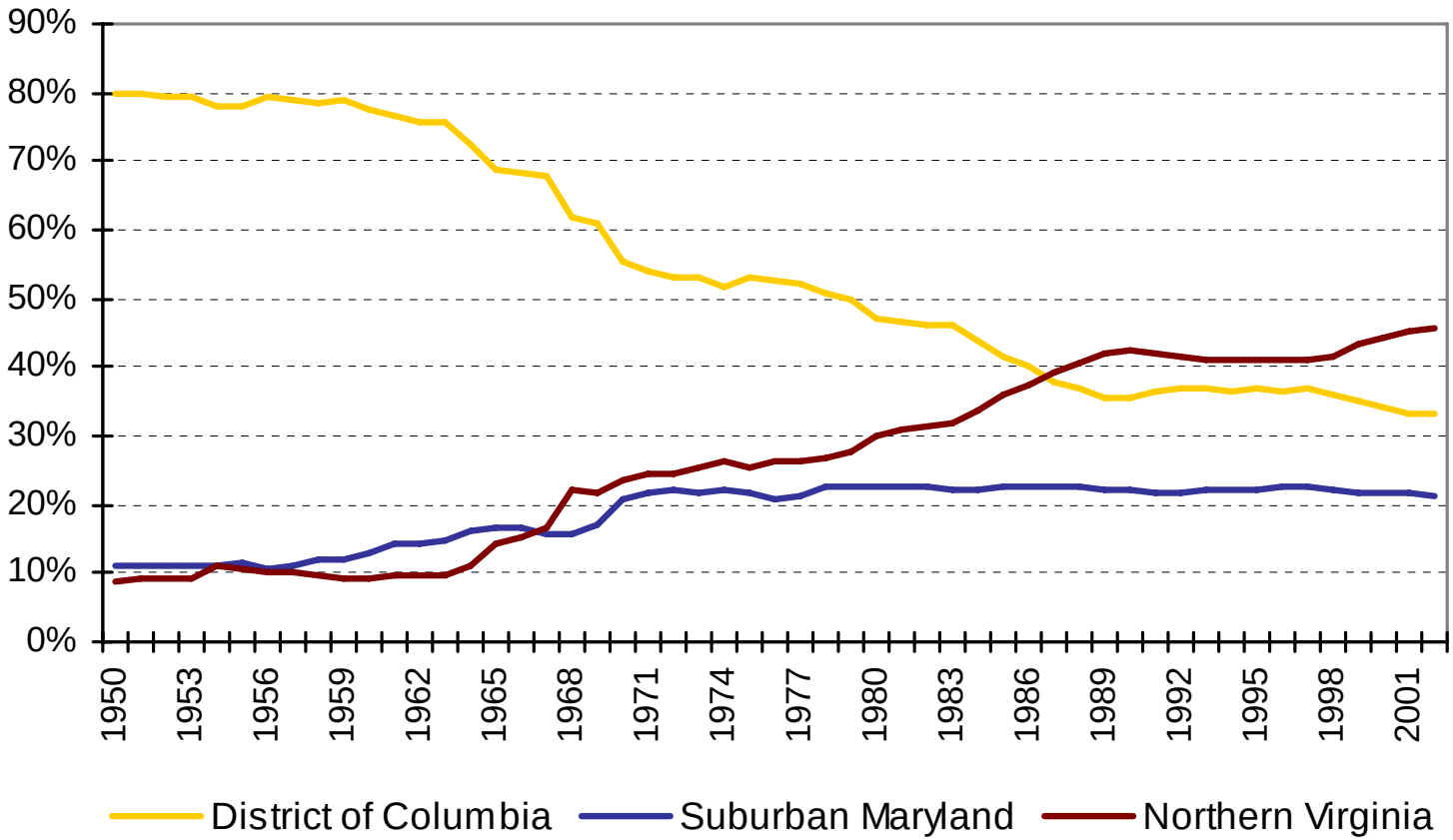
Week 5: Employment Decentralization, “edge” cities.

- Measuring Decentralization, space versus jobs.
- Wages, the urban labor market and the incentive for decentralization.
- Local agglomeration, clustering, transportation infrastructure, planning and other “limits to sprawl”.

National % of office space in CBD as opposed to Suburbs *(source: CBRE)*

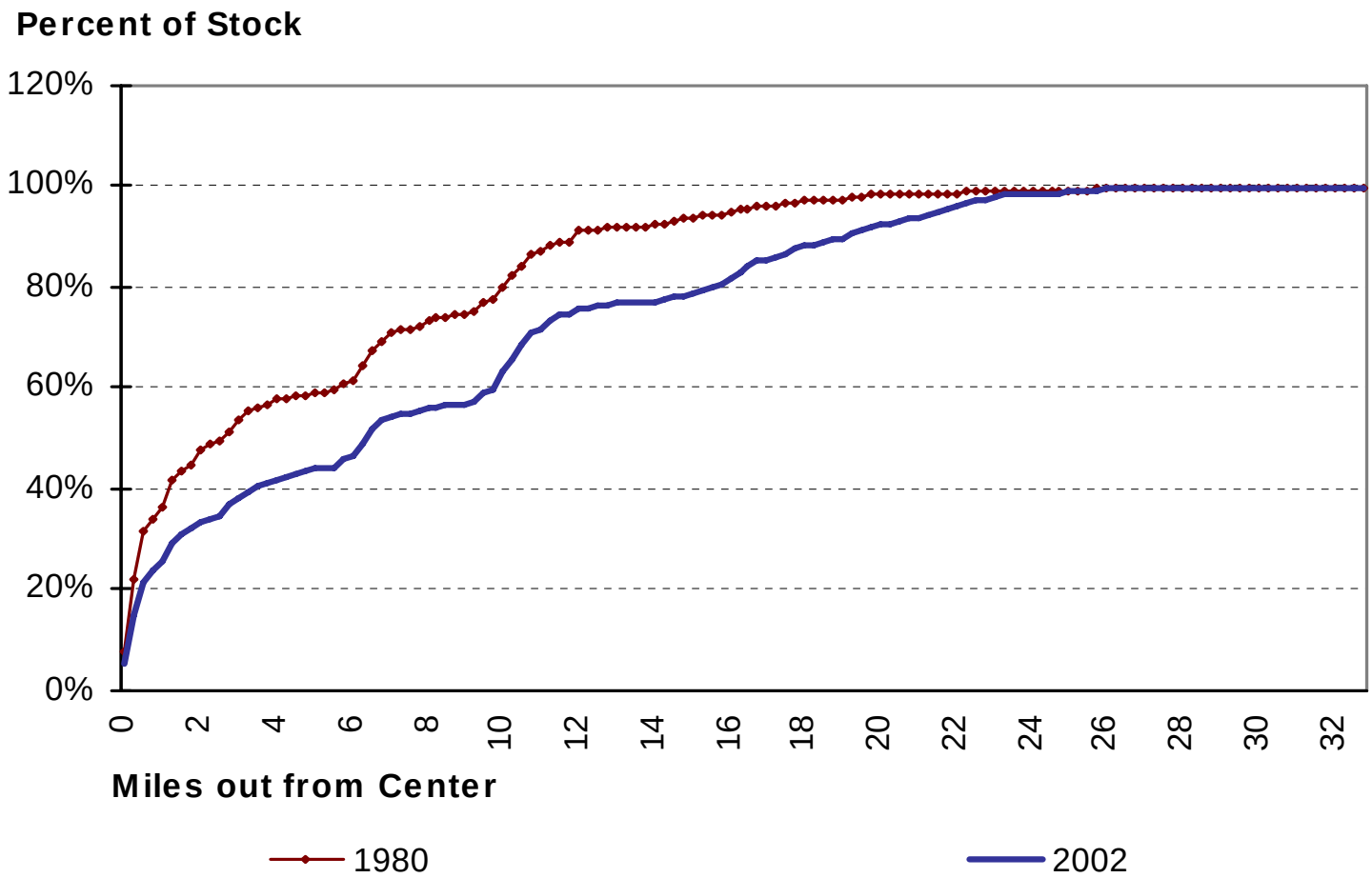


Washington D.C.: City and Suburban Office Space *(source: CBRE)*



Decentralization "flattens" the cumulative W.D.C. spatial distribution of office space.

[Source: geo-coded building data, CBRE]



The Distribution of Office Using Jobs Across The NY CMSA [Source: Employment Zip file, 1999]

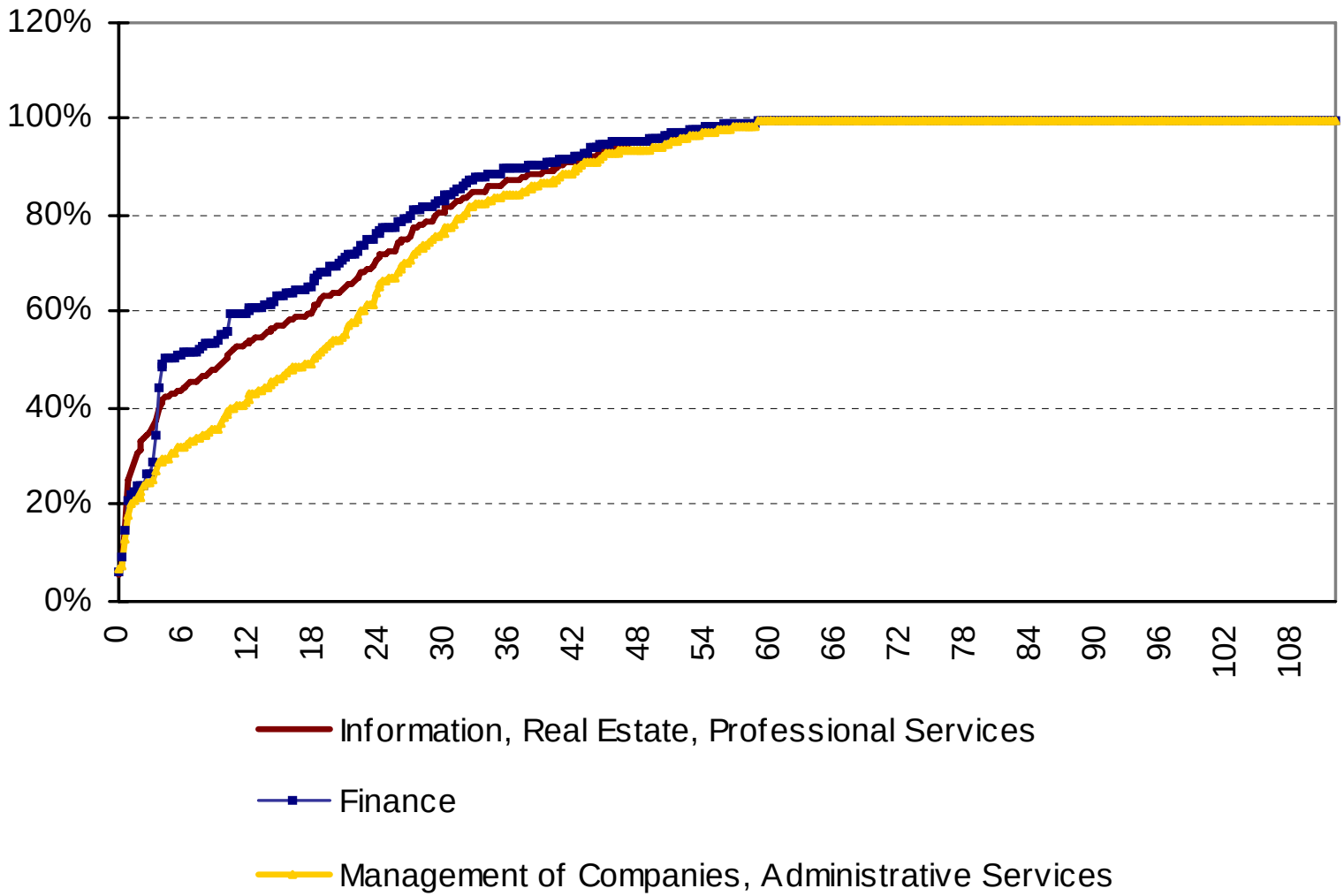


Figure 7: Los Angeles Spatial Distributions

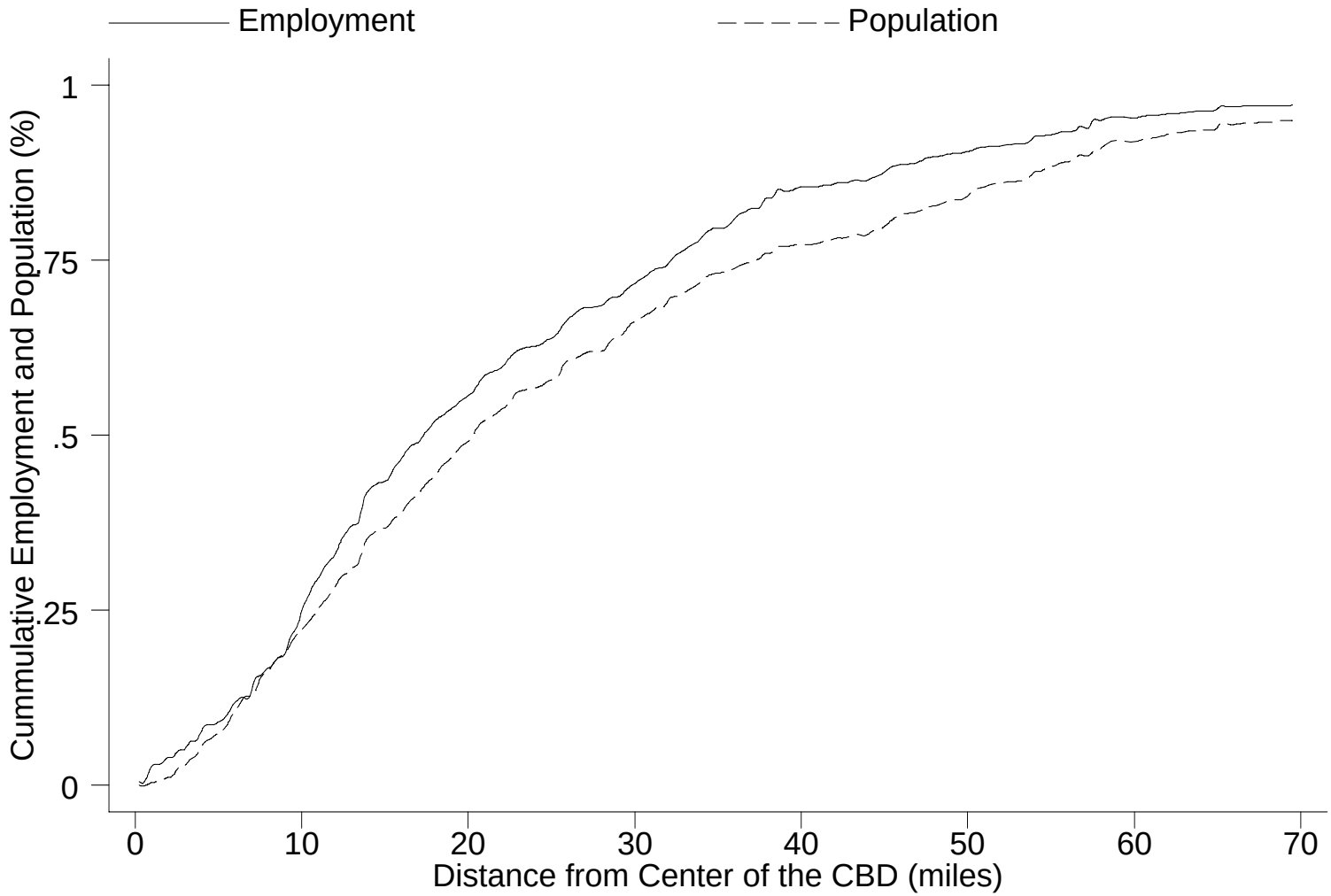
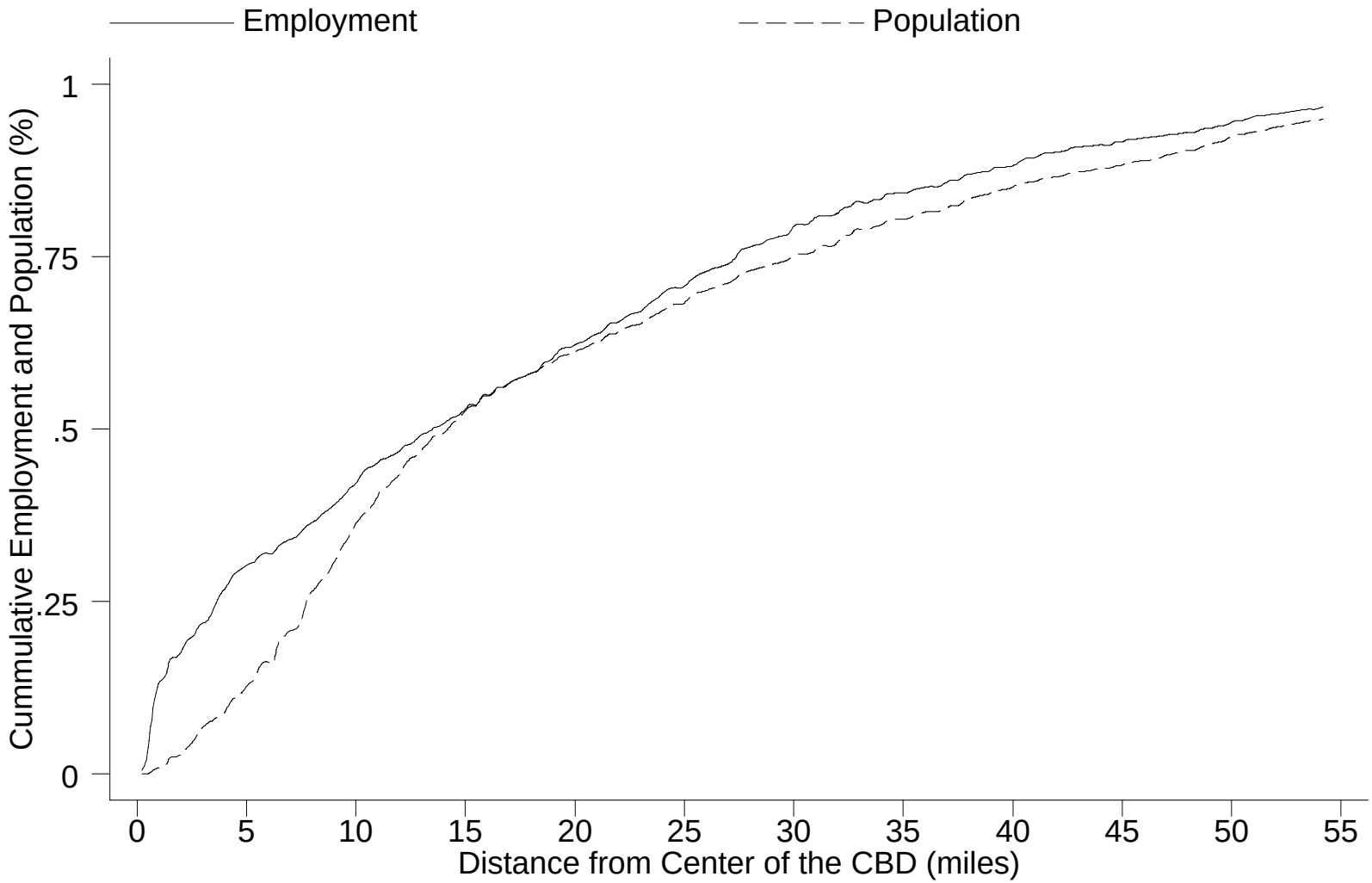


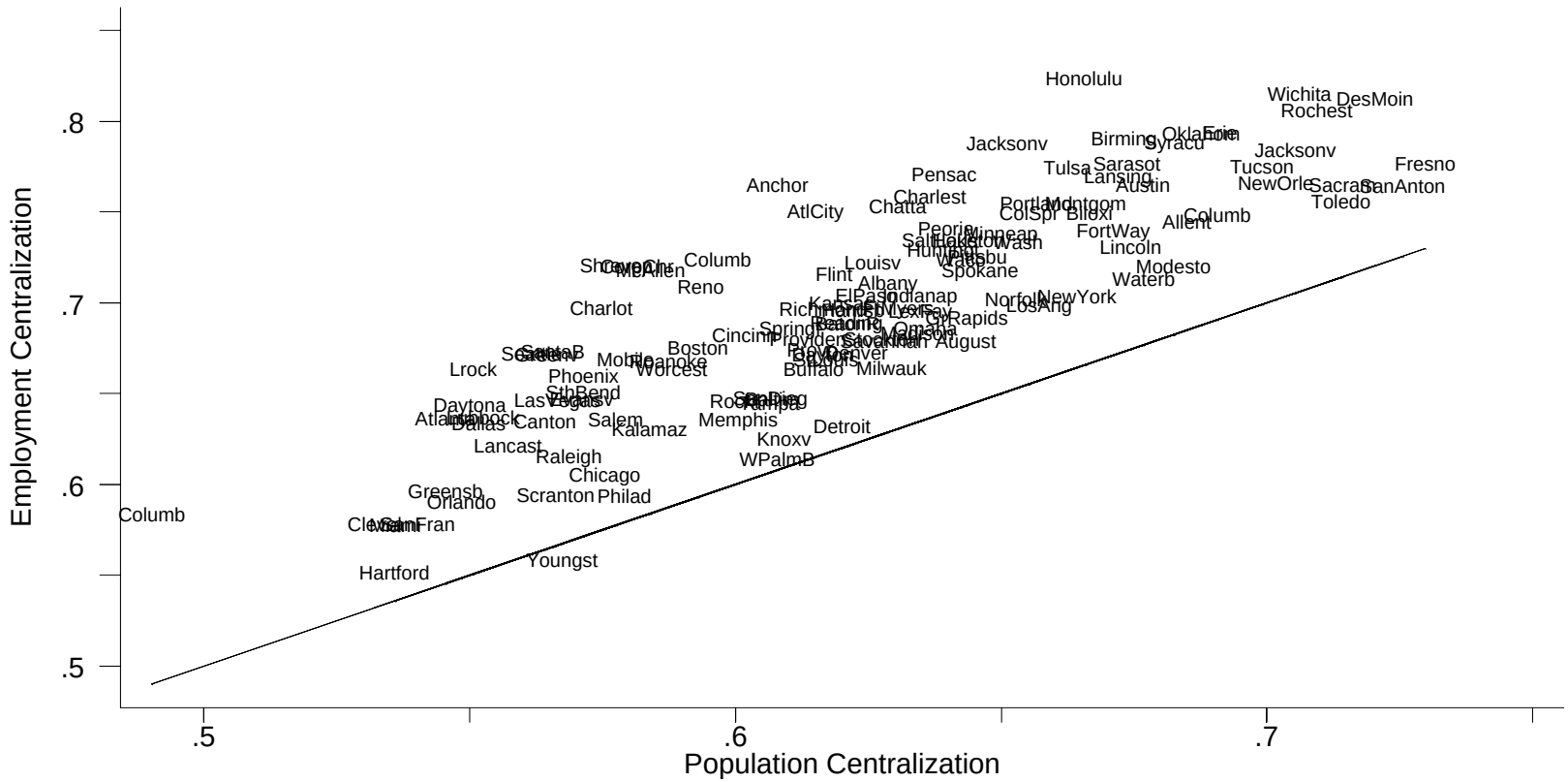
Figure 6: New York Spatial Distributions



$$\text{Concentration} = \int_0^b \frac{e(t)}{b}\, dt$$

Where: e(t): cumulative fraction of jobs (population) at distance t
b: distance at which 98% of population live.

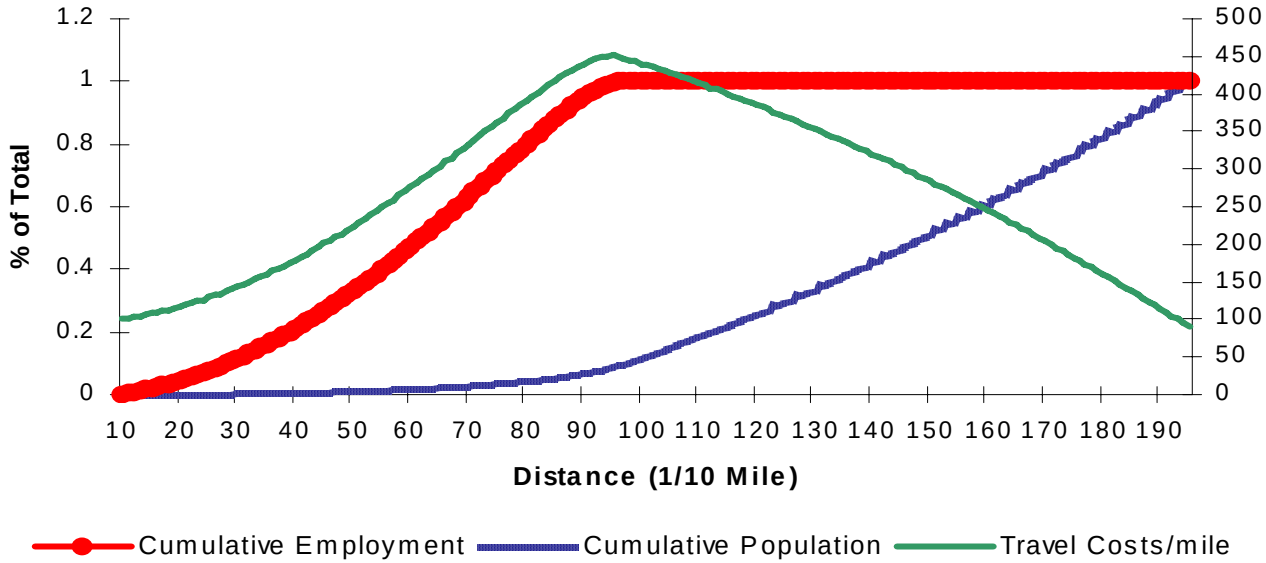
Figure 8: Employment and Population Centralization in a Sample of 120 Cities



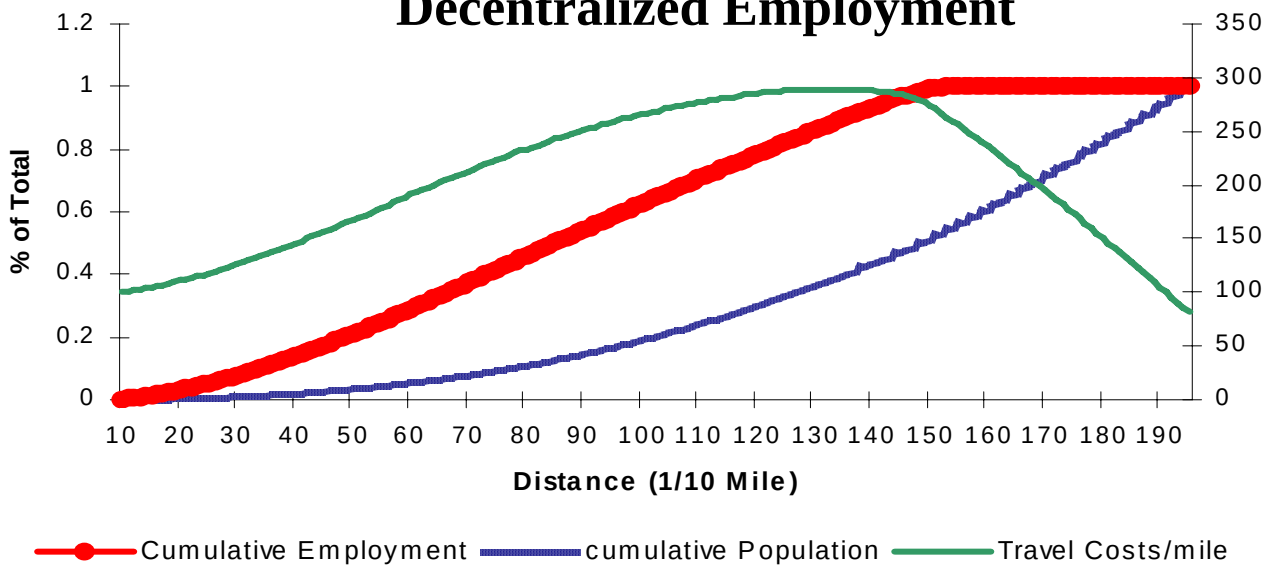
Employment Dispersal and commuting

- If people can commute only inward (not true but a useful assumption!). Then the number of people traveling inward at any point is the difference between the *cumulative number of jobs* located up to that point and the *cumulative number of workers* living up to that point.
- *Proof:* if the number of inward travelers at distance (t) is less than this difference then not all jobs up to t are being filled. If the reverse, then there are more commuters than jobs up to t and jobs beyond t are not being filled.
- Implication: jobs must be more centralized than residences for positive traffic flow in the allowed direction.
- With complete job-residence dispersal: no commuting!
- With centralized employment traffic worst at the *edge* of the business district

Centralized Employment



Decentralized Employment



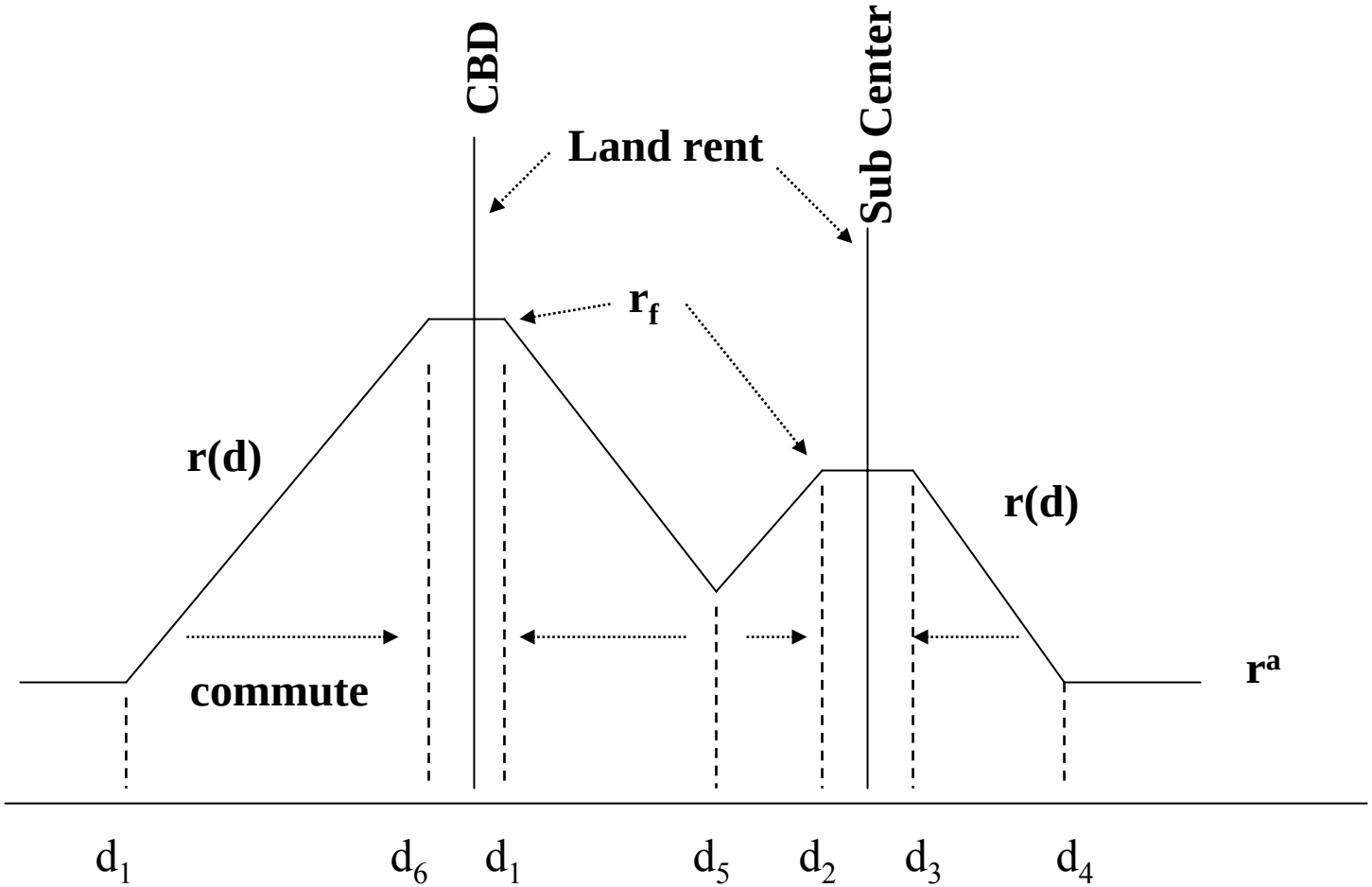
Wage as well as Rent Gradients

- In a location equilibrium, no one wants to change the location of *either* home or work.
- For workers at a particular plant – what insures that they are indifferent to different residential locations? Housing Rent (Lecture 2).
- For residents at a particular home location what insures that they are indifferent to switching jobs? *Different Wages*. Jobs closer to the center must pay for the incremental additional cost of commuting: hence a "Wage Gradient".
- But: cities do not have inward-only commuting!

Commuting times in the greater NY CMSA [internal = Origin and destination in same area]

Origin	Destination		Internal
	Downtown	Midtown	
CT	56.5	56.2	20
NJ	53.2	52.9	22.1
NY	40.6	39.8	40.9
Weighted Avg	**42.1**	**41.3**	

Land Rent and Commuting in a city with both a CBD and a suburban Sub Center



Why firms leave the CBD for a Subcenter.

- Subcenter workers at d_5 pay the same for land as CBD workers living there, but have a shorter commute. Hence their wage must be less by the difference in commute: $(d_5 - d_1)$ versus $(d_2 - d_5)$.
- Note that land rents still make workers that are employed at each center indifferent about living at different locations around *that* center.
- Firms at the CBD now must not only pay higher land rent (equal here to residential), but must also pay higher wages for labor.
    - Wages: 15% more [e.g. $13,500]
    - Rent (per worker): 250 x $15-20 [e.g. $4250]

MIT study of wages and average commuting time by location of employment [POWPUMA]

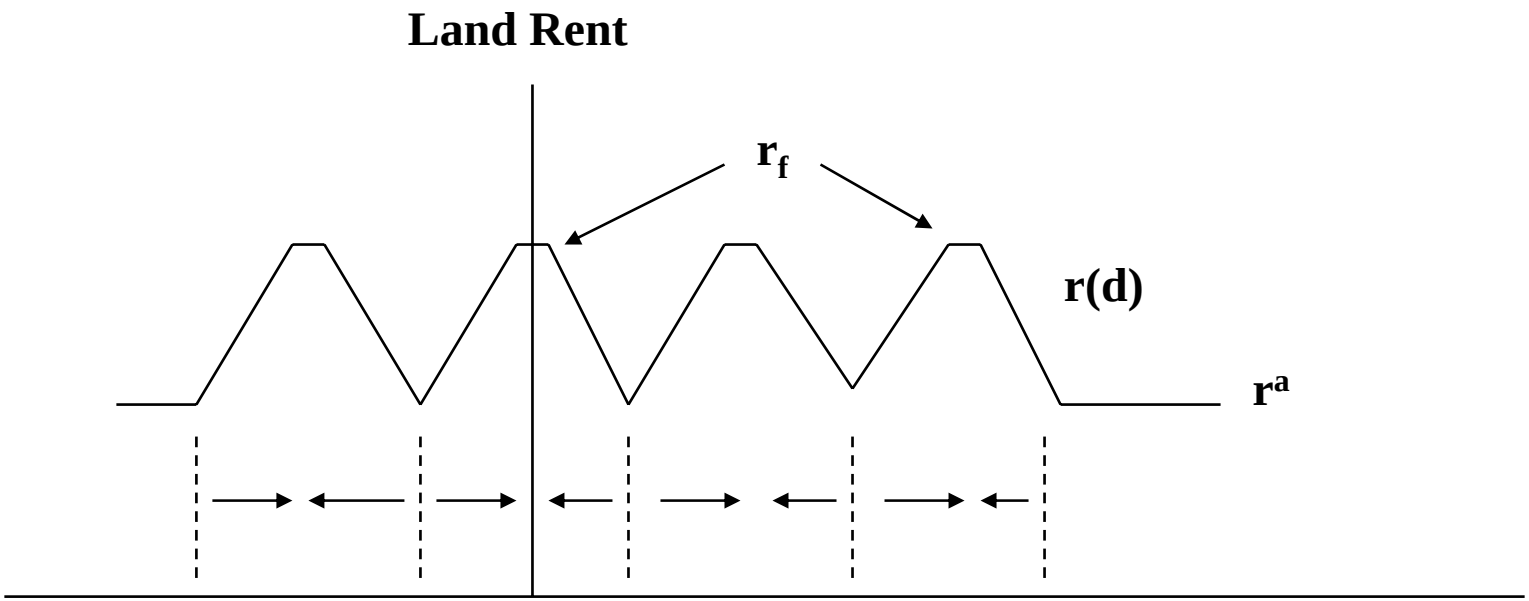
POWPUMA	Wage Premia[2]	Commute Time
1	**-.073**	22.8
2	**-.040**	25.3
3	**-.149**	19.3
4	**-.057**	22.8
5	**-.130**	18.4
6	**-.119**	20.4
7		34.3
8	**-.101**	22.7
9	**-.084**	21.9
10	**-.045**	29.1
11	-.013	27.6
12	**-.060**	26.3
13	**-.080**	25.6
14	**-.066**	21.1
15	**-.045**	24.1
16	**-.027**	27.2
17	**-.028**	28.6
18	**-.034**	27.1
19	**-.129**	25.6
20	**-.146**	20.7
21	**-.060**	24.4
22	**-.051**	25.0
23	**-.114**	20.6
24	**-.104**	19.4
Adj-R2 obs	.419 53979	mean 26.9 Std. Dev. 5.0

	PUMA	Largest Cities
1	1400	Lowell
2	1500	Chelmsford-Tewksbury-Dracut
3	1600	Lawrence-Haverhill
4	1700	Methuen-North Andover-Newburyport
5	1800	Salem-Beverly-Marblehead
6	1900	Peabody-Danvers-Gloucester
7	2000	Boston
8	2100	Revere-Everett-Chelsea
9	2200	Malden-Medford
10	2300	Cambridge-Somerville
11	2400	Waltham-Belmont-Lexington-Arlington
12	2500	Newton-Brookline
13	2600	Quincy-Milton
14	2700	Lynn-Saugus-Lynnfield
15	2800	Woburn-Melrose-Stoneham-Winchester
16	2900	Burlington-Reading-Wakefield
17	3000	Acton-Maynard-Concord
18	3100	Natick-Needham-Wellesley
19	3200	Framingham-Marlboro-Sudbury
20	3300	Milford-Franklin-Foxboro
21	3400	Dedham-Norwood-Westwood
22	3500	Braintree-Randolph-Stoughton
23	3600	Weymouth-Hingham-Hanover
24	3700	Brockton-Whitman

[1] Values in bold are significantly different from zero at the 5% level
[2] For full-time, private sector employees

Why not a Fully Dispersed Polycentric City?

An MSA grows Horizontally with additional sub centers and no increase in commuting at each sub center [See McMillen & Smith.]



The Degree of Decentralization/Dispersal: Many small –vs- Few large Centers

- Clusters (nodularity) versus “sprawl”.
- Economic Agglomeration
- Heterogeneous workers, housing mix.
- Realities of Transportation networks.
- Planning limits.
  - Forced sprawl through height limits
  - NIMBY
  - limited commercial land zoning

Boston Office Market: Nodularity and the distribution of sub centers

Office Area, Buildings, and Asking Rents, Boston-Area Towns, 1993, CBRE.

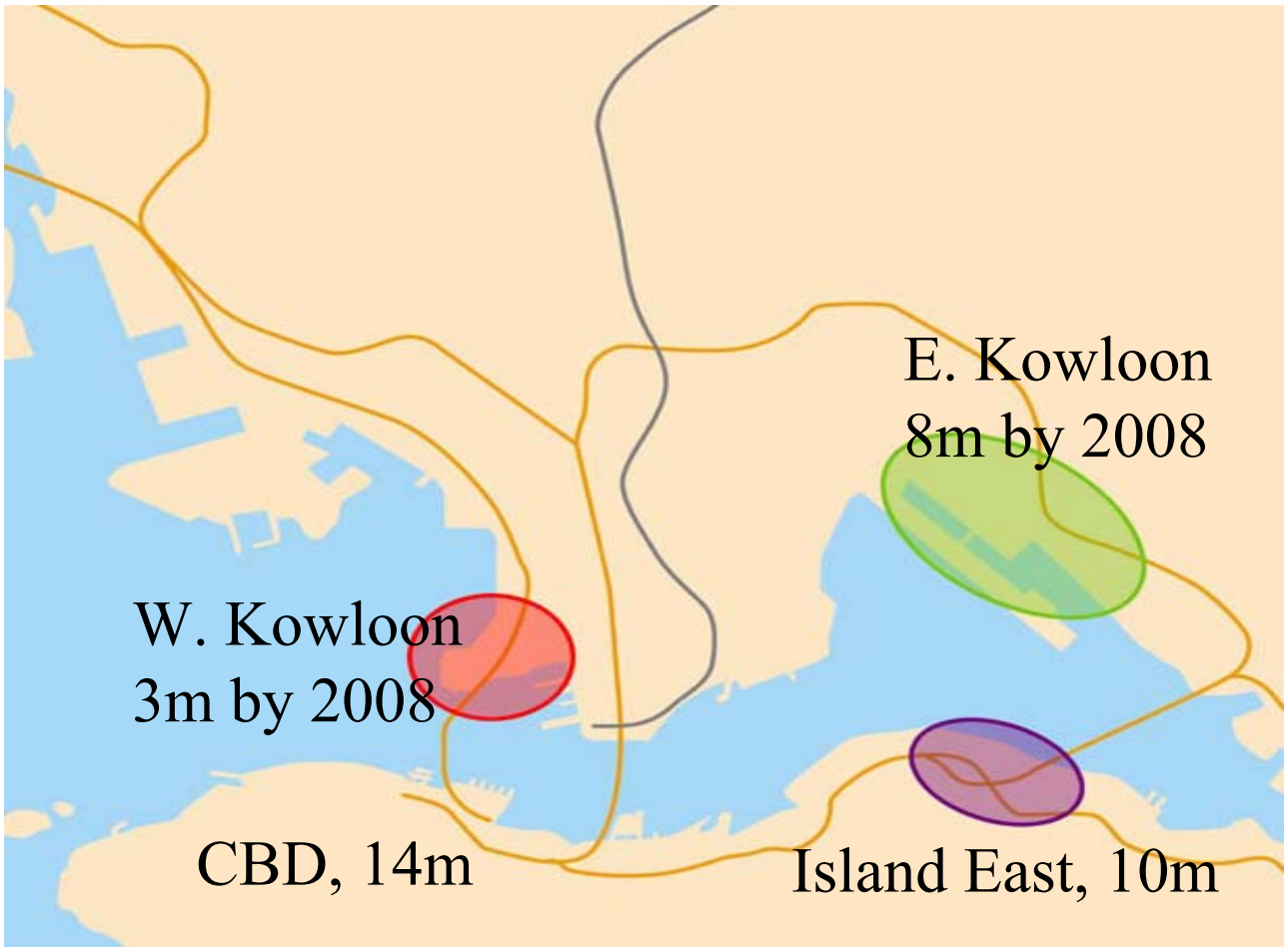
Town (Cluster	Square Feet (thousands)	Number of Buildings	Rent
Boston			
Back Bay	10,675	66	25.19
Financial District	26,754	141	26.73
South Station	3,053	21	23.50
Andover	1,438	10	16.25
Burlington	3,498	43	18.90
Cambridge	11,103	116	18.64
Framingham	3,196	39	14.06
Lexington	2,320	38	19.41
Natick	1,518	19	15.50
Newton	1,973	38	18.32
Quincy	4,797	44	15.90
Waltham	5,843	60	19.60
Wellesley	1,774	36	19.45
Westborough	1,664	15	12.50
Residual	26,793	548	15.21
MSA	106,399	1,234	20.74

adapted from DiPasquale and Wheaton (1996)

Metropolitan Area	*% Office Space Within Primary Downtown (CBD)*	*% Office Space Within Secondary Downtowns*	*% Office Space Within Edge Cities*	*% Office Space Within Edgeless Locations*	*% Difference Between Primary Downtown and Edgeless*
Core Dominated					
Chicago	53.9	—	19.5	26.6	27.3
New York	56.7	7.2	6.2	29.9	26.8
Balanced					
Boston	37.4	4.6	18.8	39.2	-1.8
Washington	28.6	12.5	27.1	31.8	-3.2
Denver	30.4	4.2	29.4	35.9	-5.4
Los Angeles	29.8	7.8	25.4	37.0	-7.2
San Francisco	33.9	8.8	13.9	43.4	-9.5
Dispersed					
Dallas	20.5	4.5	40.3	34.6	-14.1
Houston	23.0	—	37.9	39.1	-16.1
Atlanta	23.6	9.9	25.3	41.2	-17.7
Detroit	21.3	—	39.5	39.2	-17.9
Edgeless					
Philadelphia	34.2	3.2	8.9	53.6	-19.4
Miami	13.1	4.5	16.6	65.8	-52.7
Average	37.7	6.0	19.8	36.5	

Typology of Metropolitan Areas by Core vs. Edgeless Office Space, 1999

Even Hong Kong has Subcenters

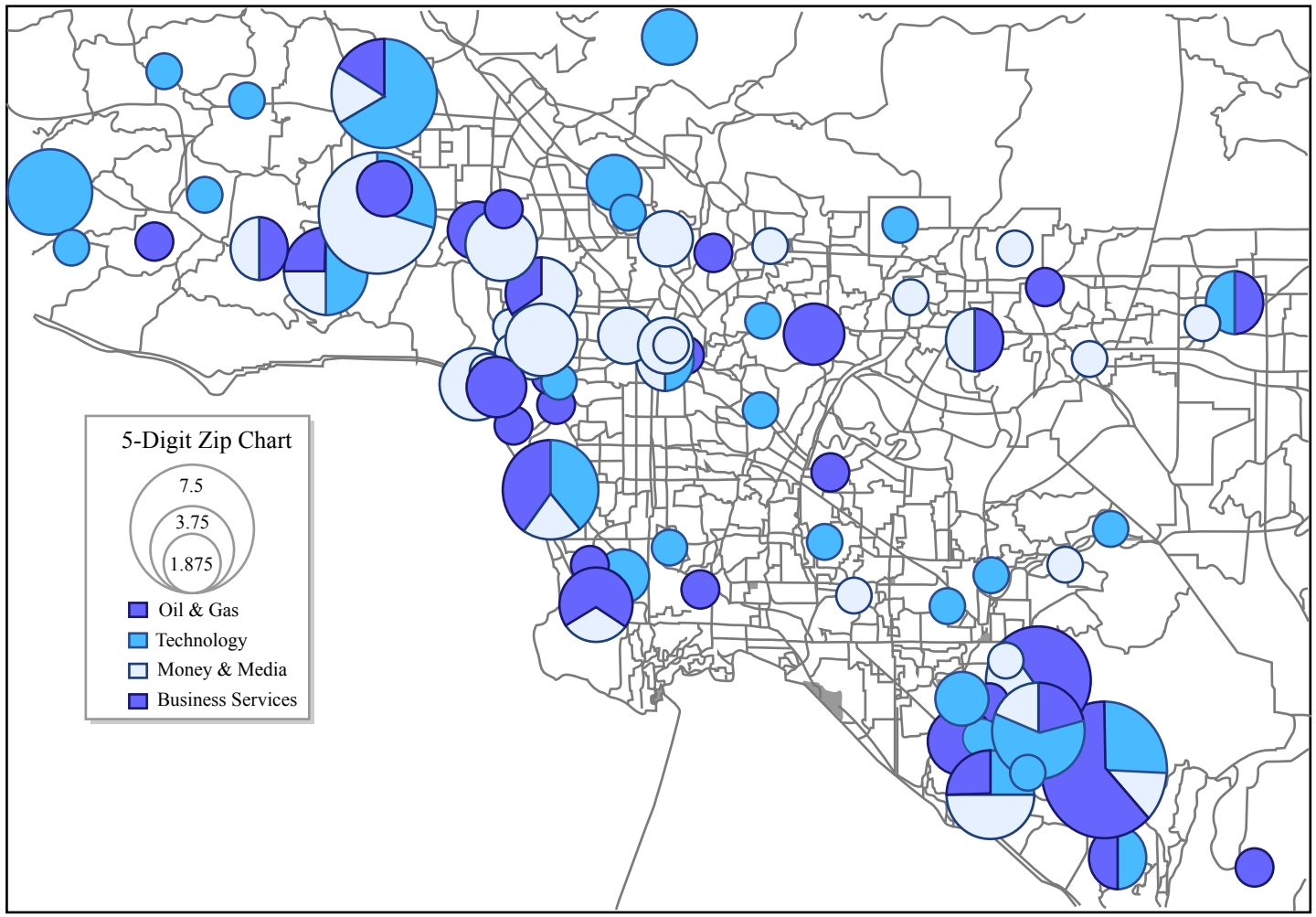


Urban "Agglomeration"

- Firms of the same type share information and ideas if they are in proximity to each other. [non competes?]
- Firms of different types that do business with each other find it more convenient if in proximity. [transportation costs are trivial and the Internet?]
- Fun, Entertainment, nice lunch spots emerge when lots of firms locate together [implication is that workers accept *lower* wages!].
- Workers can switch jobs more easily (not have to move residence) when there are many similar jobs in proximity.
- Firms find it easier to fill vacancies when there are many workers in other (similar) companies nearby.
- Firms with high turnover need labor market density. Firms with "lifers" or low turnover do not [Shilton].

HQ more dispersed than other employment in LA

(see Shilton, JRER, 1999)



Circle size reflects total number of headquarters within a zip code. Shading is the proportion of each major SIC industrial sector.

Same true in Boston *(see: Shilton, JRER, 1999)*

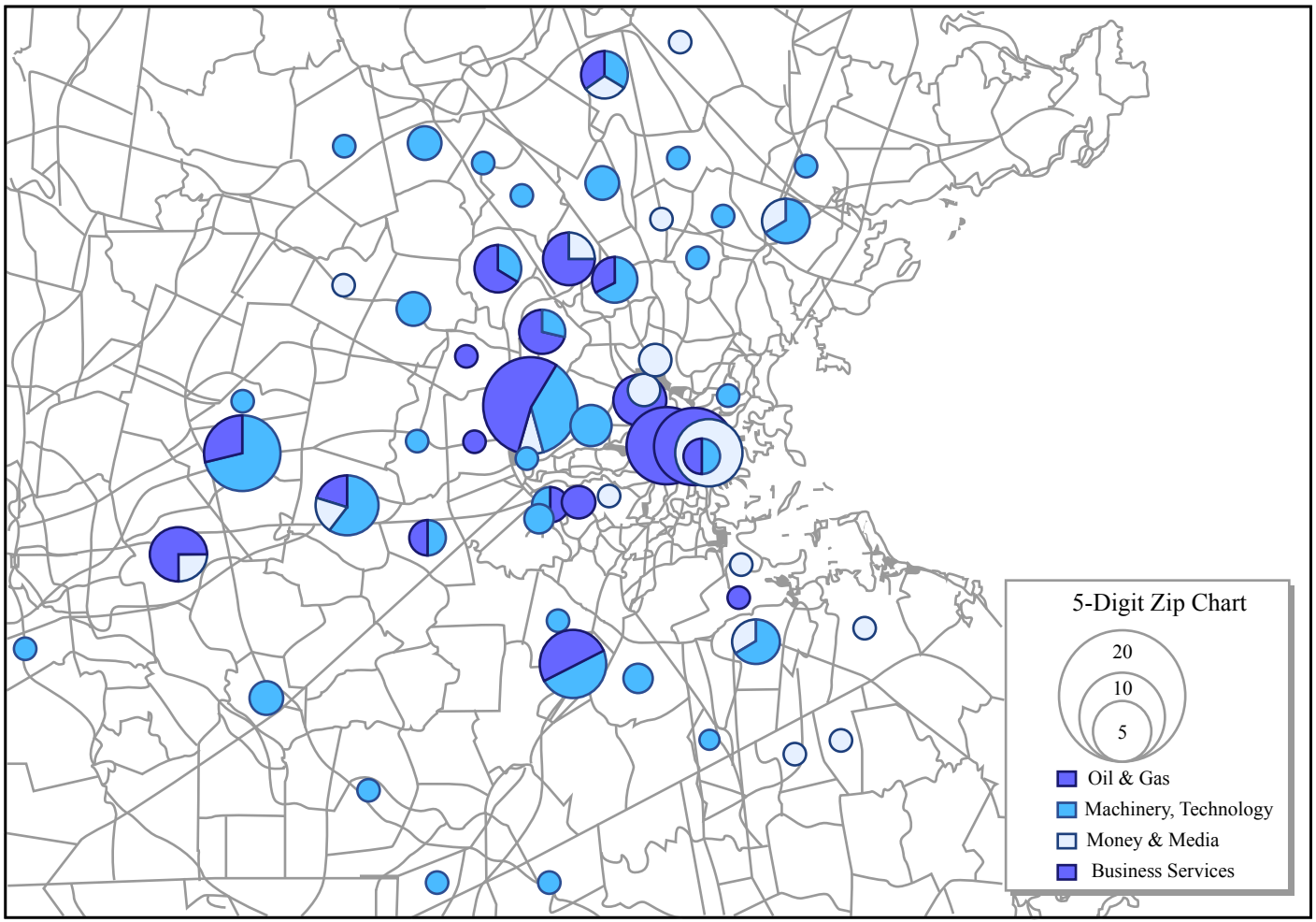
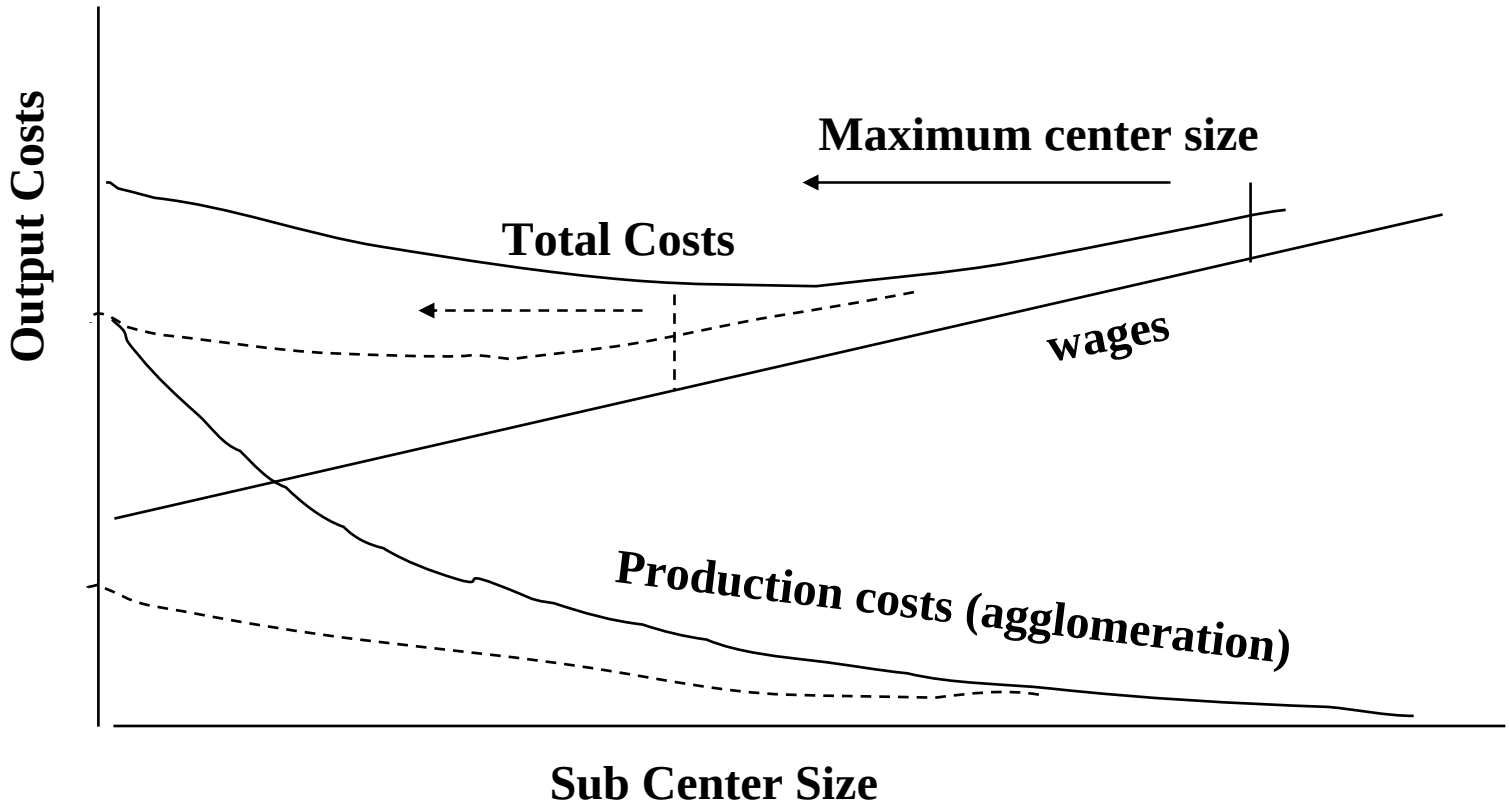


Figure by MIT OpenCourseWare.

Firm Production costs are lower in larger subcenters (Agglomeration), but wages are higher
Information technology (----) erodes agglomeration?
Or reduces need to commute?



Heterogenous Workers/Available Housing.

- Workers are not all the same – many firms need a diverse mix of workers
- The model of dispersal assumes that either (1) local workers are employable, or (2) each firm's workers can find local housing.
- What if each town has only housing/workers of a particular type?

  - Only firms using that type of worker would want to locate there.

  - Firms would need a much wider "commute shed" to secure workers = higher travel costs erode the suburban wage advantage.

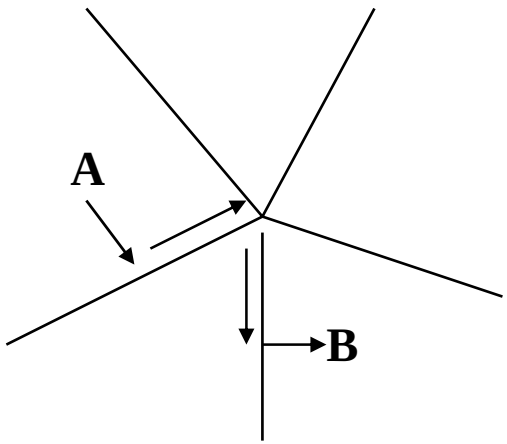
- Is the CBD the site with best access to *all* type of Workers in the region? *What about Headquarters?* [Shilton]

The layout of the Region's Road System.

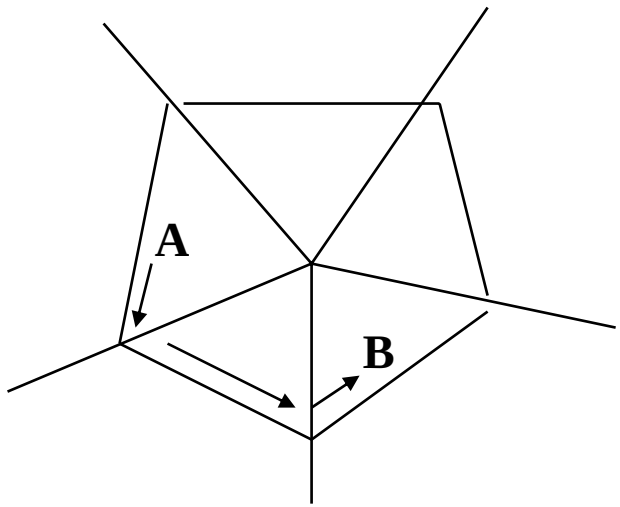
- From radial to circumferential highways (1970s)

- Philadelphia, Atlanta contrasts.

***Radial* : good inward access**
Poor suburb-to-suburb

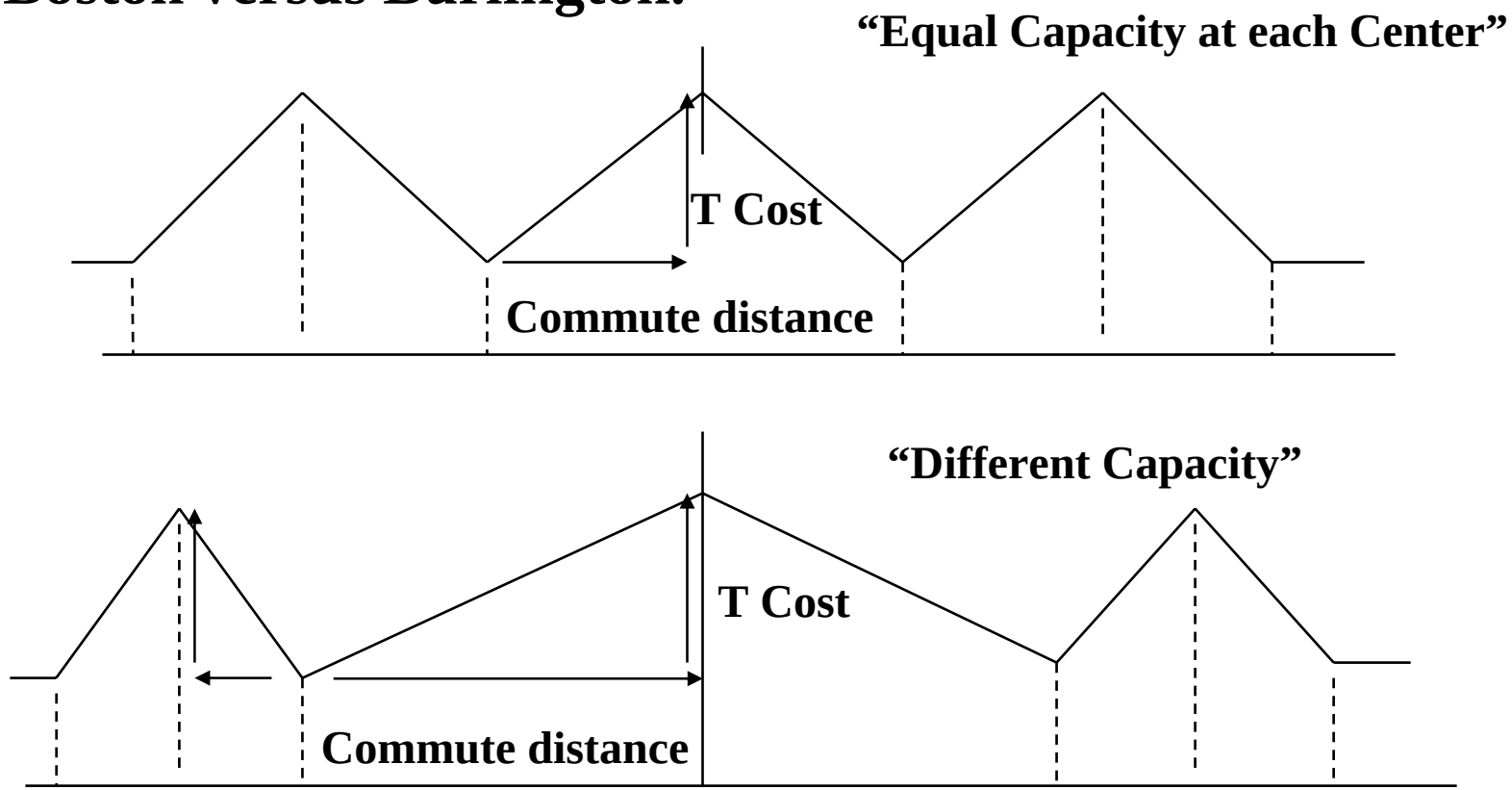


***Circumferential*: greater**
Suburb-to-suburb access



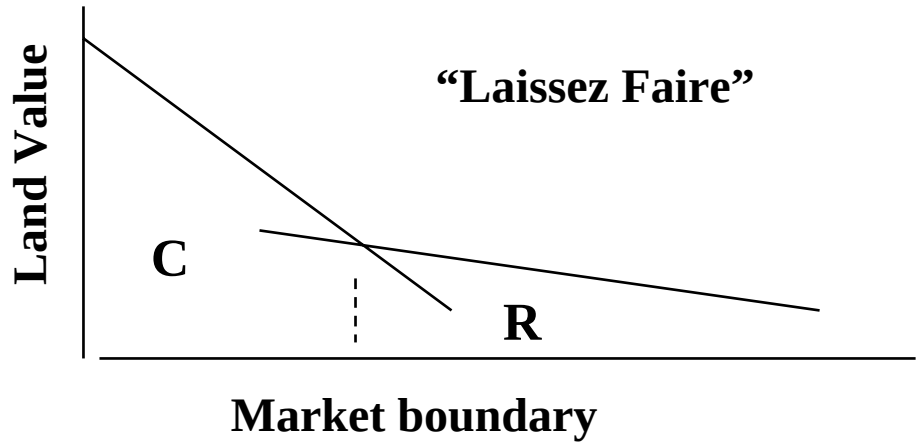
Subcenters with Different transport capacity:

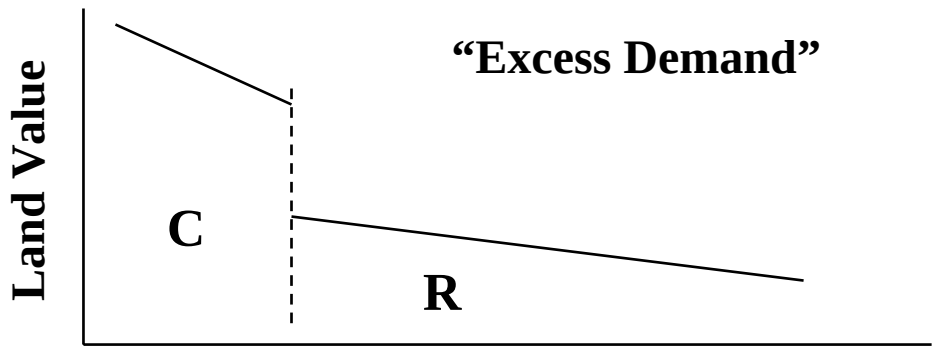
- Center with greater capacity grows until travel costs *to its edge* equal those of center with lower capacity.
- Boston versus Burlington.

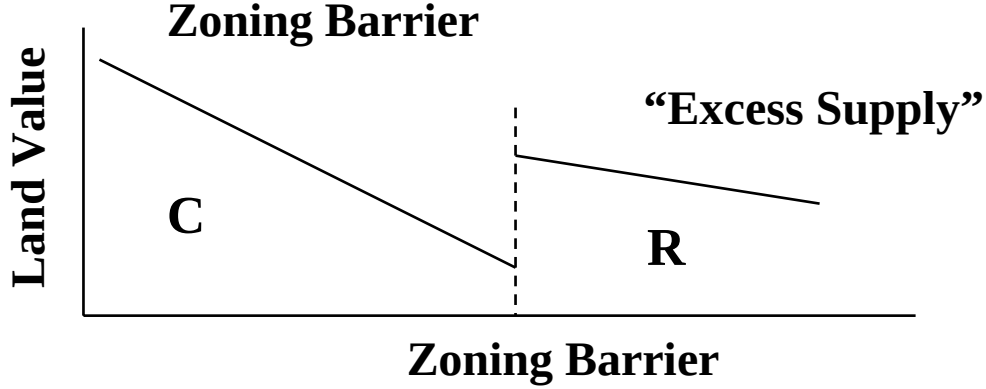


Is there a separate "Commercial" land Market?

Yes if zoning creates one!







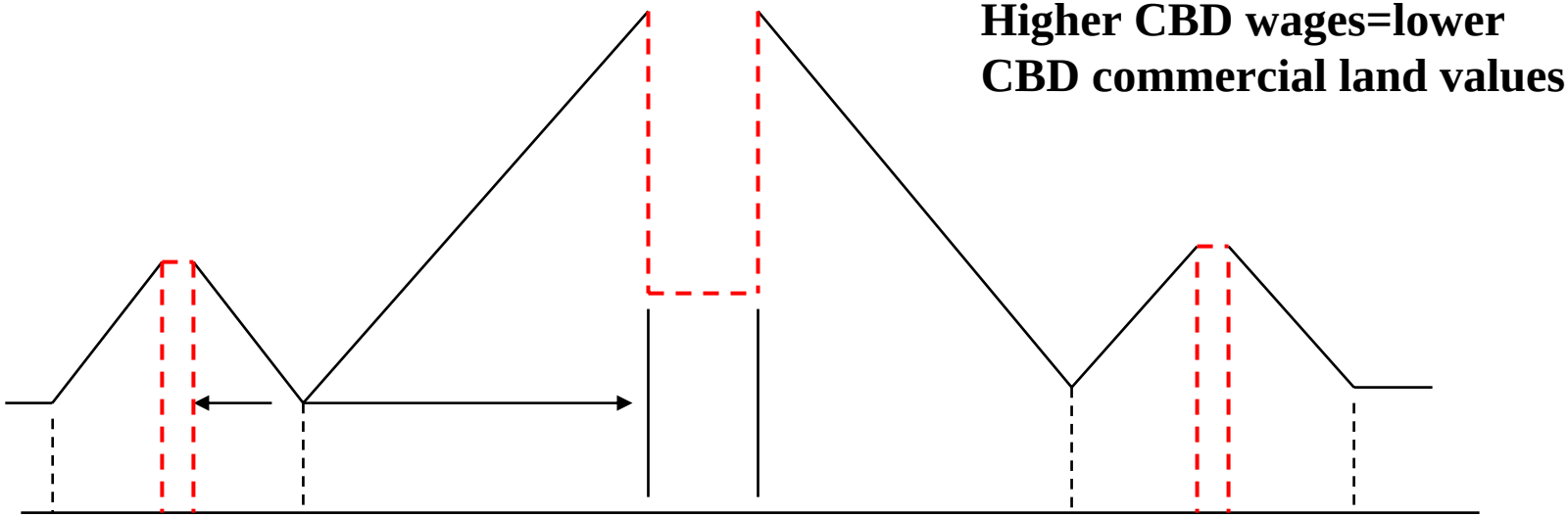
What if zoning limits the amount of commercial space at a "desirable" location

- A center with a good transportation system (for example) is supposed to grow and expand until its advantage is eventually eroded through longer commutes (at higher speeds).
- Without this growth, its advantage will remain and without greater commuting, net wages will be lower – hence commercial land values will rise above residential and office *Rents (for existing buildings)* will rise to absorb the advantage.
- The existing buildings have a sunk "Entitlement" that cannot be competed away with more development.

Overly large CBD will have commercial land value (red) < residential land value (black).

Hence office rents < replacement cost

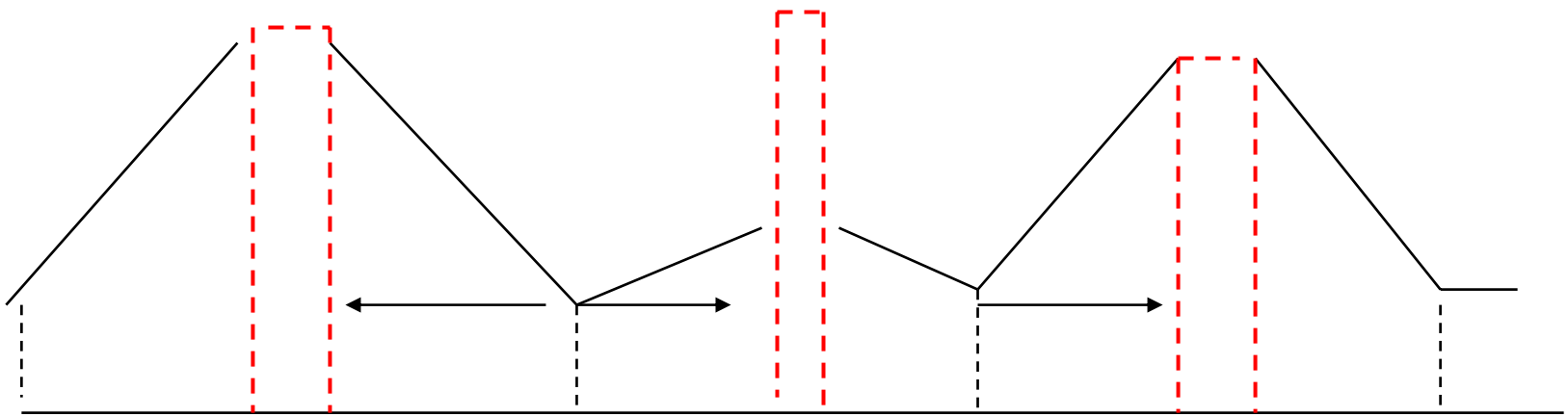
- Lower rents must compensate for higher wages to overly large center.
- Eventually sunk cost buildings will deteriorate and not be replaced, hence the center will shrink



Overly small Sub center (restricted suburb) will have commercial land value (red) > residential land value (black). Hence office rents > replacement cost

- Higher rents must compensate for lower wages to overly small center.

Lower Sub center wages=higher Sub center commercial land values



The same argument is at work within central cities. The stock of office space is *fixed* at various locations (streets) within major CBS districts. Yet these locations offer different access – in this case to mass transit lines. How can locations that require an extra 10 minutes walk pay higher wages? By paying less rent – at least until buildings deteriorate and then are built only on top of transit stops!

10 minute walk x 2 x $30 wage x 250days/200 sqft = $12.50 rent discount

(See: Brennen, Cannady, Colwell, AREUEA, 1984)

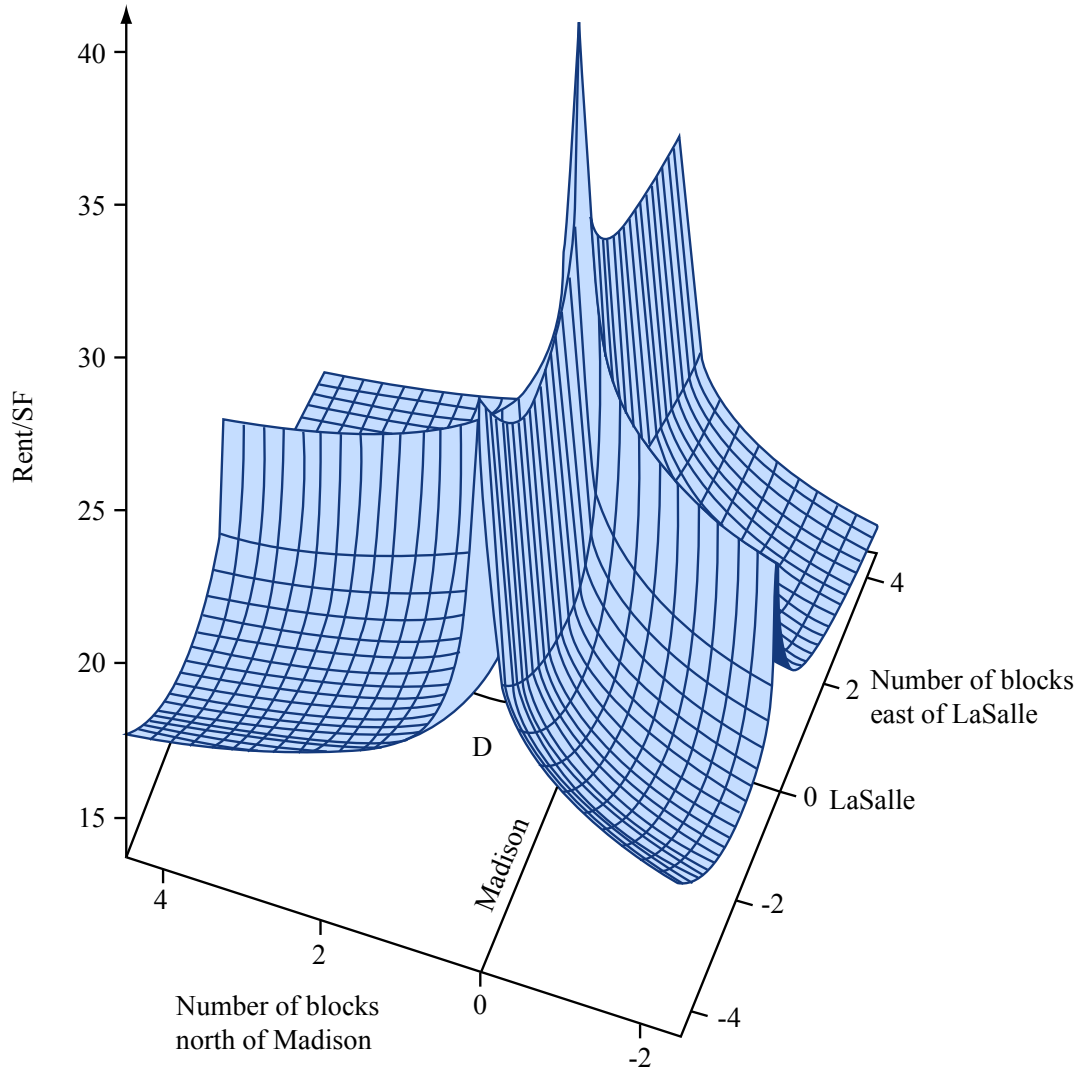


Figure by MIT OpenCourseWare.

Should Office Rents be higher in larger Sub centers? *(Archer-Smith, 2003)*

- Yes, if residential rents are higher from longer commutes.
- But that necessitates an offsetting agglomeration or other advantage (how to distinguish between the two?).
- No if larger sub centers have better transport systems (that's what makes them larger).
- Yes, if as centers grow, they bump up against boundary zoning constraints.

How Polycentric "Balanced Use" Cities react to rising Travel Costs

1. Firms move more to where their workers live: Suburban office development reduces commuting.
2. Workers get less picky about residential locations and move closer to their suburban workplaces.
3. Residential development downtown generates a nearby workforce for firms and also helps eliminate commuting.
4. The result: Cities where jobs and population are better aligned spatially.
5. Balanced (mixed) Land Use make life easy, interesting and more productive. Higher transport costs "force" greater "Balance".