



Urban and real estate economics

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Urban and real estate economics

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Urban and real estate economics

Week 7

Spatial patterns in cities III

Further patterns

Áron Horváth

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1. Separation of groups
2. Various participants in the city
3. History and cities
4. Urban sprawl
5. Separation with segregation

1. Separation of groups

Separation

Consider two similar groups with the first one having a more expensive leisure time.

- R is the rent of dwelling
- d is the distance from the centre,
- k is the cost to take one unit of distance,
- x is the sum of money spent on consumption.

Separation

$$R_1(d) = y - k_1 \cdot d - x_{0,1}$$

$$R_2(d) = y - k_2 \cdot d - x_{0,2}$$

No doubt the two groups will get separated!

The consumption will get evened up within the group

Indirect way:

$$x_A = y - k \cdot d_A - R_A > x_B = y - k \cdot d_B - R_B$$

In this case the inhabitant of B would be willing to pay more for the building plot of A so R_A will increase until the equality is realized.

Those who have more expensive leisure time will occupy inner parts

Indirect way:

Some number 2 lives closer to the centre than number 1 ($A < B$).

In the case of change in residency:

Change in utility of number 1:

$$k_1(d_A - d_B) - (R_A - R_B)$$

Change in utility of number 2:

$$k_2(d_B - d_A) - (R_B - R_A)$$

As $k_1 > k_2$, so all in all they can reach a higher level of utility, so the loser can be compensated from the profit of the winner, consequently it is worth changing.

Example: garden cities

- Usually housings with more income do not like to live in crowd. In this case the location depends on the k/q rate.
- If the residents with more income want to have much more spacious areas (the income elasticity of demand for areas is higher than the income elasticity of travel cost), they move to the edge of the city.
- If this relation is not true, other explanation needs to be found for the patterns of cities!

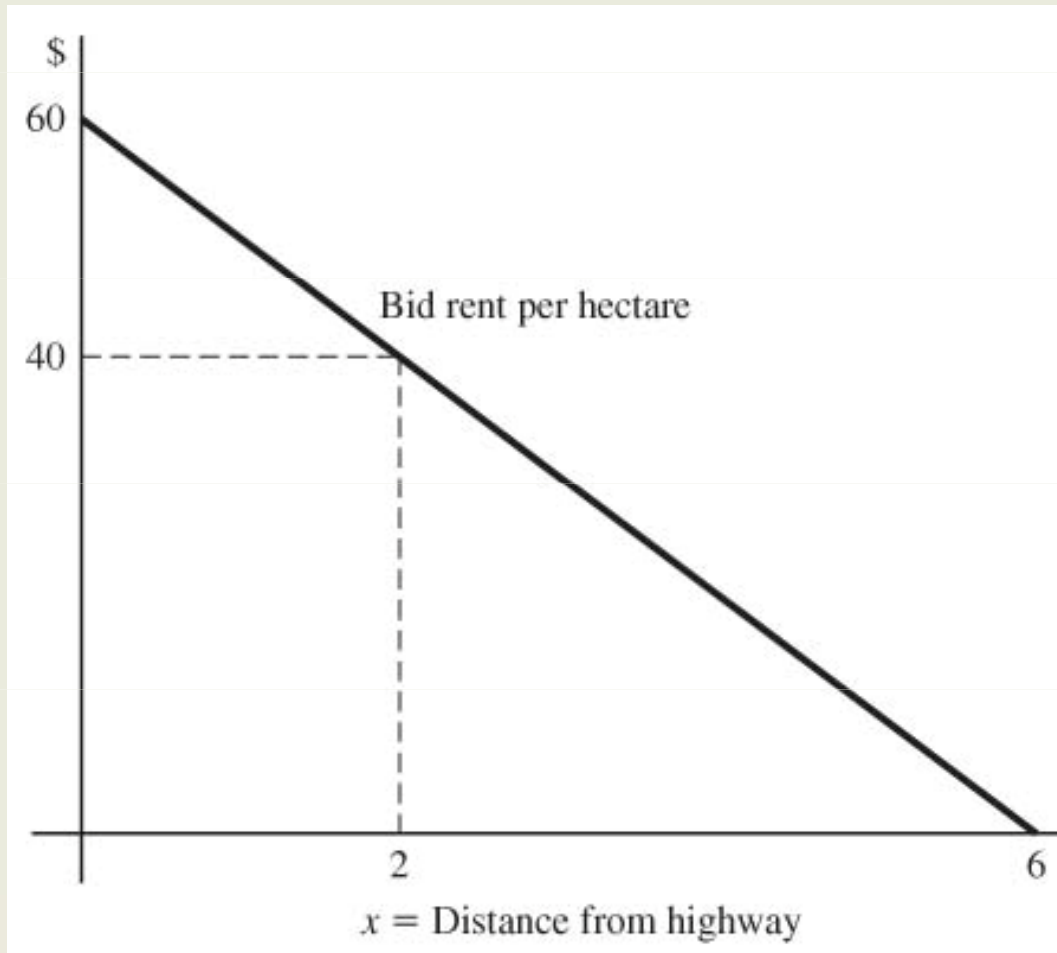
2. Various participants in the city

The three sectors

1. Industry (factories)
2. Offices
3. Residents

Factories

- Raw materials come from outside the city.
- The outputs go out of the city.
- Factories want to be near by the transportation routes.



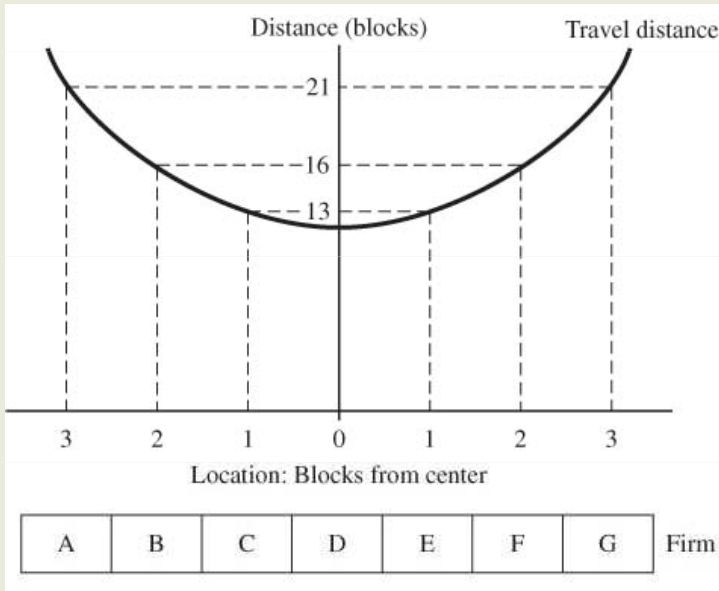
Freight cost and manufacturing Bid-Rent curve (O'Sullivan 6-1)

Freight cost increases with distance to the highway, so the bid rent for land decreases to generate zero economic profit at every location

Offices (intellectual jobs)

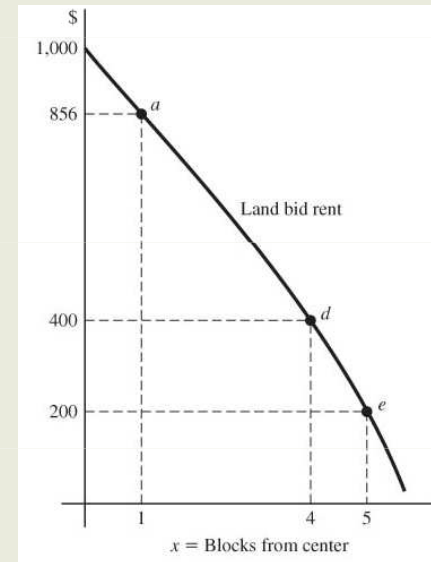
- More communicate is needed with partners and colleagues.
- Much time must be spent on travelling.
- The workforce is qualified so its cost of travelling is expensive.
- They like to live in the city centre.

The cost of travelling raises increasingly



Travel distances for information exchange (O'Sullivan, 6-2)

Each office firm interacts with all other office firms in the CBD to exchange information. The total travel distance for information exchange is minimized at the centre of CBD and grows at an increasing rate as the distance to the centre increases.



The office bid-rent curve without factor substitution (O'Sullivan, 6-3)

The bid-rent curve of office firms is negatively sloped because as we move away from centre the cost of travel for information exchange increases. The curve is concave because travel cost increases at an increasing rate

Optimal built density

$$R = \alpha - \beta F \quad C = \mu + \tau F$$

- F is the built density (number of storeys),
- R is the rent,
- C is the building cost of unit area.
- The higher the built density is, the less the demand for one square meter is.
- The higher built density (the higher building) is, the increasing cost of building

Solve the problem!

What happens to the built density and prices if we approach the city centre?

Optimal building density

$$\max_F F(R - C) = F(\alpha - \beta F - \mu - \tau F) = F(\alpha - \mu - (\beta + \tau)F)$$

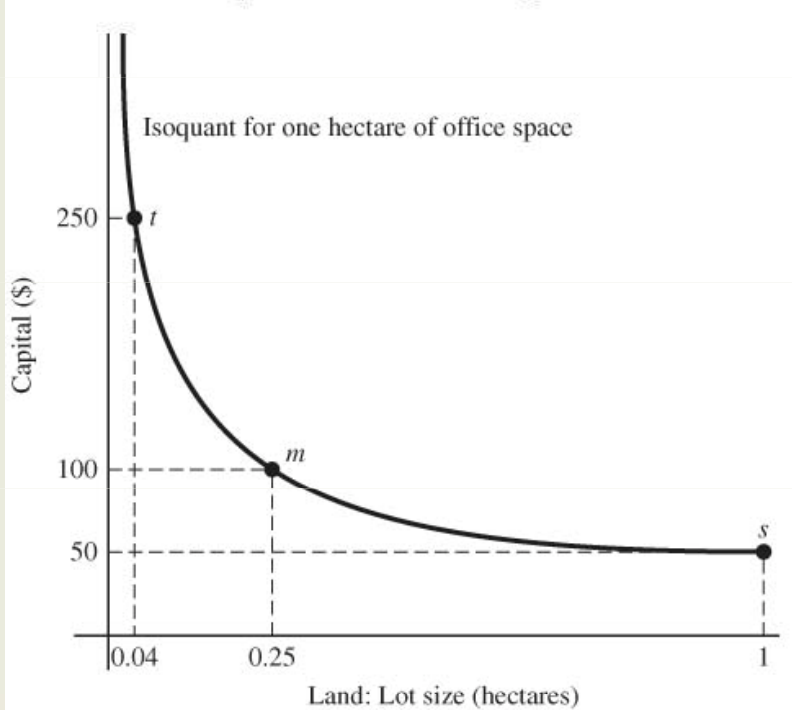
$$0 = \alpha - \mu - 2(\beta + \tau)F$$

$$F = \frac{\alpha - \mu}{2(\beta + \tau)}$$

- The building density rises, if α increases, so the demand for area increases.
- The building density increases approaching the centre.

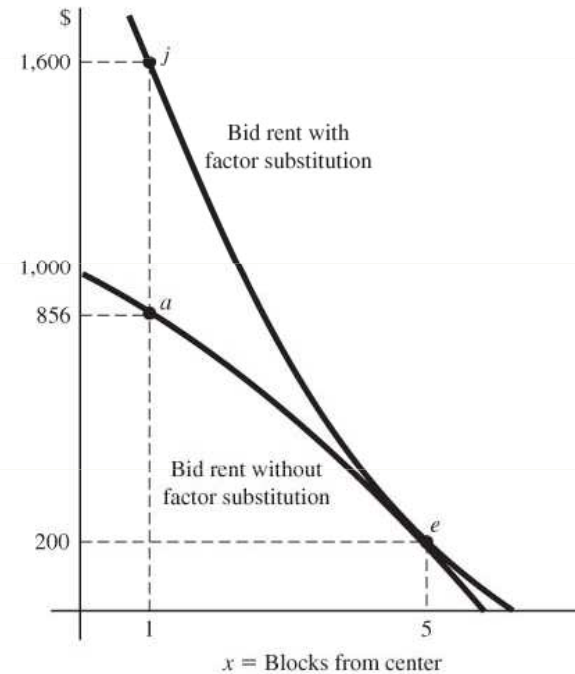
If it is allowed to build taller buildings

FIGURE 6-4 Isoquant for Office Building



The building isoquant shows the different combinations of land and capital that provide a fixed amount of office space (one hectare = 10,000 square meters). A taller building requires more capital for reinforcement and vertical transportation, so the isoquant is negatively sloped.

FIGURE 6-5 The Office Bid-Rent Curve with Factor Substitution

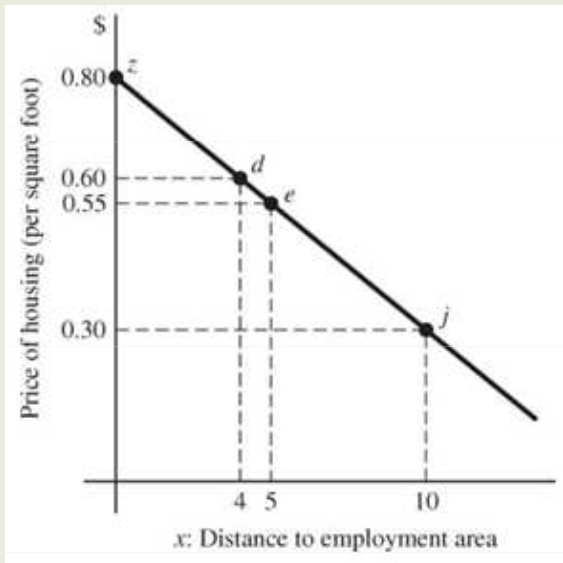


The bid-rent curve for office firms is concave without factor substitution and convex with factor substitution. A move from five blocks from the center to one block increases the bid rent because travel cost decreases (point *e* versus point *a*) and factor substitution saves on building costs (point *a* versus point *j*).

Households

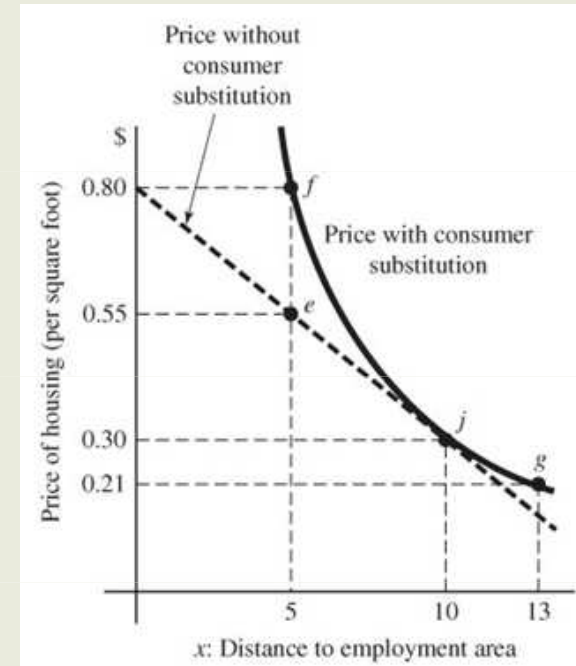
- They want to live near their work place.
- They cut the housing expenditures when the dwelling is more expensive, they substitute.

With and without substitution



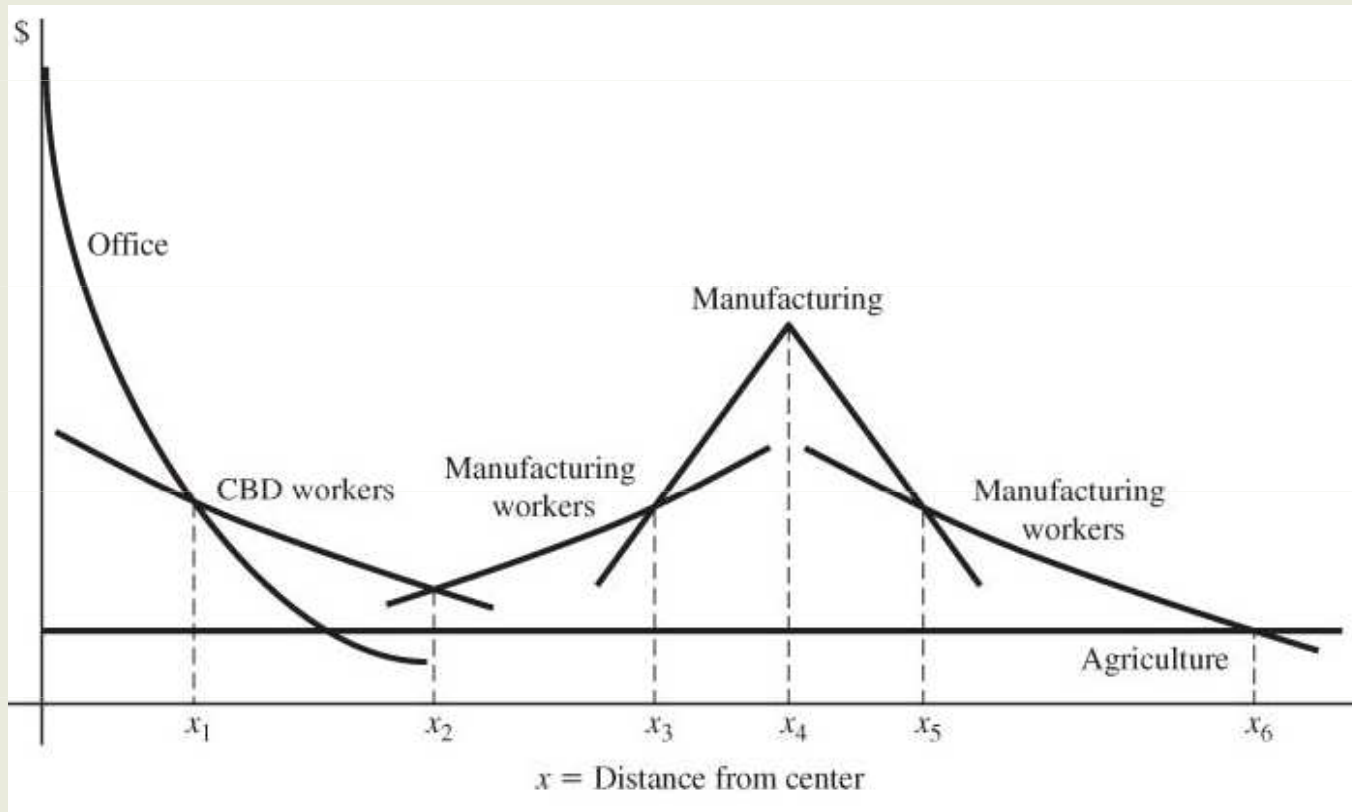
The Housing-Price Curve Without Consumer Substitution (O'Sullivan, 6-6)

The price of housing decrease as the distance to the employment area increases, offsetting commuting costs and ensuring locational equilibrium for households. In the absence of consumer substitution, the housing-price curve is linear.



Consumer Substitution and the Price of Housing (O'Sullivan 6-7)

Consumer substitution generates a convex rather than a linear housing-price curve. As the price rises, consumers substitute other goods for housing, so housing consumption (square feet of space) decreases, increasing the absolute value of the slope.



Bid Rents and Land Use Patterns (O'Sullivan, 6-10)

The equilibrium land-use pattern is determined by the bid-rent curves of firms and residents. The CBD is the area over which office firms outbid other users (from $x = 0$ to x_1). The area between x_1 and x_2 is occupied by residents who work in the CBD.

Manufacturing workers live in the areas between x_2 and x_3 and x_5 and x_6 .

Manufacturers occupy the area between x_3 and x_5 .

Task

- There are two sectors in the city: offices and the dwellings of their workers
- An instrument is developed, with the help of which the workers can travel two times faster.

Draw the displacement of the demand curve!

Who will benefit from the development?

Task: solution

- The cost of traffic decreases.
- The slope of the demand curve of office workers will be flatter.
- The city grows because it is worth moving to beyond the former city edge (the agricultural processing is worth more).
- The workers overbid the offices on the edge of the centre.

Task: solution



Task: solution + General equilibrium effects

- The labor supply grows because of the immigrants.
- The labor demand decreases because of the decrease of the office sector.
- The wages decrease.
- The bid-rent curve of office sector shifts upwards.
- The bid-rent curve of workers shifts downwards.
- The cost of travelling and the workers' wages will be lower.
- The land owners will benefit in this case.

3. History and cities

Bertaud: comparison of cities

- Alain Bertaud urban researcher studies urban patterns all around the world.
- He shows that
 - former socialist cities' patterns are less monocentric,
 - cities in the USA are the flattest,
 - Asian cities are the most densely populated.

4. Urban sprawl

Urban sprawl

- European cities are 3 or 4 times more densely populated than the American ones. Population density has recently decreased.
- The question is: Why?

Urban sprawl

- Cultural differences: Asia is more densely populated.
- Incentives:
 - lower travelling costs (petrol) in the US,
 - cheaper cars (lower taxes),
 - cheaper cooling (electricity)
- Consequences:
 - more comfortable lifestyle
 - more travelling
 - more exhaust fume (though cars are more modern)
 - public transport is more expensive to operate

The dawn of monocentric cities

- At the end of 19th century and the beginning of the 20th century cities were very monocentric.
- Public transport improved during the industrial revolution: omnibus, tram, trolley-bus, underground.
- Hence work force could reach the city centre in a short time.
- The centre could be properly saturated as technology necessary for constructing taller buildings improved.

The dusk of monocentric cities

- From the mid-20th century the ratio of employment in city centres fell from two thirds to half.
- As a consequence of motorisation, goods became cheaper to transport.
- Travelling became even cheaper.

Development of cities usually takes place in the suburbs.

- In the inner parts of cities there may be less densely built-in areas that used to be suburban areas.
- As cities grow, dwellings in the inner parts are appreciating due to their berth of ever increasing value, while they might depreciate if their structure becomes obsolete. New dwellings might be built in these plots if much profit can be made from denser building patterns and/or older dwellings become largely devastated.
- Two obstacles hinder the rebuilding:
 - building plots are multi-owned,
 - strict legal restrictions are in force.

5. Separation by segregation

Thomas Shelling – Segregation model

<http://ccl.northwestern.edu/netlogo/models/Segregation>

If separate groups don't mind who lives next door, then to what extent do these groups isolate from each other?

It is hard to investigate within closed frames, but easy to handle by simulation.

Segregation simulation

- Square grid surroundings.
- Actors move to vacant sites every now and then.
- They prefer to move next door to people of their own race.
- Segregation evolves surprisingly quickly even if only one of the groups finds it important who they live next door to.

Internet based simulation

<http://legacy.lclark.edu/~arthuro/SortModelNew.html>

Initial state:

integrated – segregated – random

What ratio of actors don't mind who they live next door to:

0% – 25% – 50%

Which intervention prevails?

nothing – support of pioneers – support of the minority – support of neighbours

Curriculum

- Denise DiPasquale–William C. Wheaton [1996]: *Urban Economics and Real Estate Markets*. Chapter 6-7.

Further readings

- <http://alain-bertaud.com/>
- Thomas C. Shelling [1971.]: Dynamic models of segregation. *Journal of Mathematical Sociology* 1 (1), pp. 143–186.