URBAN LAND RENTS/PRICES

PROF. DR. FABIAN THIEL URBAN AGGLOMERATIONS **RECOMMENDED READINGS:**

O'SULLIVAN, CHAPTER 6, URBAN LAND RENT

HARVEY, JOWSEY, URBAN LAND ECONOMICS, 6TH EDITION 2004, CHAPTER 14, LAND USE AND LAND VALUES

ÖZDILEK, Ü (2024) ON SUSTAINABLE LAND RENT. FRONT. SUSTAIN. 5:1360061. DOI: 10.3389/FRSUS.2024.1360061



The fathers of land policy: The reformer

"[i]t is not necessary to confiscate land; it is only necessary to confiscate rent."

(qf George: Progress and Poverty, 1879)

"A collective property of land (...) are not only two acts of justice, they are acts of essential interest for a nation that wishes to live."

(L. Walras: Etudes d'economie sociale, Paris 1896)





Thunen: Isolated state





J.H. Thunen: "The isolated state" (1826)

In the model, Thunen imagined an isolated city, set in the middle of a level and uniformly fertile plain without navigable waterways and bounded by a wilderness.

Ricardian Rent



INTRODUCTION TO LAND RENT

Land Rent

The periodic payment of an amount from the user of land to the owner of land

Market Value of land

The amount that someone has to pay in order to buy a land plot

HOW IS LAND RENT DETERMINED?

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The rent of a land plot is determined by the income that someone can earn by using it

In the case of agricultural land, what determines the income that can be earned from a plot?

Mainly fertility

	PRODUCT PRICE	QUANTITY PRODUCED	TOTAL INCOME	OTHER COSTS	MAXIMUM RENT	RENT OFFER BY USER
LOW FERTILITY	€10	2	€20	€15	€šš	?
HIGH FERTILITY	€10	4	€40	€15	€šš	?

HOW IS LAND RENT DETERMINED?

The above method of rent calculation is essentially an application of a traditional method of land valuation, the residual method

The rent for <u>urban land</u> is determined by other factors, not by fertility- which factors?

- Use of land (residential commercial, etc.)
- Direct and broader accessibility
- Characteristics of the closer and broader environment
- Characteristics of the plot
- In the case of industries which have transportation cost as main criterion for location selection, the main determinant of land rent is accessibility
 the method of determining the rent though is the same method of residual

LAND RENT DETERMINATION IN THE MANUFACTURING SECTOR

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Application of the residual method for determining the rent of a land plot suitable for industrial use

DISTANCE FROM MOTORWAY	TOTAL INCOME	OTHER PRODUCTION COSTS	COST OF CARGO UP TO MOTORWAY	MAXIMUM RENT	AREA OF PLOT IN HECTARES	RENT OFFER BY USER PER HECTARE
0	€250	€130	0	€?	2	?
1	€250	€130	€20	€?	2	?
2	€250	€130	€40	€?	2	?
3	€250	€130	€60	€?	2	?

THE LAND RENT CURVE HAS A NEGATIVE SLOPE



What is this graph telling us

<u>Rent/hectare decreases</u> as we move away from the motorway – Why? Because as we move away from the motorway, the transportation cost of the manufacturer increases

THE LAND RENT CURVE HAS A NEGATIVE SLOPE

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Let's see from the previous table, the move from 3 kilometres to 2 kilometres from the motorway:

- ➤ Change in rent/hectare : \$30-\$40 = -\$10
- > The change in distance is: 3 2 = 1

Therefore <u>the slope</u> of the land rent curve can be calculated as the ratio of the change in rent/hectare over the change in distance

$$\frac{\Delta_{\text{RENT/HECTA RE}}}{\Delta_{\text{DISTANCE}}} = -\frac{\$10}{1} = -\$10$$

THE LAND RENT CURVE HAS A NEGATIVE SLOPE

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What does the slope of the rent curve that we have just calculated tell us?

That for <u>every kilometre</u> we move away from the motorway the land rent the company is willing to pay <u>decreases by</u> <u>\$10</u>

OFFICE USERS AND INFORMATION EXCHANGE

The users of office space cluster in the center of a city because the exchange of information is important

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For a company that needs to have contacts with many companies in the center, the total travel distance increases with increasing rate as we move away from the center



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 center of the CBD and grows at an increasing rate as the distance to the center increases.

OFFICE LAND RENT CURVE WITH A FIXED PLOT SIZE



OFFICE LAND RENT WITH SUBSTITUTION OF PRODUCTION INPUTS

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What happens when we allow choice between building height and size of a plot?

- A developer can either use:
- 1. Smaller plot and build a higher building
- 2. Or a larger plot and build lower building

FACTOR SUBSTITUTION: CHOOSING A BUILDING HEIGHT

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The primary purpose of the developer is to minimise the total cost of the development which is equal to:

TOTAL COST = COST OF LAND + CONSTRUCTION/CAPITAL COST

As land rent increases the company substitutes land for capital

What does it mean?

> O'Sullivan demontrates that when land is expensive the savings in land costs from using less land are greater than increases in construction/capital costs from building a taller building

FACTOR SUBSTITUTION: CHOOSING A BUILDING HEIGHT

In other words, when land is expensive it is less costly for the developer to buy smaller land and build taller buildings than to buy more land and build lower buildings (substitution of land with capital)

What's the impact of this on development density as we move away from the centre?

If there are no planning restrictions, areas which are <u>near the centre</u> and have high land rent will be developed with <u>higher buildings and higher</u> <u>density</u> while remote areas where the land rent is low will be developed with lower buildings

HOUSING PRICES

Basic Question

What is the price that the developers are willing to pay for land at different locations within a city?

This will depend heavily on how much the consumers are willing to pay in order to buy a house at different parts of the city

We will try to answer this question with a simple model of location choice which is based on the role of the trip from residence to work

A SIMPLE URBAN HOUSING MARKET MODEL: ASSUMPTIONS

- 1. The cost of commuting is strictly monetary, we ignore its time cost
- 2. One member of each household commutes to a job in an employment area, either the CBD or a manufacturing district
- 3. Non-commuting travel is insignificant
- 4. Public services and taxes are the same at all locations, as well as all other location characteristics that affect housing location choice

A SIMPLE URBAN HOUSING MARKET MODEL: ASSUMPTIONS

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- □ Cost of commuting = \$50 /mile/month
- □ Each household consumes 1,000 square feet of living space
- □ Each household has a fixed amount of \$800 to spend on housing
- □ The "price" of housing is defined as the monthly rent per square foot

So at a distance of one mile from the place of work how much is the travel cost to work for the household?

Monthly travel cost=\$50

Therefore how much money is left for rent payment?

LINEAR RELATIONSHIP BETWEEN HOUSING PRICE AND DISTANCE FROM PLACE OF WORK

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At a distance of one mile from the centre the available amount for rent payment

\$800 - \$50 = \$750

Therefore the monthly rent per square foot is equal to:

AMOUNT AVAILABLE FOR RENT PAYMENT

-----= \$750/1000 = \$ 0.75

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HOUSE SIZE IN SQ. m²

PRICES ADJUST TO ACHIEVE LOCATIONAL EQUILIBRIUM

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In order to have locational equilibrium when the household is moving to another site, the change in the housing rent <u>must compensate for the change in the cost of travel</u> to the place of work

How much does the travel cost change if we move an x distance in relation to the place of work?

Change in distance x travel cost per mile

PRICES ADJUST TO ACHIEVE LOCATIONAL EQUILIBRIUM

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How much does the housing rent change Change in rent/square foot * size of the house

In order for the axiom to be valid

Change in distance * travel cost/mile = - change in rent/sqft * house size

Why do we have the negative sign at the right side of the equation?

<u>The negative sign</u> at the right side of the equation indicates that any increase in the travel cost must be balanced by a corresponding reduction in housing rent

WHAT IS THE SLOPE OF THE RENT-DISTANCE LINE IN THIS EXAMPLE?

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Therefore in order to have locational equilibrium the following relationship must hold:

 Δ_{DISTANCE} * Travel cost per mile(T) = - Δ_{RENT} * Size of the house (M)

If we solve this equation in connection with the slope of the rent curve :

$$\frac{\Delta_{\text{RENT}}}{\Delta_{\text{DISTANCE}}} = -\frac{TRAVEL \ COST \ PER \ MILE}{SIZE \ OF \ THE \ HOUSE} = -\frac{\$50}{1,000} = -\$0.05$$

CONSUMER SUBSTITUTION GENERATES A CONVEX HOUSING-PRICE CURVE

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- Until now we have assumed that households rent a *fixed* amount of square feet regardless of the price
- This is contrary to the law of demand according to which demand changes as prices change
- If we assume that the law of demand is valid what happens?

As we approach the place of work and the housing rent/price per square foot increases the demand for housing (in terms of house size) <u>should be decreasing</u>

CONSUMER SUBSTITUTION GENERATES A CONVEX HOUSING-PRICE CURVE

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The size of the house is the denominator in the formula of the slope of the housing rent curve

Therefore as we approach the center households buy smaller houses because of the higher price and the denominator of the slope formula (house size) decreases

If for example the consumption decreases at 500 sq.ft. then the slope will be doubled

$$\frac{\Delta_{\text{RENT}}}{\Delta_{\text{DISTANCE}}} = -\frac{TRAVEL \ COST \ PER \ MILE}{SIZE \ OF \ THE \ HOUSE} = -\frac{\$50}{500} = -\$0.10$$

EFFECT OF THE LAW OF DEMAND ON THE SLOPE OF THE HOUSING RENT CURVE

- > What happens in areas that are further away from the place of work?
- The rent is significantly lower resulting in a significant increase in the demanded house size. If the demanded house size is 1,500, how much will the slope be?

$$\frac{\Delta_{\text{RENT}}}{\Delta_{\text{DISTANCE}}} = -\frac{TRAVEL \ COST \ PER \ MILE}{SIZE \ OF \ THE \ HOUSE} = -\frac{\$50}{1,500} = -\$0.033$$

EFFECT OF THE LAW OF DEMAND ON THE RELATIONSHIP BETWEEN HOUSING RENT AND DISTANCE FROM PLACE OF WORK

- Therefore, <u>the slope</u> of the line that describes the relationship between housing rent and distance from the place of work is <u>high near the place of work and decreases</u> <u>as we move away</u>
- In other words, while we approach the centre, the housing rent increases at <u>an increasing rate</u>

WHAT DOES THE CONVEXITY OF HOUSING RENT CURVE MEAN?

AS WE APPROACH THE PLACE OF WORK HOUSING RENT INCREASES AT AN

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DISTANCE FROM PLACE OF WORK

DEVELOPMENT DENSITY AS WE APPROACH THE WORK PLACE

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If there is factor substitution, then as we approach the workplace and land price increases the developers will substitute land for capital meaning that they will buy smaller plots and build higher buildings



This is in line with law of demand since households demand smaller houses as rent increases

RESIDENTIAL DENSITY

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The above chart explains the increasing population density as we approach large employment centers. As we said this is due to two reasons:

1. <u>Consumer Substitution</u>

Because rent increases as we approach the workplace, households demand smaller houses

2. <u>Factor substitution on the part of developers</u>

Because land costs increase as we approach the workplace, developers use less land per residential unit

RE-EXAMINING THE ASSUMPTIONS OF THE SIMPLE URBAN HOUSING MODEL

- 1. The journey to work has no time cost (but it has)
 - If time has opportunity cost then land rent will decrease at a higher or lower rate as we move away from the centre of the city?
 - > With higher rate Why?

- 2. In each household there is only one employee
 - If most households have two employees working at different work places what happens?

RE-EXAMINING THE ASSUMPTIONS OF THE SIMPLE URBAN HOUSING MODEL

- 3. <u>Travel to other destinations except work (shopping, entertainment and other activities) are insignificant</u>
 - If non-working destinations are concentrated in the opposite direction from work then the decrease in the rent at a location that is further away from the workplace maybe lower
- 4. <u>The quality of the environment, of public services and taxes are the</u> <u>same at all locations</u>
 - If there is a differentiation, then as we move away from the workplace, the rent may decrease at as smaller rate if at the same time we move away from a lower quality environment, or entering another community that has better services

HOW LAND USES ARE DETERMINED IN A FREE MARKET?

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How the uses of land are determined in a free market?

What is the principle of the determination of land uses in a free market?

Every plot is used by the <u>user who is willing to pay the</u> <u>highest rent</u>

THE DETERMINATION OF LAND USES

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LETS SEE WHAT THIS MEANS THIS THROUGH A SIMPLE CITY MODEL IN WHICH:

- 1. THE INDUSTRIES EXPORT THEIR PRODUCTS WITH TRUCKS AND USE MOTORWAYS TO CROSS THE CITY
- 2. IN THE CITY THERE ARE TWO MOTORWAYS:
 - A) ONE WHICH CROSSES THE CITY AND PASSES FROM THE CENTER
 - B) ONE CIRCUMFERENTIAL FREEWAY, WHICH CONNECTS WITH A)
- 3. All companies that use office spaces exchange information at the center of the city
- 4. HOUSEHOLDS WORK IN OFFICES or at the factories AND TRAVEL FROM THEIR HOUSES TO THEIR WORKPLACE

RENT CURVE FOR COMPANIES THAT USE OFFICE SPACES





THE RENT CURVE FOR INDUSTRIAL USE



RENT CURVE OF EMPLOYERS



CBD - Timeline Munich





CBD - Timeline Munich





CBD – Timeline Munich



EQUILIBRIUM LAND USE PATTERNS

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FIGURE 6-10 Bid Rents and Land Use Patterns



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 . Manufactures occupy the area between x_3 and x_5 .