Urban Economics [31C02100, REC-E3500, USP-342]
Final exam **20 Feb, 2019**

Instructions: Please answer all the questions. You may answer either in Finnish or in English.

1. Congestion externality

Suppose there are three potential users of a freeway: persons A, B and C. The cost of the best alternative route for each commuter is as follows:

Commuter	Alternate cost
A	€7
B	€5
C	€3

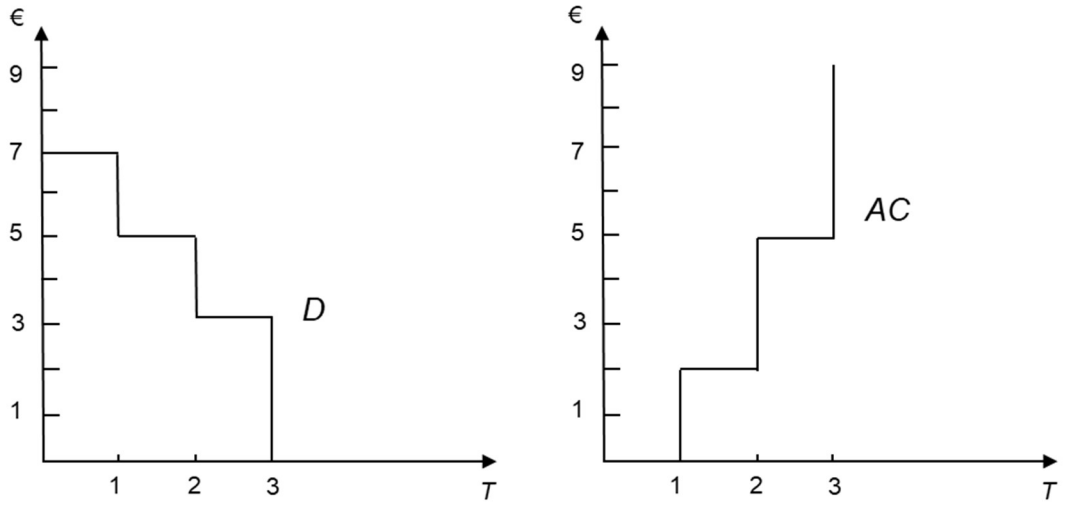
The average cost AC of using the freeway (i.e. the cost per car) as a function of traffic volume *T* is as follows:

T	AC
1	€2
2	€5
3	€9

Using this information, answer the following questions:

a) Draw the aggregate demand curve for freeway use and the average cost curve (AC).

Answer:



b) Find the equilibrium allocation of traffic between the freeway and the alternate routes.

Answer: The equilibrium allocation of traffic can be found from the intersection of the demand and AC curves. In equilibrium, commuters A and B take the freeway and commuter C takes the alternate route. Another way of saying this is that no commuter has an incentive to switch routes.

c) Compute the total commuting costs for all commuters for the following four traffic allocations. Which allocation of traffic is socially optimal and why? How does the cost at the optimum compare with the total cost at the equilibrium allocation?

On freeway	On alternate routes
No one	A, B and C
A	B and C
A and B	C
A, B and C	No one

Answer:

On freeway	On alternate routes	Total costs
0	7 + 5 + 3	15
2	5 + 3	10
5 + 5 = 10	3	13
9 + 9 + 9 = 27	0	27

The socially optimal allocation of traffic is the one that minimizes the total costs of commuting. In this case, the allocation is such that commuter A takes the freeway and commuters B and C take their alternate routes. The socially optimal allocation has lower costs the equilibrium allocation.

2. Roback model

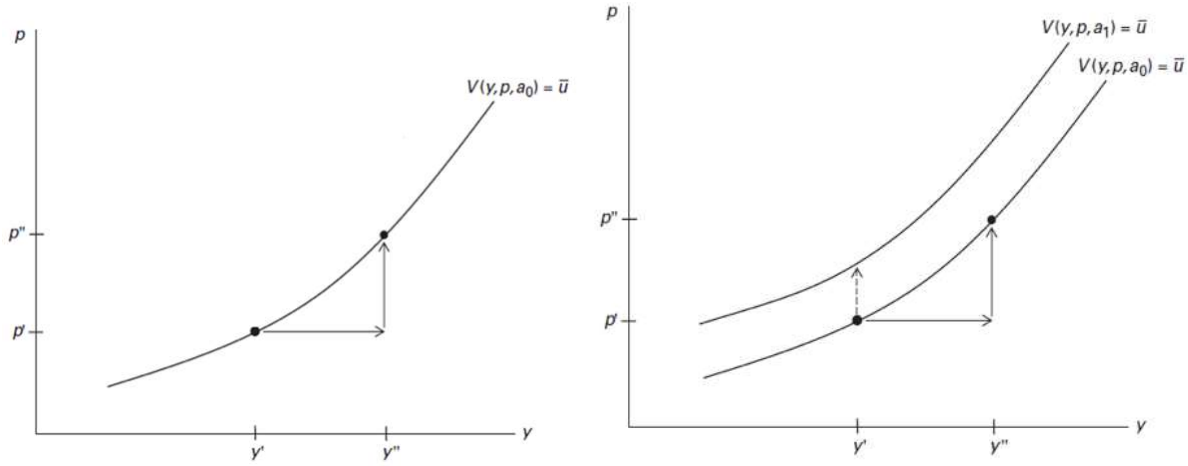
a) Explain briefly what spatial equilibrium means in the Roback model. What does it mean for households or workers and what does it mean for firms?

Answer: Workers: In equilibrium, workers are mobile so they must be as well off in all locations (in this case regions or cities). If not, workers would move to locations offering higher utility, bidding up housing prices or pushing down incomes until utilities are equalized everywhere.

Firms: Firms are also mobile, so in equilibrium, firms' profits must be the same in all regions. If not, firms could relocate to more profitable cities, which would increase factor prices (real estate, labor) in those cities until equilibrium is reached.

b) Draw the indifference curve for workers in the Roback model. Explain the shape of the curve. Then consider another city with a higher amenity level (amenity increases worker welfare). Where does the indifference curve lie with respect to the first indifference curve and why?

Answer:

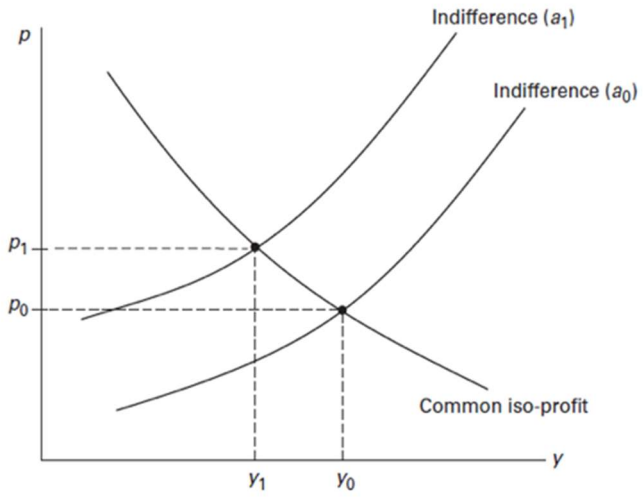


Consider the figure on the left and the point (p', y'). Suppose that income increases from y' to y''. This change would raise utility so a change in housing price is needed to keep utility constant. Since utility decreases with p, the required adjustment is upward so that p rises from p' to p''.

The case with two amenity levels ($a_1 > a_0$) is depicted in the figure on the right. Why does the indifference curve with higher a lie above the curve with lower a? Again starting from (p', y'), higher a leads to higher utility and adjustments in p and y are needed to cancel the gain. For example, if only housing price adjusts, housing price must increase to cancel the utility gain.

c) Using the Roback model, illustrate graphically how amenity differences across two cities are reflected in wages and housing costs. Explain the intuition behind your result. You can assume that the amenity has no effect on firms' costs.

Answer:



In the low amenity city, real-estate price and the income level are given by the intersection point of the a_0 indifference curve and the common iso-profit curve (remember that the amenity has no effect on firm costs, so that there is only one iso-profit curve). This intersection point (p_0, y_0) satisfies two requirements. When paying p_0 for real estate and earning y_0 in income, consumers enjoy utility level $\bar{u}$ since the point (p_0, y_0) lies on the a_0 indifference curve. Firms earn zero profit since the inter-section point lies on the iso-profit curve

In the high amenity city, real-estate price and income level are given by the intersection point of the a_1 indifference curve and the iso-profit curve. This point (p_1, y_1) lies uphill from the low-amenity intersection on the iso-profit curve. The high-amenity region has a higher real-estate price than the low-amenity region ($p_1 > p_0$) and a lower income level ($y_1 < y_0$).

When firm costs are independent of amenities, better amenities lead to higher real-estate prices and lower incomes. These adjustments are needed to keep utility the same in both cities.

3. Monocentric city model

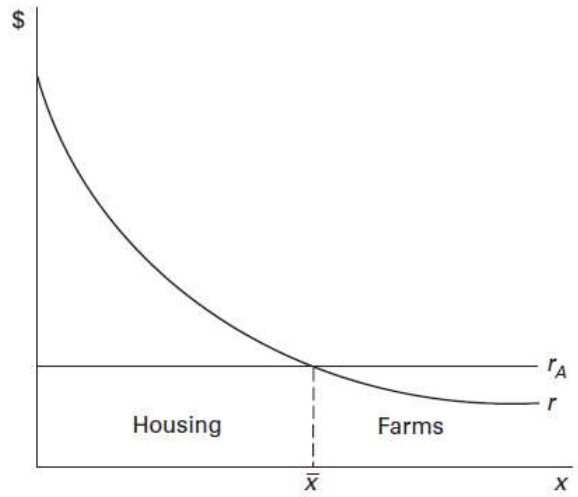
a) Explain briefly the locational or spatial equilibrium in the context of the monocentric city model. What does it mean for workers and what does it mean for housing developers?

Answer: In the monocentric city, all consumers of a given type are equally well off regardless of where they live in the city. In the simplest case, all the consumers are identical and they are equally well off anywhere in the city. Due to commuting costs, this equilibrium can hold only if price per housing per square meter falls as distance increases.

For housing developers, profits are equal everywhere in the city. If not, developers would not be willing to build housing everywhere. The spatial variation in land rent equates profits and makes developers willing to build housing throughout the city.

b) Explain how the edge of the city is determined in the model.

Answer: The city's land area is a result of competition between housing developers and farmers. Urban land rents for housing slope downwards (and are convex). At some distance from the city center, urban and agricultural land rents are equal. Beyond this point, farmers are able to outbid landlords for the land. Housing is build inside the intersection of the rent curves and land outside the intersection is in agricultural use, as depicted in the figure below.



c) Explain what happens to the edge of the city when the city's population increases. In what other aspects does the new larger city differ from the original smaller city?

Answer: Population increase leads to excess demand for housing. This leads to higher housing prices everywhere in the city so that people economize on dwelling size. Housing price increase makes building more profitable and developers compete for land driving up land rent at all locations. Higher cost of land leads to taller buildings as developers substitute capital for land in housing production. The city's edge expands as developers are able to outbid farmers farther away from the center. With taller buildings and smaller dwellings, population density increases at all locations. Population density has increases and city's land area has expands so that the new city can fit the larger population.

4. Hedonic model

a) Explain briefly the central idea of the hedonic model.

Answer: The idea behind the model is that housing is a multidimensional product traded in bundles and households value the many features of a house/dwelling, such as floor area, number of bedrooms, size of the yard, condition, structural quality, and accessibility and other locational characteristics.

The notion of implicit markets denotes the process of production, exchange, and consumption of commodities that are traded in "bundles". I.e. there is an implicit market for living space and neighborhood characteristics. The explicit market, with observed prices and transactions, is for the bundles themselves, i.e. houses/dwelling.

In a hedonic regression model, the goal is to estimate the relationship between prices and product attributes in a differentiated product market.

b) House prices and the hedonic model can be used to infer households' valuation of local public goods. Explain why this is the case.

Answer: Homebuyers implicitly purchase the right to consume a bundle of local public goods when they buy a house in a certain neighborhood. Thus, the hedonic price function can

be used to infer buyers' valuation for these local public goods by analyzing whether house prices are higher in areas with better local public goods.

c) You are interested in studying the value of a good school to homebuyers. Explain the inherent difficulties in estimating the causal effect of school quality to house prices. Also, give an example of a research design that would allow you to estimate the causal effect.

Answer: Often school choice is based on residential location. Sometimes this is an explicit rule where each housing unit is tied to a particular school through catchment areas. Sometimes pupil attainment is freer, but residential location is still an important element in school choice. If school quality varies, we might expect this to be reflected in house prices because good schools can be accessed through the housing market.

However, the housing market mechanism together with heterogeneous households leads to segregation based on overall neighborhood quality. This mechanism may lead to a correlation between housing prices and school quality, even if parents do not actually care about school quality making it difficult to estimate the causal effect.

One solution for this problem is to find areas where school quality varies, but neighborhood quality stays fixed. When access to local public goods is spatially bounded by catchment areas, there is a discrete change in space in the quality of the public good. In this case, a solution to this problem is to concentrate on houses at school catchment area boundaries. Houses near a boundary share the same overall neighborhood, but the children of the residents are assigned to different schools, i.e. neighborhood attributes stay fixed, but there is a difference in school quality.