

Urban Economics [31C02100, REC-E3500]

Final exam – model solutions

19 Feb, 2020

Instructions: Please answer all the questions in English. All questions have equal weight. You are not allowed to use any reference material, calculators, phones, computers or tablets during the exam. Please return the question sheet along with your answers.

1. Determine if the following claims are true or false. Justify each answer you give with at most three sentences.

- a) In the monocentric city model, a congestion charge has the same effect on city structure as an urban growth boundary.

Answer: FALSE. Both policies will decrease the spatial size of the city. Congestion charge densifies the city closer to CBD more than in other areas because it affects commuting costs. The urban growth boundary will densify the city throughout, but will not cause a clear population shift toward the CBD the same way as the congestion charge will.

- b) The economic burden of an increase in the land tax is borne by rental households.

Answer: FALSE. The land tax does not affect rental households' valuations for the housing so they are not willing to pay higher rents simply because the landowners pay higher taxes. The economic burden of an increase in the land tax is borne by landowners.

- c) The socially optimal freeway is congested.

Answer: TRUE. Expanding the freeway, by adding lanes, consumes resources while the benefit from expanding the freeway is the reduction in total commuting costs. At the optimum, the costs and benefits of expansion should be equal. This means that at the optimum, there must be a positive benefit from reducing congestion, i.e. there must be congestion.

- d) The monocentric city model is less successful in predicting the residential patterns of different income groups than it is in predicting price, density and building height patterns.

Answer: TRUE. When there are time costs present related to commuting, the model does not offer a clear prediction about the relative location of different income groups. The ambiguity arises from two opposing forces: the desire to rent their large dwellings at a low price per square meter pulls the rich toward the suburbs and the desire to limit their high time cost of commuting pulls them toward the center. Depending on the relative strengths of these forces, either location is possible for the rich (and the poor).

- e) The welfare loss from rent control due to misallocation is always smaller than the welfare loss due to undersupply of housing.

Answer: FALSE. The misallocation costs can be higher. The size of the misallocation cost depends on the way the rent-controlled units are allocated to the households. Misallocation cost are high when the units are allocated to households with low valuations.

- f) In the presence of positive externalities from building higher buildings, the *free market* equilibrium will be such that buildings are too low.

Answer: TRUE. This is because the private developer only considers her private benefits and does not take into account the positive spillovers from higher buildings to other parties.

2. 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 to the CBD increases.

For housing developers, profits are equal everywhere in the city. If not, developers would not be willing to build housing everywhere in the city. 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.

- 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.

3. 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

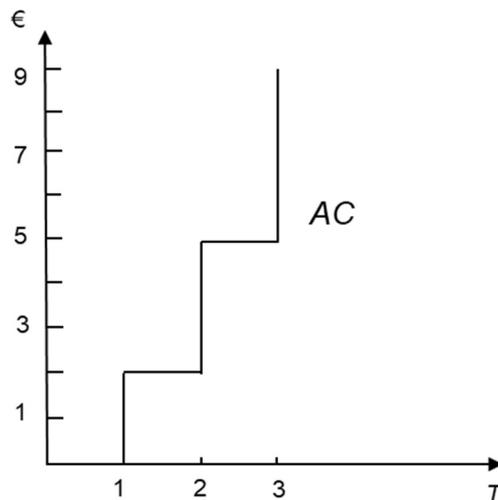
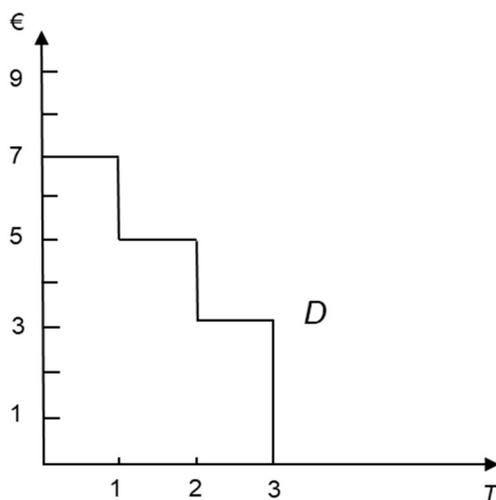
The average cost AC of using the freeway (i.e. the cost per car) as a function of traffic volume T is as follows:

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 than the equilibrium allocation.

4. Roback model

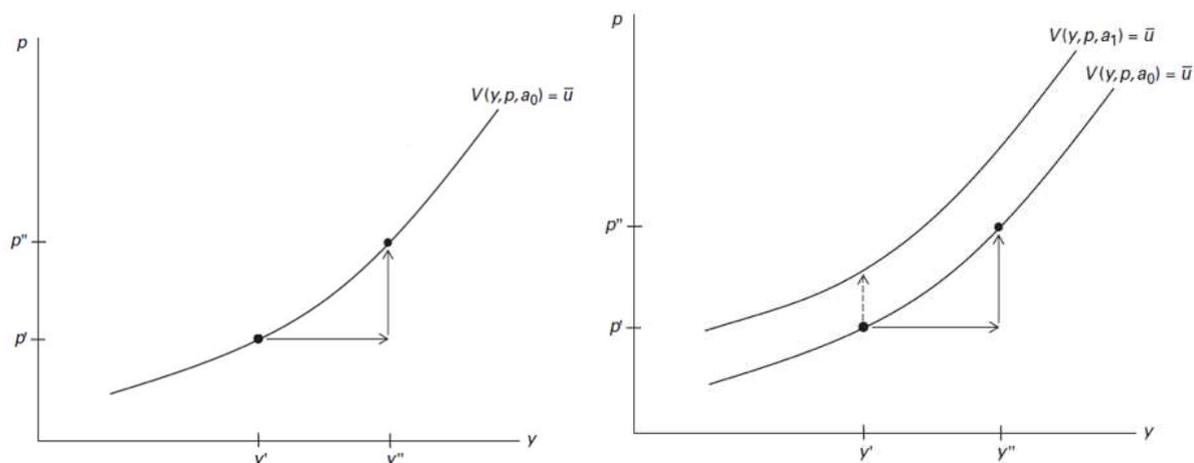
a) Explain briefly what spatial equilibrium means in the Roback model. What does it mean for households or workers and what does it mean for firms?

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:

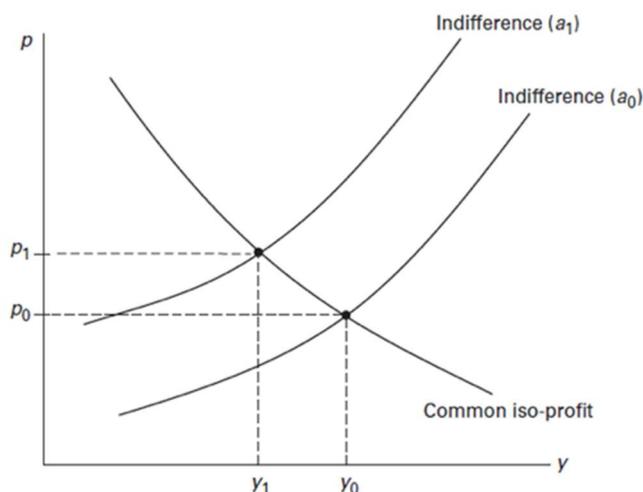


Consider the figure on the left and the point (p', y') . Suppose that income increases from y' to y'' . This change would raise utility so a change in housing price is needed to keep utility constant. Since utility decreases with p , the required adjustment is upward so that p rises from p' to p'' .

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 intersection 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.