

UNIVERSITY COLLEGE LONDON

EXAMINATION FOR INTERNAL STUDENTS

MODULE CODE : ECON3021

ASSESSMENT : ECON3021A
PATTERN

MODULE NAME : Urban Economics

DATE : 18 May 2016

TIME : 2:30 pm

TIME ALLOWED : 2 hours

This paper is suitable for candidates who attended classes for this module in the following academic year(s):

2015/16

SUMMER TERM 2016
ECON3021: URBAN ECONOMICS

TIME ALLOWANCE: 2 hours

Answer three questions from Part A and Answer two questions from Part B.

Questions in Part A carry 16 per cent of the total mark and questions in Part B carry 26 per cent of the total mark each.

In cases where a student answers more questions than requested by the examination rubric, the policy of the Economics Department is that the student's first set of answers up to the required number will be the ones that count (not the best answers). All remaining answers will be ignored.

PART A

Answer *three* questions from this section.

A.1 There are N identical consumers living in a circular city. Each consumer chooses a quantity of consumption goods c , quantity of land l , and a location in the city at distance x from the centre. A consumer earns income y from working at the city centre and pays travel costs t per unit of distance to commute. The price of consumption is p per unit and the price of land at distance x from the centre is $r(x)$ per unit. Consumers have utility given by the function $u(c, l)$. Land and consumption are normal goods. Rent at the boundary is fixed at r_A , but the boundary of the city x_B is determined in equilibrium. The city is in spatial equilibrium.

(i) Following a reduction in transport costs, t , how do the boundary of the city, rent and utility change in the new spatial equilibrium? Give a proof of your answer.

A.2 Suppose there are an odd number of citizens N and a set of feasible policies $\{p_1, \dots, p_M\}$ which are real numbers. We denote each citizen by i and let α_i represent the specific characteristics of citizen i . Citizen i 's indirect utility function over policies is

$$U(p; \alpha_i)$$

where p is the policy implemented. Denote by $p(\alpha_i)$ the unique preferred policy, 'bliss point', of citizen i from the set of feasible policies:

$$p(\alpha_i) = \arg \max_{p \in \{p_1, \dots, p_M\}} U(p; \alpha_i).$$

We assume voting takes place by majority rule.

- (i) Define formally single peaked preferences.
- (ii) State formally the median voter theorem.
- (iii) Prove the median voter theorem.

A.3 There are $2n + 1$ individuals in a city where each individual i is indexed by an integer from $-n$ to n . Each individual chooses to take either action 0 or action 1, where action 1 represents committing a crime. The utility of individual i depends on his own action, a_i , and the action of individual $i - 1$ (his neighbour) denoted a_{i-1} . Assume agents are arranged on a circle so that the utility of individual $i = -n$ depends on the action of agent $i = n$. There are three types of agent in this city $\tau \in \{0, 1, 2\}$. Denote by $U_\tau(a_i, a_{i-1})$ the utility of type τ . Each agent i is of type 0 with positive probability and type 1 with positive probability. The probability of being type 0, 1, or 2 is independent across agents. Type 0 maximizes his utility by choosing action 0 regardless of a_{i-1} and type 1 maximizes his utility by choosing action 1 regardless of a_{i-1} . Type 2 agents are socially influenced in their decision to commit a crime such that they are swayed by their neighbour's behaviour: the utility of a type 2 agent is maximized by imitating his neighbour, $i - 1$. The utility of a type two agent is as follows:

$$U_2(1, 1) > U_2(0, 1)$$

and

$$U_2(0, 0) > U_2(1, 0).$$

Each agent i observes the action of his neighbour $i - 1$.

- (i) Explain and show, using diagrams of cities, what this framework implies about the relationship between social influence and the variance in crime across cities.
- (ii) Describe briefly how you might model a similar situation, but where an individual's decision to commit a crime depends on not just one other person in the population but on multiple other people.

A.4 An individual considers buying a property costing V , paying savings of E towards the property, and borrowing a mortgage of $M = V - E$ to cover the rest of the cost of the property. He faces a nominal interest rate i for borrowing. He also faces a nominal interest rate i on his returns from investing money in an asset other than housing. If he buys the house he must pay property tax at rate T , operating costs at rate c , and earns nominal capital gains at rate g . Note that the nominal interest rate i is approximated by the sum of the real interest rate i^r and inflation rate π , so that $i \approx i^r + \pi$. Similarly the nominal capital gains rate g is approximated by the sum of the real capital gains rate g^r and inflation rate π , so that $g \approx g^r + \pi$. You can consider these approximations exact when answering the question. The income tax rate is t . Note that income tax is paid on any interest earned from investing money in an asset other than housing. Also mortgage interest payments are tax deductible.

- (i) Write down the expression for the user cost of buying the property when $t = 0$. Explain why inflation disappears in the expression for user cost. Explain intuitively what the user cost represents about the decision to buy.
- (ii) Derive the user cost when $t \neq 0$.
- (iii) How does a change in the tax rate t affect the user cost of buying? Give intuition for why it affects the user cost in this way. How does a change in the inflation rate π affect the user cost of buying? Give intuition for why it affects the user cost in this way.

PART B

Answer two questions from this section.

B.1 There are N consumers living in a circular city. Each household chooses a quantity of consumption goods c , quantity of land l , and a location in the city at distance x from the centre. Individuals are either high income or low income types. There are N_1 individuals who earn income y_1 from working at the city centre and N_2 individuals who earn income y_2 from working at the city centre, where $y_1 > y_2$ and $N_1 + N_2 = N$. Individuals are otherwise identical. Each individual pays travel costs t per unit of distance to commute to the city centre. The price of consumption is p per unit and the price of land at distance x from the centre is $r(x)$ per unit. Consumers have utility given by the function $u(c, l)$. Land and consumption are normal goods. The boundary of the city x_B is determined in equilibrium. Rent at the boundary is fixed at r_A .

- (i) Derive the bid rent function for type 1, denoted $b_1(x)$, when rent at the centre is fixed at $b_1(0)$ for type 1.
- (ii) Where will each type live in spatial equilibrium? Give intuition for your statement. There is no need to prove your statement.
- (iii) Solve for spatial equilibrium. In your answer you may use your previous answers to parts (i) and (ii).
- (iv) Suppose the population of the high income type increases from N_1 to N'_1 where $N_1 < N'_1$. The population of the low income type stays the same. How do the boundary of the city, the utility of the two types, and the rent function change in the new spatial equilibrium? Give a proof of your statements.

B.2 A consumer lives for two periods. In period 1 the consumer has assets a_1 . In period 1 he must either buy or rent one unit of housing. If the consumer rents he pays p_r for the unit of housing and if he buys he pays p_b for the unit of housing. In period 1 the consumer spends the remaining budget on some amount of consumption c_1 at price 1 per unit and some amount of savings s at price 1 per unit. In period 2 the consumer does not buy or rent housing, he spends all his period 2 assets on consumption at price 1 per unit. If the consumer bought a house in the first period he sells it in the second period. The price of housing in the second period sells for a high value of p_H with probability π_H , and with probability $1 - \pi_H$ it sells for a low value $p_L < p_H$. Thus the second period assets of the individual who purchased a house in period 1 are equal to the sale price of the house plus rs , where r is the gross return on savings s . The second period assets of renters are just equal to the return on savings from the first period, rs . Utility is

$$u(c_1, c_2^H, c_2^L) = \ln c_1 + \beta (\pi_H \ln c_2^H + (1 - \pi_H) \ln c_2^L),$$

where c_2^L is second period consumption in the low house price state and c_2^H is second period consumption in the high house price state.

- (i) State the first and second period budget constraints for a consumer who buys a house and also for a consumer who rents a house.
- (ii) State the consumer's maximization problem for a consumer who buys a house and also for a consumer who rents a house. Derive the first order condition for a consumer who buys and the first order condition for a consumer who rents.
- (iii) Explain how the different parameters of the model affect the decision to buy or to rent. Give intuition for your answers.

B.3 The population of a city is of mass 1 and forms a continuum of individuals with ideal points uniformly distributed over the interval $[0, 1]$. An individual's ideal point represents his ideal type of public good. The population votes in a two-stage process. First, they vote by majority rule over whether to form a single borough or split into two boroughs. The single borough is formed of everyone with ideal points $[0, 1]$. The two boroughs are composed respectively of those with ideal points $[0, 0.5]$ and $(0.5, 1]$. Second, the population of each borough votes by majority rule over what type of public good to provide in that borough. The public good chosen can be any point on $[0, 1]$. Each individual i 's utility function is of the form

$$U_i = g(1 - al_i) + y_i - t_i$$

where $g > 0$, $1 > a > 0$, l_i is the distance between i 's ideal point on $[0, 1]$ and the location of the public good in his borough on $[0, 1]$, $y_i = y > 0$ is i 's income and t_i is i 's taxes. Taxes have to cover the cost of the public good in the borough, which costs k . This cost is split equally between all those in the borough. There is complete information.

- (i) Under what conditions will the population choose to form a single borough and under what conditions will the population choose to split into two boroughs? Show and explain your workings out carefully.
- (ii) Explain the trade-off the population faces between forming a single borough or forming two. Explain intuitively how the parameters of the model affect the decision.
- (iii) Explain in words how and why the choice of a population to form a single borough or split into two might differ from the choice of a social planner who maximizes the sum of utilities in the population.