Public economics (Prof. Parisi, academic year 2023-24)

Exercises: natural monopoly, bureaucratic behaviour, Lindahl equilibrium.

1. Consider a market with the following inverse demand function: $p = 175 - q$. Technology has the following total cost function: TC $= 3q + 18$, where the marginal cost is constant: $MC = 3$ and the average cost equals $AC = 3 + 18/q$.
   a) Discuss whether the market is a natural monopoly. Hint: draw the MC and AC cost functions (calculate how the total cost decreases as the quantity increases…) and discuss the features of these curves. Refer to figure 8.1 in the textbook and the related discussion.

   Then, calculate:
   b) the (private) monopolist's quantity, price, and total profits;
   c) the socially efficient quantity and price (first-best solution);
   d) the loss corresponding to the first-best solution;
   e) the quantity and price that allows the firm to break even (second-best solution);
   f) the welfare loss resulting from the second-best solution.

   Results: (a) discussion in class; (b) q=86, p=89, profits=7378; (c) q=172, p=3; (d) loss=-18; (e) q=171,7 (we exclude the solution q=0,1), p=3,3; (f) welfare loss=0,02.

2. Consider a market with the following inverse demand function: $p = 10 - q$. Technology has the following total cost function: TC $= 10 + 2q$.
   a) Discuss whether the market is a natural monopoly;
   b) calculate the socially efficient quantity, the price, and the corresponding operating loss for the firm:
   c) calculate the price and the quantity that allows the firm to break even;
   d) calculate the welfare loss resulting from the second-best solution;
   e) illustrate the two equilibrium solutions graphically.

   Results: (b) q=8; p=2; loss=-10; (c) q=6,4; p=3,6; (d) WL=1,28.

3. Define natural monopoly. Draw the demand, marginal revenue, marginal cost (that can be assumed constant), and average cost curves for a natural monopoly.
   a) What are the problems arising when the government regulates a natural monopoly by limiting price to be equal to marginal cost?
   b) Suppose a natural monopoly was required to charge average total cost. On your diagram, label the price charged and the deadweight loss to society relative to marginal cost pricing.

   Results: discussion in class.

4. Assume a bureaucratic organization producing a service, in absence of competition, for which the inverse demand function is given by the following function: $p = 150 - q$. The average cost and the marginal cost are constant and equal 20. Basing on the model of Niskanen, calculate:
   a) the quantity and the price at which the organization sells the service;
   b) the elasticity of demand corresponding to the equilibrium quantity;
   c) total revenue and total cost obtained by the bureaucratic organization;
   d) discuss the rationale behind the behaviour of the bureaucratic organization.

Results: (a) p=75, q=75; (b) e=-1; (c) TR=5625, TC=1500; (d) discussion in class or refer to the textbook.

5. Consider a bureaucratic organization producing a service, in absence of competition, for which the inverse demand function is given by the following function: $p = 10 - q$. The total cost is given by the following function: $TC = 2q$. Calculate:
   a) the quantity, price, revenue, profits at which the organization sells the service if the organization acts as a private monopolist;
   b) the quantity, price, revenue, profits at which the organization sells the service if the organization acts as predicted by the model of Niskanen;
   c) represent both equilibrium points in a graph;
   d) describe the benefits that the bureaucrats running the organization can obtain from an increase in revenue (bureau size) and the likely cost for the society.

   Results: (a) q=4, p=6, TR=24, Profits=16; (b) q=5, p=5, TR=25, Profits=16; (c) and (d): discussion in class or refer to the textbook.

6. Consider again data of the previous exercise. We are going to interpret the results in a different way.
   a) Derive the total revenue graph and represent it graphically (report the quantity on the horizontal axis). Hint: total revenue is 0 when… and it is maximized when…
   b) Represent the quantity that maximizes total revenue and calculate the corresponding revenue.
   c) How can you interpret total revenue in line with the model of Niskanen?
   d) Is this outcome cost-efficient? You can answer this question by drawing the total cost function along with total revenue and representing also the efficient quantity (refer to the results previously obtained).

   Results: (b) q=5, TR=25; (d) no, the quantity that minimizes total cost is 4 where MR=MC. Discussion in class

7. In line with the model of Niskanen, define a rent-seeking behaviour of bureaucrats and compare it with a profit-seeking behaviour.

   Results: discussion in class.

8. Define the tax price and show how its formula can be derived in the case of:
   a) uniform taxation;
   b) proportional taxation.

   Results: discussion in class or refer to the textbook.

9. Consider two individuals, a rich one and a poor one. Represent graphically their optimal demand for public goods with proportional taxation under the assumption that:
   a) the income effect dominates the substitution effect;
   b) the substitution effect is higher than the income effect.
   c) How can you interpret the results?

Results: discussion in class or refer to the textbook.

10. Two individuals have the following demand curves for a public good G: $p_1 = 20 - G$, $p_2 = 30 - G$, where p_i. Supply of the public good is given by the following function: $p = 2G$. Derive the level of expenditure corresponding to the Lindahl equilibrium. How do you interpret the tax price paid by each individual?

Results: G=12,5. Discussion in class or refer to the textbook.