Written Exam for the B.Sc. in Economics 2009-II

Industrial Organization

Final Exam

May 29, 2009

(3-hour closed book exam)

Please note that the language used in your exam paper must correspond to the language of the title for which you registered during exam registration. I.e. if you registered for the English title of the course, you must write your exam paper in English. Likewise, if you registered for the Danish title of the course or if you registered for the English title which was followed by "eksamen på dansk" in brackets, you must write your exam paper in Danish.

If you are in doubt about which title you registered for, please see the print of your exam registration from the students' self-service system.

Attempt all three questions

Question 1

a) Consider a market in which there is a single (monopoly) firm. Let q denote the firm's output and p denote its price. Market demand is given by $p = a - q$, where a is a positive constant. The firm's marginal cost is constant and equals c (with $0 \le c < a$). There are no fixed costs. The firm's sales are subsidized by the government: if a firm sells q units, it receives the amount sq from the government, where s is the per-unit subsidy. The firm wants to maximize its profits, π, where

$$\pi = \text{revenues from sales} - \text{costs} + sq.$$

Suppose the firm's choice variable is its output, and solve for the optimal output, given some $s \ge 0$.

b) Now suppose that the subsidy s is chosen by the government, and that the government wants to maximize W, where

$$W = \text{consumer surplus} + \pi - sq$$

That is, the government first chooses s, subject to $s \ge 0$; then, after having observed s, the firm chooses q. Solve for the subgame perfect Nash equilibrium of this game.

c) Assume that $a = 11$ and $c = 1$. Solve the problem in part b) but with V instead of W, where

$$V = \text{consumer surplus} + z\pi - sq$$

and z is a constant satisfying $1/2 < z < 1$. Show that market price, given the optimal s, is decreasing in z; that is, the more the government cares about the firm's profit, the lower is the market price. What is the logic behind this result?

Question 2

a) Consider a market with two ex ante identical firms, Firm 1 and Firm 2. Both firms' marginal costs are constant and equal to eight, and there are no fixed costs. The firms simultaneously choose their price, p_1 and p_2, respectively. Firm 1's demand is given by

$$D_1\left(p_1, p_2\right) = \begin{cases} 0 & \text{if } p_1 > p_2, \\ 50 & \text{if } p_1 = p_2 \text{ and } p_1 \leq 10 \\ 100 & \text{otherwise,} \end{cases}$$

and symmetrically for Firm 2. The firms want to maximize their profits. Solve for the Nash equilibrium of this game.

b) Explain briefly what is meant by the "Bertrand paradox".

c) Three key assumptions of the Bertrand model are that (i) the game is played only once, (ii) the firms do not face any capacity constraints, and (iii) the product that the firms produce is homogeneous. Explain briefly, in words, how and why the result of the Bertrand model changes as we relax each one of the assumptions.

d) Explain briefly the conjectural-variations approach to modelling an oligopoly.

e) Explain briefly what is meant by "double marginalization".

f) Give a brief verbal account of Rotemberg and Saloner's theory of price wars. What are the main ingredients of their model, what is their result, and what is the intuition for the result?

Question 3

Consider a market in which there are two firms, Firm 1 and Firm 2. The firms produce identical products and they face the following indirect demand function: $p = 45 - 9(q_1 + q_2)$, where p is market price, q_1 is Firm 1's output, and q_2 is Firm 2's output. Both firms' marginal cost of producing the product is constant and equal to 9, and there are no fixed costs. Moreover, the firms compete in quantities. Firm i $(i = 1, 2)$ is owned by individual O_i and managed by some other individual M_i. Each owner O_i can give an instruction to his or her own manager M_i whether to try to maximize the firm's profits or its revenues. The sequence of events of the game is as follows:

1. O_1 and O_2 simultaneously choose whether to instruct its manager to maximize profits (P) or revenues (R).

2. M_1 and M_2 observe their own instruction and the other manager's instruction. Then they simultaneously choose the own firm's output, trying to maximize either the profits or the revenues (depending on the instruction they received).

The objective of each owner is to maximize the own firm's profits.

a) Solve for all subgame-perfect Nash equilibria of the game described above.

b) Interpret your results: what is the economic logic that explains why the owners make the choices they make in the equilibrium (or the equilibria) that you derived? Are the managers' choice variables strategic substitutes or strategic complements, and what is the significance of this? What is the significance of the assumption that each manager can observe also the other manager's instruction before making the output decision? *[You are encouraged to attempt part b) even if you have not been able to answer part a).]*

3