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

Advanced Industrial Organization

Final Exam

June, 2009

(4-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.

ALL QUESTIONS BELOW SHOULD BE ANSWERED

1. Explain the SSNIP test and discuss problems in implementing it in practice. Related to this discuss the Cellophane Fallacy

   See Motta Chap 3.2

2. Consider a beach that is 2 miles long. 2000 people are uniformly spread along the beach. At one end of the beach firm A is selling cold (i.e. refrigerated) bottles of water. At the other end of the beach firm B is selling lukewarm - non refrigerated - bottles of water. Everyone on the beach prefers cold to lukewarm water. Nobody, however, like to walk along the beach. The utility that individual i located in $x_i \in [0, 2]$ obtains from purchasing a bottle of water from firm A is

$$u_{i,A} = 10 - p_A - x_i$$

   while the utility he obtains from buying a bottle from B is

$$u_{i,B} = 8 - p_B - (2 - x_i)$$

   where p_A and p_B are the prices of firms A and B, respectively.

   Assume that there are no fixed costs and that marginal cost is equal to one for both firms. (A found the refrigerator in a dump, and has a cable connecting the refrigerator to the municipality's power outlet).

   (a) Suppose both firms choose prices. Find the Nash equilibrium
   The indifferent consumer is located in x_i fulfilling

$$10 - p_A - x_i = 8 - p_B - (2 - x_i)$$

   so

$$x_i = 2 + \frac{p_B - p_A}{2}$$

   Best reply

$$\max_{p_A} (\ p_A - 1) \left(2 + \frac{p_B - p_A}{2}\right)$$

   foc gives

$$p_A = \frac{1}{2} p_B + \frac{5}{2}$$

For B

$$\max_{p_B} \ (p_B - 1) \left(2 - \left(2 + \frac{p_B - p_A}{2}\right)\right)$$

$$p_B = \frac{1}{2} p_A + \frac{1}{2}$$

so equilibrium

$$\begin{aligned} p_A &= \frac{1}{2} p_B + \frac{5}{2} \\ p_B &= \frac{1}{2} p_A + \frac{1}{2} \end{aligned}$$

$$p_A = \frac{11}{3}, p_B = \frac{7}{3}$$

Indifferent consumer in equilibrium

$$x_i = 2 + \frac{p_B - p_A}{2} = 2 + \frac{\frac{7}{3} - \frac{11}{3}}{2} = \frac{4}{3}$$

(b) Calculate the Herfindal-Hirschman index in the Nash equilibrium
HHI index

$$\left(\frac{x_i}{2}\right)^2 + \left(\frac{2 - x_i}{2}\right)^2 = \left(\frac{\frac{4}{3}}{2}\right)^2 + \left(\frac{2 - \frac{4}{3}}{2}\right)^2 = \frac{5}{9}$$

(c) Firm B gets hold of a refrigerator, and it works for the rest of this exercise, so now Mr i's utility from buying from B is

$$u_{iB} = 10 - p_B - (2 - x_i)$$

For later comparison, find the Nash equilibrum and the associated profits.
Indifferent consumer

$$x_i = 1 + \frac{p_B - p_A}{2}$$

Price $p_A = p_B = p = 3$. Profit 2

(d) Now suppose that firm A employs a kid, who is instructed to give a coupon to all the people in the other half of the beach. I.e. firm A instructs the kid to give coupons to all beach guests $x_i \in [1,2]$. The coupon says that a guest when presenting the coupon to firm A will get a rebate, so the coupon holder pays $\hat{p}_A$. Similarly, B employs a kid givining out similar coupons to guests $x_i \in [0,1]$.

Find the equilibrium where firms use coupons to price discriminate between costumers lying close and those lying far away.

Indifferent consumer on $A's$ turf

$$x_i = 1 + \frac{\hat{p}_B - p_A}{2}$$

$A's$ best reply

$$\max_{p_A} \ (p_A - 1)\left(1 + \frac{\hat{p}_B - p_A}{2}\right)$$

$$p_A = \frac{1}{2}\hat{p}_B + \frac{3}{2}$$

$B's$ best reply (rember the length of $A's$ turf is one, not two!)

$$\max_{\hat{p}_B} \ (\hat{p}_B - 1)\left(1 - \left(1 + \frac{\hat{p}_B - p_A}{2}\right)\right)$$

$$p_B = \frac{1}{2}p_A + \frac{1}{2}$$

so eq

$$\begin{aligned} p_A &= \frac{1}{2}\hat{p}_B + \frac{3}{2} \\ \hat{p}_B &= \frac{1}{2}p_A + \frac{1}{2} \end{aligned}$$

$$p_A = \frac{7}{3}, \hat{p}_B = \frac{5}{3}$$

By symmetry

$$p_A = p_B = \frac{7}{3}; \hat{p}_A = \hat{p}_B = \frac{5}{3}$$

(e) Is the equilibrium you found in d. efficient?

No. The consumers close to the middle does not buy from the closest store. On $A's$ turf the consumer located in x_i fulfilling

(f)

$$10 - p_A - x_i = 10 - \hat{p}_B - (2 - x_i)$$

is indifferent, i.e. x_i fulfills

$$10 - \frac{7}{3} - x_i = 10 - \frac{5}{3} - (2 - x_i)$$

$$x_i = \frac{2}{3}$$

Consumers in $[2/3, 1]$ buys from B although they are closer to A and consumers in [1,1 1/3] buys from A although B is closer. So equilibrium not efficient.

Compare also the profits in the equilibrium with the profits the firms get when they cannot price discriminate using coupons (i.e. those of subquestion c). Is price discrimination good or bad for the firms?

$\pi_A = 2/3* \frac{7}{3} + 1/3 * 5/3 - 1 = \frac{10}{9} < 2$, so profits lower than if firms cannot price discrimnate

If it is bad, why do they not abandon it?

The firms are in a prisoner's dilemma situation. If one firm does not price discriminate, the other firm gains by discriminating. In the non-cooperative eq they both discriminate even though it hurts both their profits.

(g) Give a verbal explanation of what happens if the firms are able to give out many different kinds of coupons and thus distinguish more closely where the guests are located on the beach.

There will be a price per type of coupon and profits will be even more hurt.

In the limit, when there is a coupon type per guest, what is the result?

Each guest will be her own market, where there will be Bertand competition. It will be like Betrand competition with different marginal costs. The middle guest will get the good at marginal cost. In the interval [0,1] consumer x is indifferent between A and B if

$$p_A^{x_i} + x_i = p_B^{x_i} + (2 - x_i)$$

the lowest price B can offer while not loosing money is $p_B^{x_i} = 1$, hence if A offers

$$p_A^{x_i} = 3 - 2x_i$$

the consumer is indifferent (adn if A offersε less , the consumer strictly prefer A). In equilibrium, therefore

$$p_A^{x_i} = \begin{cases} 3 - 2x_i & \text{if} \quad 0 \leq x_i \leq 1 \\ 1 & \text{if} \quad 1 \leq x_i \leq 2 \end{cases}$$

$$p_B^{x_i} = \begin{cases} 1 & \text{if} \quad 0 \leq x_i \leq 1 \\ -1 + 2x_i & \text{if} \quad 1 \leq x_i \leq 2 \end{cases}$$

(h) Back to only one kind of coupons. Suppose that guests in the beach freely and costless can exchange coupons. Discuss (no math needed this time) what you believe will be the result for the Nash equilibrium among the firms.

Consumers will exchange coupons so that all consumers to the left will get A coupons and those to the right will get B coupons. Coupons will therefore be worthless for the firms as a price discrimination devise. The Nash equilibrium will therefore be as the equilibrium without coupons.

3. Consider a firm U selling to two retailers D_1 and D_2. The retailers sell to a market where the inverse demand is given by $p(q_1 + q_2)$, where $p\prime < 0$ and q_1 and q_2 are the quantities D_1 and D_2 sell to the market, respectively. First firm U makes a take it or leave it offer to each of the retailers consisting of a contract with each of the retailers q_i, $T_i(q_i)$. The contract is made such that either the retailer accepts to buy q_i units at a total cost $T_i(q_i)$, or he buys nothing. In equilibrium he buys q_i at $T_i(q_i)$.

   Assume that the retailers *cannot observe* the contract offered to the other retailer and that they have *passive conjectures* concerning the contract offered to the other retailer. I.e. retailer i takes as given the take or leave it contract q_j, $T_j(q_j)$ that he believes (correctly in equilibrium) is offered to retailer j.

(a) Find the (Perfect Bayesian) equilibrium contracts and the quantities sold in the market

$i's$ conjecture about what j is offered is $q_j^e, T_j^e(.)$. With passive conjectures, this does not depend on what i is offered himself.

D_i takes as given q_j^e, when offered a contract by U. D_i is therefore willing to pay up to p$P(q+q_j)\,q$ for any given quantity q

U maximizes joint profit and makes take it or leave it offer , q_i ,$T_i(q_i)$ where

$$q_i = \arg\max_q \left(p(q+q_j) - c\right) q \rightarrow q_i = R^C(q_j)$$

where $R^C(q_j)$ is the best response of i to q_j and

$$T_i(q_i) = \left(P(q_i+q_j) - c\right) q_i$$

Same wrt q_j so in equilibrium, it is going to be as if the two retailers are in Cournot competition

$$\begin{aligned}
q_i &= q_j = q^C = R^C\left(q^C\right) \\
p_1 &= p_2 = p^C \\
\pi_U &= \left(p^C - c\right) 2q^C = 2\pi^C \\
\pi_{D_1} &= \pi_{D_2} = 0
\end{aligned}$$

(b) Suppose that U can make the contract offers observable and can commit to the publicly observed contracts. Find the equilibrium contract (s) in this case.

Both tariffs offered by U can be observed by D_1 and D_2.

Then U can extract all monopoly profit For instance by offering

$$T_i(q_i) = \begin{cases} p^m Q^m/2 & \text{if } q_i = Q^m/2 \\ \infty & \text{if } q_i \neq Q^m/2 \end{cases}$$

Then outcome is

$$(q_i, T_i(q_i)) = (Q^m/2, p^m Q^m/2)$$

Monopolist reaps all profit

(c) Explain why foreclosure is advantageous in the case where contracts are unobservable and conjectures are passive.

We see from a, that when contracts are unobservable and conjectures passive, the equilibrium resembles the Cournot equilibirum where total profit $2\pi^c < \pi^m$, i.e. total profit is less than the monopoly profit. But forclosing one of the firms, the upstream can make the remaining retailer accept a contract where he buys the monopoly amount at the monopoly profit. This is better for the upstream firm and worse for consumers.

4. A competition authority learns that a firm, which is dominant in its market, employs the following rebate scheme, which determines the rebate depending on how much the costumer firm buys in a calendar year. The rebate is given on the whole purchase. I.e. if for instance, the firms purchase is 477.000 kr, the rebate is 10% of the 477.000 kr = 47.700 kr

Purchase in kr	Rebate %
0-100.000	0
100.001-200.000	2
200.001-300.000	4
300.001-400.000	6
400.001-500.000	10
500.001-600.000	15
600.001-	20

Does such a scheme violate article 82, "abuse of dominant position", (corresponding to §11 in the Danish competition law). The answer should include the argument for why it does (if that is what you think) or does not (if that is what you think).

Answer is yes, as in the SMC case covered in class. The rebate is progressive and retroactive, therefore it creates loyalty. A domintant firm is not allowed to use such schemes.