Written Exam for the B.Sc. in Economics summer 2012

Industrial Organization

Final Exam

June 11, 2012

(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 both questions. Make sure that you explain all the steps of your analysis and that you define any new notation that you use.

Question 1

This is a model of "double-marginalization". It is identical to one that we studied in the course.

Consider two vertically related monopoly firms. The upstream firm produces its good using a constant-returns-to-scale technology with marginal cost given by $c \in [0, 1)$. It chooses a linear wholesale price, denoted p_w. The downstream firm is a retailer and sells the good that the upstream firm produces to the final consumers. The demand of the final consumers is given by $Q(p) = 1 - p$, where p is the price chosen by the downstream firm. This firm is assumed not to have any additional costs on top of the costs of buying the good from the upstream firm at the wholesale price p_w. The sequence of events is as follows. First the upstream firm chooses p_w; thereafter, knowing p_w, the downstream firm chooses p.

a) Solve the model. Also solve the version of the model where the two firms have merged and therefore make their decisions with the objective of maximizing the joint profits. Compare the prices the final consumers must pay under integration and under non-integration. Would the consumers benefit from the merger?

b) Specify a two-part tariff that — if this is charged by the upstream firm instead of the linear price — gives rise to the same consumer price and joint-profit level as under integration.

c) Suppose we believed that the results under a) and b) were robust to modifications of the model and that the model was relevant to real world markets — so that we dared to take the results seriously. What are the policy implications of the results under a) and b)? Discuss.

Question 2

This is a model of behavioral-based price discrimination. It is related to the one we studied in the course, but there are also some important differences.

A rough, verbal description of the model

On a street in a town there is a monopoly hot-dog salesman. This salesman faces two groups of potential customers: those who smoke and those who do not smoke. Smokers tend to have a higher valuation for hot-dogs than non-smokers. Therefore, if the salesman knows that a particular customer is a smoker, then he may have an incentive to charge this customer a higher price. However, the only way in which the salesman can learn whether a customer is a smoker is if he observes that customer smoking. Moreover, a potential customer who belongs to the group of smokers can *decide* whether or not to light up a cigarette. The customer understands that if she indeed lights up, she will have to pay a higher price for a hot-dog; on the other hand, smoking yields some utility, which might make it worthwhile to pay the higher price.

Formal description of the model

The fraction of "smokers" (i.e., those who regularly smoke but who may, or may not, light up a cigarette when meeting the hot-dog salesman) is denoted by γ; the fraction of "non-smokers" therefore equals $1-\gamma$. The fraction of the smokers who decide to light up a cigarette, which is an endogenous variable, is denoted by λ.

Non-smokers are characterized by the single number $x \in [0,1]$, which is a parameter that determines the non-smoker's reservation price for a hot-dog: $r_n = x$. Smokers are characterized by the two numbers (x,b), where $b \in [0,1]$ is the smoker's benefit from smoking and $x \in [0,1]$ is a parameter that determines her reservation price for a hot-dog: $r_s = 2x$. The exact way in which the values of x and b determine the choices are specified below, after the timing of events.

It is assumed that the distribution of (x,b) is *uniform* on the unit square $[0,1]^2$. Moreover, the mass of all consumers equals one.[1] The monopoly salesman has constant marginal cost that is equal to zero. There is no discounting.

The timing of the game is as follows.

(i) Smokers learn their value of b, but do not yet know their x value. They then decide whether or not to light up a cigarette.

(ii) The monopoly salesman faces one individual (potential) customer. He cannot observe that customer's value of x and b, or whether the customer is a smoker or not. The salesman observes only whether the customer have lit up a cigarette or not. He then chooses a price, which is denoted by p_s if the customer smoked and by p_n if the customer did not smoke.

(iii) Smokers and non-smokers learn their x. They then decide whether or not to buy a hot-dog. The price non-smokers are charged is p_n. The price that smokers are charged is p_s if they have lit up a cigarette and p_n otherwise.

At stage (iii), if a smoker is charged the price p (where $p = p_s$ or $p = p_n$) for a hot-dog, she buys a hot-dog if and only if $r_s \geq p$. At stage (i), if a smoker expects to be charged the price p_s if lighting up a cigarette and the price p_n if not doing that, then she chooses to light up a cigarette if and only if[2]

$$b + \int_{p_s^*/2}^{1} (2x - p_s)\, dx \geq 0 + \int_{p_n^*/2}^{1} (2x - p_n)\, dx.$$

Similarly, at stage (iii), if a non-smoker is charged the price p_n for a hot-dog, she buys a hot-dog if and only if $r_n \geq p_n$.

[1] That is, if we denote by $f(x,b)$ the mass of smokers with parameters x and b, then we assume that $f(x,r) = \gamma$ for all $(x,b) \in [0,1]^2$ and $f(x,b) = 0$ for all $(x,r) \notin [0,1]^2$. Similarly, if we denote by $g(x)$ the mass of non-smokers with parameter x, then we assume that $g(x) = 1-\gamma$ for all $x \in [0,1]$ and $g(x) = 0$ for all $x \notin [0,1]$. These assumptions imply that the mass of all customers equals unity: $\int_0^1 \int_0^1 f(x,b)\, dxdb + \int_0^1 g(x)\, dx = 1$.

[2] To understand this expression, remember that a smoker has not yet learned her value of x at the point in time when she decides whether to light up a cigarette.

Questions

a) Consider stage (ii) of the game and suppose that the salesman believes that a fraction $\widehat{\lambda} \in (0,1)$ of the smokers have lit up a cigarette. Show that the prices p_s and p_n that maximize the salesman's expected profits are given by

$$p_s = 1 \qquad \text{and} \qquad p_n = \frac{1-\gamma\widehat{\lambda}}{2-\gamma\left(1+\widehat{\lambda}\right)}.$$

b) Explain in words how you would derive (or characterize) λ^*, where λ^* is the fraction of smokers who decide to light up a cigarette in an equilibrium of the overall game.

[You should answer the b) question only in terms of a verbal reasoning. Formal calculations will not be given any credit and must not be part of the answer.]

c) The consumer surplus, given λ^* and the equilibrium prices p_s^* and p_n^*, equals

$$S = \underbrace{\gamma \int_{1-\lambda^*}^{1} b db}_{\text{Term 1}} + \underbrace{\gamma\lambda^* \int_{p_s^*/2}^{1} (2x - p_s^*)\, dx}_{\text{Term 2}} + \underbrace{\gamma\,(1-\lambda^*) \int_{p_n^*/2}^{1} (2x - p_n^*)\, dx}_{\text{Term 3}}$$
$$\underbrace{+(1-\gamma) \int_{p_n^*}^{1} (x - p_n^*)\, dx.}_{\text{Term 4}}$$

Explain these four terms in words — what is the source of the surplus that each term represents and why does the term look the way it does?

[You should answer the c) question only in terms of a verbal reasoning. Formal calculations will not be given any credit and must not be part of the answer.]

d) Suppose a law was introduced that forced the salesman to charge the same price to all customers. Which (potential) customers would benefit from such a law and which would be hurt by it? Discuss.

[You should answer the d) question only in terms of a verbal reasoning. Formal calculations will not be given any credit and must not be part of the answer.]

END OF EXAM