Written Exam for the B.Sc. in Economics autumn 2011-2012

Microeconomics B

Final Exam

20. January 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.

Question 1
Consider a monopoly with the cost function and demand curve:

$$C(q) = 200 + 10q + 3q^2$$
$$p\ (q) = 100 - 6q$$

a) Solve the profit maximization problem for the monopolist.
b) The government proposes a regulation that requires the firm to set its price equal to the marginal costs ($p = MC$)

1) What does this imply for the price and quantity produced? Find the new price and quantity
2) How can the government subsidise the monopoly such that it does not suffer a loss and terminates production

c) The government cannot find a majority for the proposal in b) and in a secret working group a civil servant suggests giving a subsidy to production (per unit produced) in combination with a lump-sum tax.

1) What should the size of the subsidy be to ensure that price and quantity produced corresponds to the case of perfect competition?
2) What lump-sum tax should be imposed on the monopolist to ensure that the profit corresponds to a perfect competition case?

d) Which of the two programs in b) and c) is the most expensive for the government? Explain why this is the case.

Answers

a) *q=5, p(5)=70, profit=25*
b) *MC=10+6q, p=MC gives q=7½ and p=55. The profit is -31 ¼. A subsidy could thus be a lump-sum subsidy of 31 ¼.*
c) *This changes the cost function by adding s*q to the cost. Solving the firm's problem tells us that q=5+s/18. The production in perfect competition is found in b) to be equal to 7½. Hence the subsidy s=45 per unit produced. The profit without the lump-sum tax is thus 337½. The profit in perfect competition (without the subsidy mentioned in b) is -200_; hence a lump-sum tax of 537½ is required. If we include the subsidy in b), we only need to have a tax of 337½.*
d) *The net revenue for the government in b) is -31 ¼ , in c) it is -45*7,5+337½ = 0. Hence, the program under b) is the most expensive. This is because the subsidy in c) induces a behavioral change, which allows the monopoly to exploit its influence on the market price. This is hindered in b)*

Question 2
Consider an island in the Pacific Ocean, where different types of bikes are sold. The consumers cannot really tell the quality of the different bikes apart, but are capable of distinguishing them into two general types: Carbon bikes (C-bikes) and Aluminum bikes (A-bikes). The willingness to pay for A-bikes is 600 Euro and for C-bikes it is 1500 Euro. The sellers of these bikes are willing to sell them for 500 Euro (A-bikes) and 1200 (C-bikes).
Assume that the consumers are risk neutral and that they assume that a share of q is C-bikes. The producers cannot change the supply of the two types of bikes (since they are on a deserted island in the middle of the Pacific).

a) What is the maximal price the consumers will pay for a bike in this market?
b) What must be required from q in order for both types of bikes to be traded in the market? What is the consequence if this is not satisfied.
c) It has been discovered that the consumers of bikes are willing to pay 300 Euro more for a bike having a relatively longer guarantee on the frame. This means that you can assume that the consumers will want to get as long a guarantee as possible. The sellers of C-bikes can therefore issue a guarantee on their bikes, since they only have additional costs related to the guarantee of $C_C(y)=25y$, while sellers of A-bikes will have costs of $C_A(y)=50y$ where y is the number of years a guarantee is offered. What is the required number of years that must be offered on C-bikes such that the sellers of C-bikes can have a higher profit compared to the existing market? Is it possible that a seller of good bikes can get a higher profit compared to the existing market? How?

Answers:

a) $(1-q)*600+q*1500$
b) *That the expected value to the buyer is larger than the value for the seller of C-bikes. I.e. that $600+900q>1200$ giving that $q>2/3$. If this is not satisfied we have a case of adverse selection where only bad bikes are sold. This is so, because sellers of good bikes will not supply bikes to the market and the expected value of bikes for the buyer is equal to 600.*
c) *This is a case of signaling, where the sellers of C-bikes wish to reveal that their bike is worth more than the average bike in the market. Since sellers of good bikes can provide a guarantee where $C_C(y)=300$ giving $y=12$. In comparison, the sellers of A-bikes can only offer a guarantee of 6 years. Hence, by offering a guarantee of only 6 years the C-bike seller can signal that his bikes are C-bikes and thus receive the additional 300, but at a cost of only 150. Hence the profit per bike increases from 0 to 150.*

Question 3

Comment on the following statement:
It can be a good idea to reduce the quality in the economy class for an airline company in order to increase the profit.

Answer:
The statement makes sense in a case of price discrimination of degree 2. The argument is based on the airline to offer two levels of quality (economy and business class), where the price for the two in the point of departure is such that we have a two part tariff where p=MC and an additional fixed charge equal to the Consumer's surplus derived from tourist class tickets aimed at e.g. low income buyers. The airline company has to set the price (or the fixed part of the two part tariff) for the business class tickets low enough such that it is not beneficial for the business class type of customers to buy tourist class tickets. However, the airline can increase its profits by reducing quality in the tourist class tickets and thus make it less attractive for business class customers to choose this option. When this is the case, it can actually increase the price on the business class tickets without risking that these customers choose tourist class tickets.

Question 4

Consider a Robinson Crusoe (Koopmans) economy with one consumer having a utility function $u(n; c; x) = h(\underline{n} - n; c) - x$, over n labor time, c a consumer good, and x smoke, which he takes a given when he makes his choice.

We also have a firm with a production function *f(l) = y* that transforms labor input to the consumer good, *y*. The firm also produces smoke, *z=y* as a by-product.
The consumer is the only owner of the firm and receives all profits from the firm.

a) Give an expression for the Walrasian equilibrium in this economy and comment on the equilibrium expression.
b) Find an expression for the Pareto optimal allocation in this economy? Explain why the Walrasian equilibrium is not Pareto optimal?
c) Let n^{PO} be the solution that satisfies the Pareto optimality condition you found in b). Prove that the level of the externality in Pareto optimum is smaller than in the Walrasian equilibrium. (Hint: assume that $x^{PO} \geq x^{WE}$ and then try to prove that this leads to a contradiction)
d) Show that a tax on smoke equal to $\tau = \dfrac{p}{\partial h(\bar{n} - n^{PO}, c^{PO})/\partial c}$ will result in the Pareto optimal level of smoke and explain what the tax level corresponds to. Remember that in a model like this we must also spend the revenue. Hence, the revenue from the tax is given to the consumer as a lump-sum subsidy (*Hint: does this change the first order condtions for the consumer?)*. Comment this result briefly.

Answers:

a) *He firm maximises profits max π=py-wl, s.t. z=y=f(l); the consumer maximizes utility given the budget pc= π+wn taking profit and smoke for given. The markets clear when l=n and c=y. The firms therefore sets pf'(l)=w and the consumers foc. Is*
$\dfrac{w}{p} = \dfrac{\partial h/\partial t}{\partial h/\partial c} = \dfrac{\partial h(\bar{n} - n, c)/\partial t}{\partial h(\bar{n} - n, c)/\partial c}$ and thus we get $f'(n^{WL}) = \dfrac{\partial h(\bar{n} - n^{WL}, c^{WL})/\partial t}{\partial h(\bar{n} - n^{WL}, c^{WL})/\partial c}$ as the WE condition. There will be some pollution in the WE.

b) *Since we only have one consumer we only need to consider* $\begin{aligned} &\max_{n,c,x} u(n,c,x) = h(\bar{n} - n, c) - x \\ &st.\ x = c = f(n) \end{aligned}$
to find the PO and by inserting *x=c* and *c=f(n) we can find* $\dfrac{\partial f}{\partial n} = \dfrac{\partial h(\bar{n} - n, c)/\partial t}{\partial h(\bar{n} - n, c)/\partial c - 1}$ *as the PO condition. It is different from the WE since we now take into account the impact on consumer utility when we find the optimal level of pollution.*

c) *Assume that x^{WE}<=x^{PO} The associated WE allocation satisfies the WE condition and thus not the PO condition. Hence, it is not optimal (u^{PO}>u^{WE}). If x^{WE}<=x^{PO} then we know that*
$$\begin{aligned} &h(\bar{n} - n^{PO}, c^{PO}) - x^{WE} > h(\bar{n} - n^{PO}, c^{PO}) - x^{PO} > h(\bar{n} - n^{WE}, c^{WE}) - x^{WE} \\ &\Rightarrow h(\bar{n} - n^{PO}, c^{PO}) > h(\bar{n} - n^{WE}, c^{WE}) \end{aligned}$$
BUT this conflicts with the WE being a maximum for h, which is simultaneously equal to the PO allocation (due to the 1. welfare theorem).

d) *This is a Pigou tax. Set it equal to τ, which then changes the profit max problem to $\pi = p\cdot y - w\cdot l - \tau\cdot z$. The foc. For this is $f'(l) = w/(p - \tau)$. Since the consumer's f.o.c. is not changed we just consider the firm f.o.c with the proposed tax.When you insert this you find that the optimality condition is now the same as for the PO condition in b). The tax internalizes the externality and ensures that the firm takes it into account in its profit max.*

Question 5

Why is it that we do not leave it to the market to provide public goods and what are the (theoretical) possibilities for a regulator to interfere with the market to deal with the provision of public good?

Answer:
Since we cannot restrict others from consuming our contribution to a public good and since we can ourselves freely consume the provision of public goods made by others, then this give the individual an incentive to free ride and under-contributer to the public goods and we will generally get an inefficient level of public goods. The regulator can set up a mechanism like the Clarke-Groves mechanism that can ensure an efficient level of the public good. The government could also try to set Lindahl prices, which ensures that individuals demand the same (efficient) level of the public good.

Question 6
True or False:
If a monopoly exercises price discrimination of degree 3, the mark-up over marginal costs will be higher for those groups with a higher (numerically) demand elasticity (with respect to the price). We assume that demand is differentiable and declining in price.

The argument is false. It is the groups that are less responding (smaller elasticity) with respect to price that face the higher mark-up. With two groups the profit fct is $\max_{y_1,y_2} p_1(y_1)y_1 + p_2(y_2)y_2 - c(y_1 + y_2)$ and the f.oc.

$$p_1(y_1)\left[1-\frac{1}{\left|\varepsilon_{y_1,p_1}(y_1)\right|}\right] = c'(y_1+y_2)$$

$$p_2(y_2)\left[1-\frac{1}{\left|\varepsilon_{y_2,p_2}(y_2)\right|}\right] = c'(y_1+y_2)$$

hence we see that $p_1 > p_2 \Leftrightarrow \left|\varepsilon_{y_1,p_1}(y_1)\right| < \left|\varepsilon_{y_2,p_2}(y_2)\right|$