

# **Final exam - Economics of regulation**

**Winter semester 2010/2011**

**Prof. Dr. Georg Götz**

Date: 9th April 2011

Time: 12:00-13:30

## **1. General information:**

- a. Make sure that your final exam is complete. The final exam consists of 4 problems.
- b. Only use the provided sheet of paper. Write your matriculation number immediately and clearly on each page!
- c. Please do not remove the staples from the provided sheet of paper.
- d. Allowed items at your workplace: Student ID, writing utensils (no red pen, no ink eraser, no pencil case), ruler, set square, non programmable calculator, food and drinks.
- e. Use a permanent pen (no pencil).
- f. Mobile phones have to be turned off and removed from your place!

## **2. Hints about doing the exam:**

- a. Read each task carefully and consider the distribution of points. The tasks could be extended over several pages.
- b. Please work on all tasks and state each on a new page. Please write your answers in a readable way.
- c. You may write your answers in English or in German.
- d. Label the axes of your illustrations.
- e. Each point equals approximately 1 minute of working time (rough guideline).
- f. The final exam lasts 90 minutes!

**We wish you every success!**



# 1 Rate-of-return regulation and Averch-Johnson-effect [18]

Consider a public utility, which supplies water and is subject to a rate of return regulation. The production technology is characterized by

$$Y = K^{3/4}L^{1/4}.$$

Output  $Y$  denotes the delivered and purified water in  $\text{m}^3$ . The capital stock  $K$  is 976 and the number of employees  $L$  is 61. The cost of capital is given by 12 % ( $r = 0.12$ ). The costs per employee are 0.36 per year ( $w = 0.36$ ).

(Round your answers to four decimal places.)

- a) What quantity does the public utility provide and what are the resulting costs?
- b) Does this information support the existence of an Averch-Johnson-Effect? If so:
  - i. What is the optimal, i.e. the cost minimizing, stock of capital and number of employees given the output calculated in (a)?
  - ii. What cost savings can be attained if the firm moves to efficient production?

# 2 Asymmetric information [34]

Suppose that the demand function is  $q = 100 - p$  and common knowledge. The firm's rent has a weight of  $\alpha = 0$  in the social welfare function. The firm's marginal costs  $c$  are not known to the regulator. However, the regulator knows that they are either  $c_L = 20$  with probability  $\phi = \frac{3}{5}$  or  $c_H = 30$  with probability  $(1 - \phi) = \frac{2}{5}$ . The known fixed costs of the firm are  $f = 400$ .

- a) Determine the optimal menu of regulatory contracts (i.e.  $p_L$ ,  $p_H$ ,  $T_L$ , and  $T_H$ ). Explain which constraints have to be satisfied to ensure truthful revelation. Calculate the quantities, the consumer surplus, and the firms' rents for the different types. What is total welfare in this case?
- b) Illustrate the welfare maximizing price distortion graphically and give a short description of the two opposing effects which determine it.

Suppose now that the regulator appoints an auditor to find out the true costs of the firm. Unfortunately, the auditor reports the true type only with uncertainty. In case the firm has low marginal costs, the auditor correctly reports this type with probability  $\frac{2}{3}$ . In case the firm has high marginal costs, the auditor correctly reports this type with probability  $\frac{3}{4}$ . Hence, it applies

$$\begin{aligned} \Phi_L &= \text{Prob}(s = s_L | c = c_L) = \frac{3}{4} & (1 - \Phi_L) &= \text{Prob}(s = s_H | c = c_L) = \frac{1}{4} \\ \Phi_H &= \text{Prob}(s = s_L | c = c_H) = \frac{1}{3} & (1 - \Phi_H) &= \text{Prob}(s = s_H | c = c_H) = \frac{2}{3}. \end{aligned}$$

Assume that the firm is risk neutral and there are no financial constraints.

- c) Determine the (absolute minimal) transfers which allow the regulator to induce truthful revelation and marginal cost pricing. What is the change in welfare compared to your result from part b.? Interpret and discuss your results.

### 3 Access Regulation [15]

A vertically-integrated firm  $M$  supplies a network service (over which it holds a monopoly) to a possible entrant  $E$ .  $M$  can also supply service directly to consumers. Consumer demand for the final service is  $q = 65 - p$ , where  $p$  is the price that downstream firm(s) charge for the final service.  $E$  has a cost  $c_E = 3$  for converting a unit of the network service into the final service, while  $M$  has a cost  $c_M = 5$  for doing the same. Suppose that the network service has marginal cost  $C = 2$ .

- a) Suppose first that  $M$  decides to sell its network service to  $E$  and not to sell its final service to consumers at all.  $M$  sets the access charge  $\alpha$  per unit which  $E$  must pay for the input. Calculate  $E$ 's profit maximizing price and demand for units of network access subject to the access fee. What is  $M$ 's profit maximizing access fee? What are the firms' profits?
- b) Next, suppose  $M$  chooses to sell only to final consumers and does not provide access to  $E$ . What price will  $M$  charge in optimum and what are its maximum profits in this case?
- c) Now compare your answers to a. and b. Do you expect that the most efficient firm will supply consumers? Are consumers better off in scenario a. or b.? Should a regulator force  $M$  to sell its input to  $E$ ? What regulatory policy might be implemented to increase social welfare?

### 4 Practical policy [18]

- a) What is a natural monopoly? Discuss whether the existence of a natural monopoly inevitably leads to a situation with only one firm in the market.
- b) Consider an electricity supplier who faces periodically changing demands, e.g. during night and day. The costs for the production, transportation, and distribution are composed of capacity costs for the provision and extension of the infrastructure and of short run variable costs. Discuss the welfare maximizing pricing regime.