

Written Exam at the Department of Economics summer 2020-R

Mikro II

Final Exam

21 August 2020

(3-hour open book exam)

Answers in English or in Danish.

The paper must be uploaded as one PDF document. The PDF document must be named with exam number only (e.g. '127.pdf') and uploaded to Digital Exam.

This exam question consists of 4 pages in total

This exam has been changed from a written Peter Bangsvej exam to a take-home exam with helping aids. Please read the following text carefully in order to avoid exam cheating.

Be careful not to cheat at exams!

You cheat at an exam, if you during the exam:

- Copy other people's texts without making use of quotation marks and source referencing, so that it may appear to be your own text. This also applies to text from old grading instructions.
- Make your exam answers available for other students to use during the exam
- Communicate with or otherwise receive help from other people
- Use the ideas or thoughts of others without making use of source referencing, so it may appear to be your own idea or your thoughts
- Use parts of a paper/exam answer that you have submitted before and received a passed grade for without making use of source referencing (self plagiarism)

You can read more about the rules on exam cheating on the study information pages in KUnet and in the common part of the curriculum section 4.12.

Exam cheating is always sanctioned with a warning and dispassing from the exam. In most cases, the student is also expelled from the university for one semester.

Question 1

The demand in the market for steel can be described by the following function:

$$D(p) = \max \{800 - 2p, 0\}$$

Imagine that the supply side of the market for steel can be described through a single representative firm, which has no market power. The production technology can be described by the following cost function:

$$C(y) = 300 + 0.25y^2$$

- a) What are the equilibrium price and quantity in the market for steel?
- b) What are the consumer surplus and the producer surplus in the market for steel?

Now assume that the production of steel causes pollution. The cost that occurs to society from pollution, $e(y)$, can be described by the following function:

$$e(y) = 100y + 0.25y^2$$

- c) What is the socially optimal level of steel production?
- d) What is the total net surplus in the market for steel, if you take the additional cost created through pollution into account? Explain the consequences of your results in words.
- e) Is there a deadweight loss arising from pollution? Explain why it arises or not.
- f) The government wants to introduce a Pigouvian tax to achieve the socially optimal level of steel production. The government proposes that the firm has to pay a constant tax on each unit of steel produced. How high would the Pigouvian tax have to be to achieve the socially optimal quantity?
- g) Would you recommend the government to introduce the Pigouvian tax or rather to leave the market unregulated?

Question 2

You are the owner (principal) of a high-end bike shop. You have one employee, Asger (agent) working for you. Asger sells either 0 bikes or 1 bike in any given hour. When Asger puts in high effort ($e = 1$), i.e. he actively approaches potential clients in the shop, asks questions and makes a friendly face, the probability that he sells a bike in a given hour is $p_H = 0.9$. When Asger puts in only low effort ($e = 0$), however, he sells a bike in a given hour with a much lower probability, $p_L = 0.5$. Every sold bike brings you (the principal) a revenue of 1,000. Asger's utility function is $u(e, w) = w - 90e$, where w is the wage

you pay him per hour. Due to the current recession, Asger's labor market prospects outside your bike shop look rather gloomy. His reservation utility is $\bar{u} = 0$.

Suppose you cannot directly observe Asger's effort level but you observe, at the end of each hour, whether he has sold a bike or not. You will pay a wage w_H in case Asger has sold a bike and a wage w_L in case he has not.

Assume, for now, that you want to incentivize Asger to put in the high level of effort. Moreover, there is no minimum wage in your country. You can therefore assume that $w_L = 0$

a) Write down the individual rationality (IR) constraint that makes sure that Asger works for you rather than taking his outside option, and solve it for w_H .

b) Write down the incentive compatibility (IC) constraint that makes sure that Asger puts in a high level of effort rather than a low level, and solve it for w_H .

c) Set up formally your (the principal's) profit maximization problem including constraints, assuming that you want to induce high effort. What wage will you pay Asger? What are your expected profits and what is Asger's expected utility? Note: What you maximize is your expected hourly profit.

d) We have assumed that you (the principal) want to induce high effort by Asger. Is this optimal for you?

e) Would your answer to d) change if we instead assumed $p_L = 0.3$? Why or why not?

Now imagine that you install a camera in the shop. This allows you to directly observe the effort level Asger puts in whereas before you only saw whether he sold a bike or not when you did the accounting. With the new camera in the shop you can now condition Asger's wage on his effort level e instead of making it dependent on his success which, by definition, involved some random component. You can continue to assume that you want to incentivize Asger to put in high effort. Assume that the wage will be zero in case of low effort $w_L = 0$. You will maximize your profit by choosing a wage w_H for high effort.

f) How will the camera affect your expected profit? And how will it affect Asger's expected utility compared to the case under c) when you did not have the camera? Calculate your profit and Asger's utility for the new scenario with the camera and compare it to your findings under c).

g) Does anybody receive information rents or pay information costs under the two situations in c) and f)? If yes, who?

Question 3

Consider the following payoff matrix:

Player 1\Player 2	Left	Right
High	6;0	5;5
Low	10;0	1;1

a) Determine all Nash equilibria in pure strategies of this simultaneous one-period game. Explain your reasoning in words.

The two players now decide to make a contract. Under this contract, Player 1 is obliged to pay the amount X to Player 2 whenever Player 2 chooses the action “Left”. Put differently, the contract states that whenever Player 2 plays “Left”, the payoff of Player 1 is reduced by X whereas the payoff of Player 2 increases by X .

b) Write down the new payoff matrix arising from this contract.

c) What is the minimum value of X such that (Low; Left) is a Nash equilibrium under the described contract?

d) What condition on X must hold such that (Low; Left) is the only Nash equilibrium in this game?

e) Imagine that $X = 7$. Is there a strictly dominant strategy for any of the two players?

Question 4

Do you agree or disagree with the following statements? Explain your answers.

a) “Second-degree price discrimination will typically involve lower profits for a monopolist than third-degree price discrimination.”

b) “The standard model of labor supply tells us that a universal basic income is distortionary. In the model a universal basic income can be viewed as an hourly tax on labor and will lead to a deadweight loss.” (Note: A universal basic income is a fixed amount being paid to everybody by the government. You can neglect how the basic income is financed in your answer.)