

MICROECONOMICS 3

PROBLEMS #8

ASYMMETRIC INFORMATION – MORAL HAZARD

Problem #1

Suppose X is a good used for the production of good Y . Firm A holds a license for the production of X , which can be produced at zero costs. Firm B considers purchasing a machine transforming X into Y . After transforming 10000 units of X the machine is no longer usable. However, it cannot be resold. This machine costs 30 000. Firm B is able to sell Y for the price of 5 per unit. Firm A is offering to supply X to firm B for the price of 1, after B has already bought the machine.

- Assume that firms A and B can sign a binding agreement, where they will specify the price of X . Will firm B buy the machine? Find the profits of both firms.
- Assume that it is impossible to sign such an agreement. Is firm A's promise credible? Will firm B buy the machine? Find the profits of both firms. Compare your results with those of point a).

Problem #2

Mr. X's car is worth 10 000 *zloty* and it is the only material wealth that he possesses. X faces the risk of his car being stolen with the probability of 19/83 per year. His utility function depending on wealth is $u = x^{1/2}$. Additionally, X derives the utility of 190/83 from parking regularly next to a sleazy bar, what however doubles the yearly risk of his car being stolen. Would X be willing to buy full insurance against theft in the competitive insurance market? Demonstrate that insurance with X's own participation at the level of 1700 is optimal. (Assume that monitoring where X parks or finding where his car was stolen is too costly and ignore all costs of insurance except for the expected compensation level).

Problem #3

Assume that the principal is risk-neutral and cares only for the expected value of his company's revenue, while the agent is both risk- and 'work'-averse. The agent's utility function depending on income and effort devoted to work is given by the following function: $U(w,e) = w^{1/2} - e$, where w is the non-negative wage and e is effort. For simplicity assume that only two levels of effort are possible: $e = 0$ (low) and $e = 1$ (high). The agent has the possibility to undertake work elsewhere and his utility derived from working there will amount to 1. The revenue of the company depends both of effort devoted to work by the agent and on random events, which neither the principal nor the agent can control. To be precise, the revenues are given by the following lottery depending on the agent's effort:

$$L_{e=0} = (10, 2/3; 30, 1/3)$$

$$L_{e=1} = (10, 1/3; 30, 2/3)$$

- What contract will the principal sign with the agent if he can observe the latter's effort? How will the risk burden be divided between them in this case?
- If the principal cannot observe the agent's effort, how can he incentivize the former to choose the effort level desired by the principal? How will the risk burden be divided between them in this case? What utility levels will the agent and the principal achieve?

Problem #4

The agent selects his effort e from the interval $[0,1]$. Two outcomes are possible for the principal – the good one and the bad one; $\Pr(\text{good}) = e$. The principal's revenue is: $R(\text{good}) = 4$, $R(\text{bad}) = 3$; while the agent's utility is given by $U(w,e) = w - e^2$. The 'outside option' is $U_0 = 1$. Propose the optimal remuneration scheme w for the case when:

- a) e is observable,
- b) e is not observable
- c) Repeat point a) with the utility function given by $U(w,e) = w^{1/2} - e^2$ (use a calculator or provide an approximated solution).
- d) Repeat point b) with the utility function given by $U(w,e) = w^{1/2} - e^2$ (do not solve for numbers, describe the principal's optimization problem and the interval within which the optimal effort level will be found).

Problem #5

Jan's wealth amounts to \$100,000. His car, worth \$20,000, is exposed to the risk of being stolen and the probability of theft actually taking place is 25%. Jan's expected utility function takes the form $U(W) = \ln(W)$, where W – wealth.

- a) Find Jan's expected utility (EU) in the situation when he does not buy car theft insurance.
 - b) Find the fair insurance premium assuming that the insurance company does not bear any administrative costs.
 - c) Find the maximum amount that Jan would be willing to pay for car theft insurance.
- Jan can also install a car alarm, which costs him \$1,750. Installing this alarm decreases the probability of the car being stolen from 25% to 15%.
- d) If Jan decides not to purchase insurance, will he buy and install the car alarm?
 - e) What is the maximum amount that the insurance company can charge Jan for insurance if it requires that Jan purchases and installs the car alarm and verification whether Jan fulfilled this requirement is costless (full compensation, i.e. of \$20,000, is guaranteed in the case of theft)?
 - f) What can the insurance company do when it is not able to verify whether Jan installed the car alarm?

Multiple choice questions:

Problem #1

Assume that in a system of lease in exchange for a 20% share in the harvest the marginal cost of cultivation (borne in its entirety by the farmer) is constant and amounts to 80 zloty per hour. The relationship between the harvest and the farmer's effort is described by the formula $f(x) = 1000x - x^2/2$. The difference between the farmer's effort level that is optimal from the point of view of the owner and the one that is optimal for the farmer amounts to:

- a) 0
- b) 10
- c) 20
- d) 45
- e) sufficient data have not been provided to solve the problem

Problem #2

Which of the following situations is an example of moral hazard?

- a) A holder of insurance sets his house on fire.
- b) Somebody does not close the door to his apartment because he feels safer thanks to the insurance he bought.
- c) A candidate for a job dresses very attractively for an interview.
- d) A "less-risky" person cannot buy such insurance protection as he would be willing to.
- e) A car mechanic cheats his client by changing parts of his car, which it were not necessary to change.
- f) An insurance agent insists on selling insurance to a person who does not need it.