

Economics 401 Microtheory

Mechanism Design

1. Compensation

A board of directors must design a compensation scheme for a CEO. The CEO must decide between providing a high level of effort H and a low level of effort L . As a consequence of the CEO's decision, the company is either successful yielding a profit of $4v$ or goes bankrupt yielding a profit of 0. If the CEO provides a high level of effort, the probability of success is $3/4$, if the CEO provides a low level of effort the probability of success is $1/4$. The CEO has an expected utility function $\log(1 + w)$ if she provides low effort, and $\log(1 + w) - \log 3$ in case of low effort. The amount paid by the board of directors cannot be negative, and the board of directors acts to maximize the expected profit of the firm net of the cost of paying the CEO.

First suppose that the board can observe the effort of the CEO. The compensation scheme has the form of a wage w_H paid in case of high effort, and w_L paid in case of low effort.

- a. Write the objective function of the board of directors in case of low effort. Then again in case of high effort.
- b. You may assume that the optimal compensation scheme pays $w_L = 0$, that is, no payment in case of low effort. Write down the condition for the CEO to be willing to provide high effort (the incentive constraint for the CEO). If the board chooses to induce the CEO to provide effort, what wage must it pay in case of high effort?
- c. When will the board prefer to induce the CEO to provide effort?

Now suppose that the board can only observe the whether the firm is successful or not. The compensation scheme has the form of a wage w_v paid in case of success and a wage w_0 paid in case of bankruptcy.

- d. Write the objective function of the board in case of low effort. Then again in case of high effort.
- e. You may assume that the optimal compensation scheme pays $w_0 = 0$, that is, no payment in case of low effort. Write down the condition for the CEO to be willing to

provide high effort (the incentive constraint for the CEO). If the board chooses to induce the CEO to provide effort, what wage must it pay in case of high effort?

f. When will the board prefer to induce the CEO to provide effort?

2. Price Discrimination

A firm wishes to sell either 1 or 2 units of a good to a consumer with uncertain demand. (The firm is not allowed to sell 0 units; there is no production cost.) With probability $\frac{1}{2}$ the utility function of the consumer is $(1 - p)x$ where p is the price paid per unit and x is the number of units purchased. With probability $\frac{1}{2}$ the utility is instead $(3 - p)x$. Only the consumer knows his utility function. Formulate this as a mechanism design problem for the seller, and determine how he can best maximize his expected revenue