Lecture 3: The Principal-Agent Model

Compensation in Organizations

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Discussion: Lazear (2000)

Why a Model? (Clarity of Thought)

▶ "All models are wrong, but some are useful." -George Box

▶ Maps are useful precisely because they ignore some features.

▶ A good model has what we need to study one question, and nothing more.

▶ Under the model's assumptions, we know the truth.

▶ If the outcome is unrealistic, we can argue about which precise assumptions led to it.

Why THIS Model?

- ▶ The model we study in this lecture will be the main model of this class.

- ▶ We will slightly change it to study different questions.

- ▶ It was developed in the 1970s and has framed theoretical and empirical research for decades.

The Principal-Agent Model

Players

- ▶ There is a firm (the principal) who is risk neutral (exponential utility with parameter $r = 0$).

- ▶ There is a worker (the agent) who is risk averse (exponential utility with parameter $r = r \geq 0$).

Actions

- ▶ Firm chooses a linear wage which depends on effort ($w(e)$) or output ($w(y)$)

- ▶ After seeing the wage, the worker either accepts or rejects the job.

- ▶ If they accept, worker chooses effort e at an increasing, convex cost $c(e)$

The Principal-Agent Model

Output

- Output is effort (e) plus noise/luck (ϵ): $y = e + \epsilon$ where $\epsilon \sim N(0, \sigma^2)$

- This implies output is normal with mean e and variance σ^2

Payoffs

- If accepted, firm's payoff π is expected output minus expected wages: $E[y - w | e]$

- If accepted, worker's payoff is expected utility of the wage minus effort cost: $E[u(w) - c(e) | e]$

- If rejected, worker has "outside option" of $\bar{u}$ and firm has "outside option" of 0

See the board!

Effort-Based Pay

- Suppose the firm can pay based on the worker's effort.

- Then wage is a linear function of effort: $w(e) = \alpha + \beta e$

- We now go to the board to solve!

Effort-Based Pay

Theorem 1

When wages depend directly on effort, effort is e^* which solves $c'(e^*) = 1$ and $\beta^* = 1, \alpha^* = \bar{u}$

- ▶ We reward the worker for more effort.

- ▶ Question: What is the worker's expected payoff?

- ▶ Question: Why is the marginal cost set equal to 1?

- ▶ Let's compute the firm's payoff and total surplus on the board.

Effort-Based Pay

- ► We showed that this is the first-best: the firm could not do better even if they did the work themselves!

- ► The firm gets everything, but if the worker proposed they would get everything

- ► Question: What assumption did we bake in that got us here?

- ► Question: Is this assumption realistic?

Selling the Firm

Theorem 2

When wages depend directly on effort, effort is e^* which solves $c'(e^*) = 1$ and $\beta^* = 1, \alpha^* = \bar{u} + c(e^*) - 1$

▶ Consider our result: $\beta = 1$ and the average return to effort is 1

▶ The firm gives the worker everything they produce.

▶ This is called selling the firm: the worker pays α but keeps everything they make!

▶ These are extremely strong incentives (why?)

Paying to Work

- If the worker's outside option is low enough we will have that α is negative.

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- Question: Can you give some examples?