MORAL HAZARD

- Hidden action
- Post-contractual opportunism

EXAMPLES:
- Insurance transactions
- Job transactions

→ The quality of goods and service, even if potentially homogeneous can be influenced by actions that cannot be observed!!!

The contract might be structured so that the party taking the action has relatively GREATER incentive to act in a way the other party prefers

- In insurance contracts: trade-off between the behavior of "taking care" and the insurance coverage
- In job transictions: wages linked to:
  - output (piecework)
  - sales
  - productivity increase (productivity bonus)
  - profits

→ proxy of effort

<u>Two conditions</u> for moral hazard problems:

1. Conflict of interests between the two parties to the transaction

1. Asymmetric information

PRINCIPAL AGENT MODEL

Any transaction between two parties in which the benefits of one of two parties (THE PRINCIPAL) depends on the actions and/or decisions of the other party (THE AGENT)

Consider a job transaction in which:

1 Principal (P) → employer

1 Agent (A) → employee

Agent's task will imply the maximization of the principal's benefits (profits)

Three steps:

I. **P offers A a contract** that the agent can accept or refuse (no re-contracting is allowed)

II. **A decides whether to accept or to refuse** the contract comparing the utility he will get from the contract with his reservation utility level, $\mathbf{U_R}$

III. If the utility A gets from the Principal's proposal is greater than U_R → the **agent** accepts the contract and **maximizes his own objective function** and not the principal's one

The contract the principal offers the agent must be such that:

- The agent will accept the contract

AND

- The agent will behave to maximize principal’s benefit

Two situations:

- Perfect information: the principal can directly observe the agent’s effort (not only his productive results)

- Asymmetric information: the principal can observe just the agent’s productive results (and not his effort)

Initial assumptions:

- 1 principal (P) (e.g.: publishing company)
- 1 agent (A) (e.g.: seller)
- Two levels of effort → e^H / e^L
- U_R = Agent's reservation utility level

Agent:

- utility from wage = w
- disutility from the cost of effort = C(e)

If A accepts the contract →two possible actions:

- Action H → e^H
- Action L → e^L

With: $C(e^L) < C(e^H)$

Agent’s outcome depends not only on his efforts but also on random variables that concern:

- exogenous events
- events linked to the agent but that are not under his control

$\Rightarrow$A given level of effort won’t produce a certain given outcome BUT just a distribution of outcomes

Agent’s effort influences the probability associated to each outcome

Three possible outcomes :

- No order (y_0=0)
- 100$ (y_1=100)
- 400$ (y_2=400)

1.

e^H →

- 400$ with $p_2^H = 0.6$
- 100$ with $p_1^H = 0.3$
- 0$ with $p_0^H = 0.1$

2.

e^L →

- 400$ with $p_2^L = 0.1$
- 100$ with $p_1^L = 0.3$
- 0$ with $p_0^L = 0.6$

$p_i^{H,L} > 0$ always

- The principal's objective is to maximize her expected profits:

$$E(\pi) = E(R(y(e))) - E(w)$$

- The agent's objective is to maximize his expected net utility:

$$E(U) = E(\sqrt{w}) - C(e)$$

1. Conflict of interests between the two parties of the transaction

2.

- risk neutral principal
- risk averse agent

Consider:

- $U_R = 9$ \$
- $C(e^H) = 5$ \$
- $C(e^L) = 0$ \$

Principal:

- If effort= $\boldsymbol{e^H}$

  Her expected revenues are:

$$E(R) = \sum_{i=0}^{2} p_i^H y_i = 270\$$$

- If effort= $\boldsymbol{e^L}$

  Her expected revenues are:

$$E(R) = \sum_{i=0}^{2} p_i^L y_i = 70\$$$

PERFECT INFORMATION

Agent's action (effort) is VISIBLE to the principal
P wants to incentivize A to work hard.
Two possibilities:

1. Fixed wage contract

P offers the agent a wage high enough so that:

- A accepts the contract and
- A is compensated for the high effort P wants to get from him:

$$\sqrt{w} - C(e^H) \geq U_R$$

$$w \geq 196\$$$

P could write a contract that offers the agent197$ (>196) and trusts the agent will effectively work hard (e^H)

- Agents are opportunistic

⇒if P offers such fixed fee contract we assume that the agent will take the money, will give low effort, and will leave P paying 197$ for a task that is worth for her just 70$!!!

2. Wage dependent on the agent's effort

(which is visible to P): $w(e)$.

- Which is the contract?
- Which $w(e^H)$ and $w(e^L)$?

The contract is the solution to the following optimization problem:

$$\underset{w(e^H)}{Max}\ E(\pi) = \sum_{i=0}^{2} p_i^H y_i - w(e^H)$$

s.t.

$\sqrt{w(e^H)} - C(e^H) \geq U_R$ → **participation constraint**

$\sqrt{w(e^H)} - C(e^H) \geq \sqrt{w(e^L)} - C(e^L)$ → **incentive compatible constraint**

- **participation constraint**: the agent must be willing to accept the contract and hence the net utility he perceives from the contract, working hard, with high effort, is greater than (or equal to) his reservation utility.
- **Incentive compatible constraint:** the agent HAS to choose the highest effort and hence the net utility he perceives working hard is greater (or equal to) than the net utility he perceives working less (with low effort)

$$L = 270 - w(e^H) + \lambda(\sqrt{w(e^H)} - 14) + \mu(\sqrt{w(e^H)} - 5 - \sqrt{w(e^L)})$$

Solving for first order conditions:

$$\frac{\partial L}{\partial w(e^H)} = 0$$

$$\frac{\partial L}{\partial \lambda} = 0$$

$$\frac{\partial L}{\partial \mu} = 0$$

We get:

***w(e^H)* = 196$** ***w(e^L)* = 81$**

BUT

Since when $e = e^L$

$$E(R) = \sum_{i=0}^{2} p_i^L y_i = 70\$$$

$$w(e^L) \leq 70\$$$

CONTRACT P→A:

If $\boldsymbol{e = e^H \rightarrow w(e^H) = 196\$}$

If $\boldsymbol{e = e^L \rightarrow w(e^L) = 69\$}$

Agent's utility

- If ***e= e^H***

  Agent's net utility will be:

  $$\sqrt{196}-5=14-5=9=U_R$$

- If ***e= e^L***

  Agent's net utility will be:

  $$\sqrt{69}-0=8.3<U_R$$

$\Rightarrow$the agent <u>will not accept</u> the contract if he is willing to work with ***e= e^L***

Principal's expected profits:

- If $e = e^H$:

  $E(\pi\,(e^H\,)) = 270 - 196 = 74\$$

- If $e = e^L$:

  $E(\pi\,(e^L\,)) = 70 - 69 = 1\$$

$\rightarrow\ E(\pi\,(e^H\,)) > E(\pi\,(e^L\,))$

When Wage is contingent upon the agent's effort (which is visible to P):

- No agent will accept the contract if he is willing to supply e^L, but only the agents that are willing to work hard (e^H) will accept the contract
- What P has done is to get the agent to internalize the effect of his effort decision

ASYMMETRIC INFORMATION

- Agent’s action (effort) is not visible to the Principal.
- P assumes that there is a probabilistic relationship between level of effort and level of sales
- The size of the sales are observable and the agent’s wage can be made contingent upon these variables (outcome).

→ PAYING FOR PERFORMANCE

Which is the optimal contract that P can offer A such that:

- A accepts the contract;
- A will work hard (***e*= *e*^H**) ?

The contract P offers A is:

$w(y_0) = a_0^2$ if no sales

$w(y_1) = a_1^2$ if sales=100$

$w(y_2) = a_2^2$ if sales=400$

$\Rightarrow$Wage is contingent upon the observable productive outcome (*signal*)

The contract that P offers A is the result to the following optimization problem:

$$\underset{w(y_i)}{Max}\, E(\pi) = \sum_{i=0}^{2} p_i^H y_i - \sum_{i=0}^{2} p_i^H w(y_i)$$

s.t.

$$\sum_{i=0}^{2} p_i^H \sqrt{w(y_i)} - C(e^H) \geq U_R$$

$$\sum_{i=0}^{2} p_i^H \sqrt{w(y_i)} - C(e^H) \geq \sum_{i=0}^{2} p_i^L \sqrt{w(y_i)} - C(e^L)$$

$$L = 270 - [0{,}1a_0^2 + 0{,}3a_1^2 + 0{,}6a_2^2] +$$
$$+ \lambda(0{,}1a_0 + 0{,}3a_1 + 0{,}6a_2 - 14) +$$
$$+ \mu(-0{,}5a_0 + 0{,}5a_2 - 5)$$

Solving for first order conditions:

$$\frac{\partial L}{\partial a_0} = 0 \quad \frac{\partial L}{\partial a_1} = 0 \quad \frac{\partial L}{\partial a_2} = 0 \quad \frac{\partial L}{\partial \lambda} = 0 \quad \frac{\partial L}{\partial \mu} = 0$$

We get:

$w(y_0) = a_0^2 = 30$ if no sales → <u>in any case</u>

$w(y_1) = a_1^2 = 194$ if sales=100$

$w(y_2) = a_2^2 = 239$ if sales=400$

Principal's expected profits

- ***$e=e^H$***

$$E(\pi) = \sum_{i=0}^{2} p_i^H y_i - \sum_{i=0}^{2} p_i^H w(y_i)$$

$$E(\pi(y(e^H))) = 270 - 204{,}6 = 65{,}4\$$$

with perfect information, principal's expected profit was:

$$E(\pi(e^H)) = 73\$$$

P's expected profit decreases in the case of wage contingent upon output

Agent's expected net utility

- ***e=e^H***

$$\sum_{i=0}^{2} p_i^H \sqrt{w(y_i)} - C(e^H) = 9$$

with perfect information, agent's expected utility was:

$$E(U(e^H)) = 9\$$$

A's expected utility in the case of wages contingent upon output doesn't increase.

THERE IS A LOSS OF WELFARE

***Second best* solution**

Why?

With

- Risk neutral principal and
- Risk averse agent

$\Rightarrow$ The optimal solution should be the one with **fixed fee contract**

Why?

- In general, if one party to a transaction is risk averse and the other is risk neutral, then it is efficient for the risk neutral party to bear all the risk!

With **<u>fixed wage</u>**:

P doesn’t worsen her situation, A instead improves it.

BUT

if P gives the agent a riskless wage, the agent has no incentives to work hard

There is a trade-off between efficient distribution of risk and effort incentives

With incentivizing contract part of the risk has to be borne by the agent.

It is necessary to give him a reward in the case of high level of sales

This reward has no incentivizing aim, it is just to induce the agent to accept the contract

→Informativeness principle

1 Principal and N agents

I CASE: each agent's contribution is **indistinguishable**

Agent's wage can't be contingent upon his own output, but upon the team's output as a whole.

Free riding problems

For each agent:

not $\Delta w=f(\Delta y)$

but $\Delta w=1/N\ f(\Delta y)$

$\Rightarrow$All the agents can be induced to adopt a free riding behavior

How can free riding problem be solved?

- *peer pressure*

- Repeated job transactions: punishment to free rider behavior in the future

II CASE: each agent's contribution is **distinguishable**

principal's information may even improve