Chapter 8 Further Topics in Moral Hazard

8.1 Efficiency Wages

- ♦ The aim of an <u>incentive contract</u> is to create a <u>difference</u> between the agent's expected payoff from right and wrong actions.
  - ○ Either with the <u>stick</u> of punishment or with the <u>carrot</u> of reward

- ♦ The Lucky Executive Game

  - ○ Players

    - √ a corporation (the principal) and an executive (the agent)

  - ○ The order of play

    1. The corporation offers the executive

       a <u>contract</u> which pays $w(q) \geq 0$ depending on <u>profit</u>, q.

    2. The executive decides whether to accept or reject the contract.

    3. If the executive accepts, he exerts effort e of either 0 or 10.

    4. Nature chooses profit according to the table below.

- Payoffs
  - √ Both players are risk neutral.
  - √ If the executive rejects the contract,

    then $\pi_{agent} = \bar{U} = 5$ and $\pi_{principal} = 0$.
  - √ If the executive accepts the contract,

    then $\pi_{agent} = U(e, w(q)) = w(q) - e$ and $\pi_{principal} = q - w(q)$.
  - √ Probabilities of Profits in the Lucky Executive Game

	Low profit $(q = 0)$	*High profit* $(q = 400)$
Low effort $(e = 0)$	0.5	0.5
High effort $(e = 10)$	0.1	0.9

- Optimal contracts when the principal and the agent have the same information set and all variables are contractible

  - √ The principal can observe effort.

- ○ The optimal effort level

  - √ $e^* = 10$

- ○ Wage w^*

  - √ $0.1U(e^*, w^*) + 0.9U(e^*, w^*) = \bar{U}$

    $0.1(w^* - 10) + 0.9(w^* - 10) = 5$

    $w^* = 15$

- Payoffs π^*_{agent} and $\pi^*_{principal}$

  - √ $\pi^*_{agent} = 5$

  - √ $\pi^*_{principal} = 0.1(0 - 15) + 0.9(400 - 15) = 345$

- Contracts

- Is a <u>first-best</u> contract <u>feasible</u>?

  - The <u>participation</u> constraint

    - √ $\pi_{agent}\ (\textit{High effort}) = 0.1\{w(0) - 10\} + 0.9\{w(400) - 10\} \ \geq \ \bar{U}$

    - √ The agent's expected wage must equal 15.

$$0.1w(0) \ + \ 0.9w(400) \ = \ 15$$

  - The <u>incentive compatibility</u> constraint

    - √ $\pi_{agent}\ (\textit{High effort}) \ \geq \ \pi_{agent}\ (\textit{Low effort})$

$$0.1\{w(0) - 10\} + 0.9\{w(400) - 10\} \ \geq \ 0.5w(0) + 0.5w(400)$$

$$w(400) \ - \ w(0) \ \geq \ 25$$

- √ The gap between the agent's wage for high profit and low profit must equal at least 25.

○ A contract that satisfies both constraints is $\{w(0) = -345, w(400) = 55\}$.

- √ The agent exerts high effort: $e = 10$.
- √ The agent's expected wage is 15.
- √ The agent's expected payoff (or utility) is 5.
- √ The principal's expected payoff is 345.
- √ The first-best can be achieved by selling the store, putting the entire risk on the agent.

- But this contract is <u>not</u> feasible,

  because the game requires $w(q) \geq 0$.

  - √ This is an example of the common and realistic

    <u>bankruptcy constraint</u>.

  - √ The principal <u>cannot</u> punish the agent

    by taking away more than the agent owns in the first place –

    zero in the Lucky Executive Game.

- What can be done is to use the carrot instead of the stick and abandon satisfying the participation constraint as an equality.

  - The incentive compatibility constraint

    - √ $\pi_{agent}\ (High\ effort) \ \geq\ \pi_{agent}\ (Low\ effort)$

      $$w(400) - w(0) \geq 25$$

  - The principal can use the contract $\{w(0) = 0, w(400) = 25\}$ and induce high effort.

  - The agent's expected utility is 12.5, more than double his reservation utility of 5.

- The principal's expected payoff is 337.5.

  - √ If the principal paid a lower expected wage, then the agent would exert low effort, and the principal would get 195.

- Since high enough punishments are infeasible, the principal has to use higher rewards.

  - √ The principal is willing to abandon a tight participation constraint.

- The two parts of the idea of the <u>efficiency wage</u>

  - The employer pays a wage <u>higher</u> than that needed to attract workers.

  - Workers are willing to be <u>unemployed</u>

    in order to get a chance at the efficiency-wage job.

8.2 Tournaments

- Games in which relative performance is important are called tournaments.

  - Like auctions, tournaments are especially useful

    when the principal wants to elicit information from the agents.

  - A principal-designed tournament is sometimes called

    a yardstick competition

    because the agents provide the measure for their wages.

- Farrell (2001) makes a subtler point:

  Although the shareholders of a monopoly maximize profit,

  the managers maximize their own utility, and

  moral hazard is severe

  without the benchmark of other firms' performances.

- The Firm Apex Game

  - Players

    - √ the shareholders (the principal) and the manager (the agent)

  - The order of play

    1 The shareholders offer the manager a contract

      which pays $w(c)$ depending on production cost, c.

    2 The manager decides whether to accept or reject the contract.

    3 The firm has two possible production techniques,
      Fast and *Careful*.

      Nature chooses production cost according to the table below.

4 If the manager accepts the contract, he <u>chooses</u> a technique <u>without</u> investigating the costs of both techniques or does so <u>after</u> investigating them at a utility cost to himself of α.

5 The shareholders <u>can</u> observe the production <u>technique</u> chosen by the manager and the resulting production <u>cost</u>, but <u>not</u> whether the manager investigates.

- Payoffs

  - √ If the manager rejects the contract,

    then $\pi_{agent} = \bar{U} = \log \bar{w}$ and $\pi_{principal} = 0$.

  - √ If the manager accepts the contract,

$$\pi_{agent} = \begin{cases} \log w(c) & \text{if he does not investigate} \\ \log w(c) - \alpha & \text{if he investigates} \end{cases}$$

$$\pi_{principal} = ? - w(c)$$

  - √ Probabilities of Production Costs in the Firm Apex Game

	Low cost ($c = 1$)	*High cost* ($c = 2$)
Fast technique	θ	$1 - \theta$
Careful technique	θ	$1 - \theta$

- The contract must satisfy the incentive compatibility constraint and the participation constraint.

  - $w_1 \equiv w(1)$ and $w_2 \equiv w(2)$

  - The incentive compatibility constraint

    - $\pi_{agent}\,(Investigate) \;\geq\; \pi_{agent}\,(Not\ investigate)$

$$\{1-(1-\theta)^2\}\{\log w_1 - \alpha\} \;+\; (1-\theta)^2\{\log w_2 - \alpha\}$$
$$\geq\; \theta \log w_1 \;+\; (1-\theta)\log w_2$$

    - It is binding since the shareholders want to keep the manager's compensation to a minimum.

$$\theta(1-\theta)\log(w_1/w_2) \;=\; \alpha$$

- The <u>participation</u> constraint

  - √ $\pi_{agent}\,(Investigate) \; = \; \bar{U}$

    $$\{1-(1-\theta)^2\}\,\log w_1 \; + \; (1-\theta)^2\,\log w_2 \; - \alpha \; = \; \log \overline{w}$$

  - √ It is binding.

- The <u>contract</u> that satisfies both constraints is

  $$w_1^o \; = \; \overline{w}\,\exp(\alpha/\theta)$$

  and

  $$w_2^o \; = \; \overline{w}\,\exp\{-\alpha/(1-\theta)\}.$$

- The expected cost to the firm is

$$\{1 - (1-\theta)^2\}\, w_1^{\mathrm{o}} \;+\; (1-\theta)^2\, w_2^{\mathrm{o}}.$$

  - √ Assume that $\theta = 0.1$, $\alpha = 1$, and $\overline{w} = 1$.

    Then the rounded values are $w_1^{\mathrm{o}} = 22.026$ and $w_2^{\mathrm{o}} = 0.33$.

  - √ The expected cost to the firm is 4.185.

  - √ Quite possibly, the shareholders decide it is not worth making the manager investigate.

- The Apex and Brydox Game

  - The shareholders of each firm can threaten to boil their manager in oil

    if the other firm adopts a low-cost technology and

    their firm does not.

  - Apex's forcing contract specifies

    $w_1 = w_2$ to fully insure the manager, and

    boiling-in-oil if Brydox has lower costs than Apex.

- √ The contract need satisfy only the <u>participation</u> constraint that

$$\log w \;-\; \alpha \;=\; \bar{U} \;=\; \log \bar{w}.$$

- √ Assume that $\theta = 0.1$, $\alpha = 1$, and $\bar{w} = 1$.

  Then $w = 2.72$, and

  Apex's <u>cost</u> of extracting the manager's <u>information</u> is only 2.72,

  not 4.185.

- ○ Competition raises <u>efficiency</u>,

  not through the threat of firms going bankrupt

  but through the threat of managers being <u>fired</u>.

- Tournaments

  - Situations where competition between two agents can be used to <u>simplify</u> the optimal contract

8.3 Institutions and Agency Problems

- ♦ Ways to <u>Alleviate</u> Agency Problems

    √ When agents are <u>risk averse</u>,

    the first-best <u>cannot</u> be achieved.

  - ○ Reputation
  - ○ Risk-sharing contracts
  - ○ Boiling in oil
  - ○ Selling the store

- Efficiency wages
- Tournaments
- Monitoring
- Repetition
- Changing the type of the agent

- Government Institutions and Agency Problems

  - Who should bear the cost of an accident, the pedestrian or the driver?

    - Who has the most severe <u>moral hazard</u>?
    - the <u>least-cost avoider</u> principle

  - Criminal law is also concerned with tradeoffs
    between incentives and insurance.

- Private Institutions and Agency Problems

  - Agency theory also helps explain the development of many curious <u>private institutions</u>.

  - Having a <u>zero</u> marginal cost of computer time is a way around the moral hazard of slacking on research.

  - <u>Longterm contracts</u> are an important occasion for moral hazard, since so many variables are unforeseen, and hence noncontractible.

- √ The term <u>opportunism</u> has been used to describe the <u>behavior</u> of agents who take advantage of noncontractibility to increase their payoff at the expense of the principal.

- √ <u>hold-up potential</u>

♦ It should be clear from the variety of these examples that moral hazard is a common problem.