Competitive Strategy: Week 13

Incentives

Simon Board

Moral Hazard

- A principal employs an agent
  - Agent's actions have efficiency implications but are not freely observable.
  - Agent pursues their private interests at principal's expense.
- Form of post–contractual opportunism.
- Not issue in neoclassical economics as all attributes observable.
- Term comes from the insurance industry.
- We'll focus on extrinsic incentives
  - Warning: don't underestimate intrinsic motivation.
  - This can be undermined by monetary rewards.

Examples

- Drivers with car insurance
  - Drive more recklessly when insured.
- Car mechanics
  - Replace bits that don't need replacing.
  - Install parts poorly.
- Doctors
  - Practice conservative medicine, ordering too many tests.
  - Prioritise interesting cases.
- Security brokers
  - Churn clients' portfolios, trading too frequently.

More Examples

- Rental tenants
  - Look after apartment poorly.
- Employees within organisations
  - Spend their days on the internet.
  - Call in sick during the World Cup.
  - Exaggerate difficult of assignments.
- CEOs
  - Embark on mergers to increase power.
  - Move headquarters to be closer the family.

Case Study: Air Traffic Controllers

- Air traffic controller have stressful job
  - If too stressed to work they could claim disability.
  - Generous pay (up to 75% or wage) for duration.
- In 1972, disabled also received retraining
  - Large increases in "psychological illness".
- In 1974, tried to monitor disabilities
  - Need to show stress was job related.
  - Examiners look for incidents to cause stress
- After 1974, the number of "separation violations" of planes significantly increased.

Risk Aversion

- Risk averse agent has wage w with mean $\overline{w}$.
  - The certainty equivalent is $\overline{w} - \frac{1}{2}r(\overline{w})\mathrm{Var}(w)$
  - $r(\overline{w}) = -u''(\overline{w})/u'(\overline{w})$ is the coeff. of absolute risk aversion.
- Justification
  1. Local approximation.
  2. Normal w and exponential utility $u(w) = -e^{-rw}$.
- Assume constant risk aversion, $r(\overline{w}) = r$.
  - For example, exponential utility.
- Certainty equivalent (CE) is $\overline{w} - \frac{1}{2}r\mathrm{Var}(w)$.
- Risk premium $\frac{1}{2}r\mathrm{Var}(w)$.

Principal–Agent Model

- Agent takes effort e. Principal observes $z = e + x$.
  - x is random, with mean zero and variance V.
- Principal pays wage $w = \alpha + \beta(e + x)$. β is incentive intensity.
- Agent's cost of effort is convex, increasing $C(e)$. Their CE is

$$E[w] - \frac{1}{2} r \mathrm{Var}(w) - C(e) = (\alpha + \beta e) - C(e) - \frac{1}{2} r \beta^2 V$$

- Principal's profit is concave, increasing $P(e)$. Their CE is

$$P(e) - E[w] = P(e) - (\alpha + \beta e)$$

- Contract will maximise total CE

$$P(e) - C(e) - \frac{1}{2} r \beta^2 V \tag{CE}$$

  else there is scope for mutually beneficial trade.

Incentives

- Agent chooses e to maximise their CE. Hence,

$$C'(e) = \beta \tag{IC}$$

  - Thus $\beta \uparrow$ implies $e \uparrow$ [see picture].
- Substitute (IC) into (CE). Contract maximises

$$P(e) - C(e) - \frac{1}{2} r V [C'(e)]^2$$

- Maximising w.r.t. e, FOC is

$$P'(e) - C'(e)[1 + \frac{1}{2} r V C''(e)] = 0$$

- From (IC), $\beta^* = P'(e)/[1 + \frac{1}{2} r V C''(e)]$

The Intensity of Incentives

- $P'(e) \uparrow$ implies $\beta^* \uparrow$
  - If effort important then provide more incentives.
- $r \uparrow$ implies $\beta^* \downarrow$
  - If risk averse then provide less incentives
- $V \uparrow$ implies $\beta^* \downarrow$
  - If more risk then provide less incentives
- $C''(e) \uparrow$ implies $\beta^* \downarrow$
  - If harder to elicit extra effort then provide less incentives

Informativeness Principle

- Principal observes y correlated to x and independent of e.
  - Use y to reduce noise in contract. Assume $E[y] = 0$.
- Principal pays wage $w = \alpha + \beta(z + \gamma y)$. Total CE

$$P(e) - C(e) - \frac{1}{2} r\beta^2 \mathrm{Var}(x + \gamma y)$$

- Choose γ to minimise $\mathrm{Var}(x + \gamma y)$.
  - $\mathrm{Var}(x + \gamma y) = \mathrm{Var}(x) + \gamma^2 \mathrm{Var}(y) + 2\gamma \mathrm{Cov}(x, y)$.
  - Taking FOCs and rearranging,

$$\gamma^* = -\mathrm{Cov}(x, y)/\mathrm{Var}(y)$$

- If $\mathrm{Cov}(x, y) = 0$ then $\gamma^* = 0$. If $\mathrm{Cov}(x, y) > 0$ then $\gamma^* < 0$.
  - Idea: If market buoyant then reduce agent's pay.

Comparative Performance Evaluation

- Should i's pay depend on j's performance? Should I curve the final?
- Performance of i, $z_i = e_i + x_i + x_C$, where (x_i, x_C) independent.
- Relative performance with two agents (i, j)
  - i's pay depends on $z_i - \gamma z_j = (e_i - \gamma e_j) + x_i - \gamma x_j + (1-\gamma)x_C$.
  - Minimise $\text{Var}(z_i - \gamma z_j) = \text{Var}(x_i) + \gamma^2 \text{Var}(x_j) + (1-\gamma)^2 \text{Var}(x_C)$.

$$\gamma^* = \text{Var}(x_C)/(\text{Var}(x_j) + \text{Var}(x_C))$$

  - Thus $\gamma^* \uparrow$ as $\text{Var}(x_C) \uparrow$ or $\text{Var}(x_j) \downarrow$.
- With $N+1$ agents, i's pay depends on $z_i - \sum_{j \neq i} \gamma_j z_j$, where

$$\gamma_j^* = \text{Var}(x_C) \left[\text{Var}(x_j) + \text{Var}(x_C) \sum_{k \neq i} \frac{\text{Var}(x_j)}{\text{Var}(x_k)} \right]^{-1}$$

Deductables

- If you have car accident you have to pay first $500.
  - Why not pay proportion of loss?
- Owner can effect probability of incident
  - More careful driving.
  - Lock car at night.
- Owner has little control over the size of the loss
  - How big is accident?
  - Is car stolen or just radio?
- Thus payment shouldn't depend on size of loss.

Monitoring

- Monitoring increases accuracy of measurement.
  - Variance of error x is V
  - Monitoring cost given by decreasing convex $M(V)$
- Total CE
$$P(e) - C(e) - \frac{1}{2} r V \beta^2 - M(V)$$
- Maximise w.r.t. V implies
$$-M'(V^*) = \frac{1}{2} r \beta^2$$
Hence $\beta \uparrow$ implies more monitoring.
- In addition, recall $\beta^* = P'(e)/[1 + \frac{1}{2} r V C''(e)]$.
  - So more monitoring implies higher incentives.
- Monitoring and incentives are compliments.

Equal Compensation Principle

- Agents do many different jobs at once
  - If motivate teacher to get high exam scores they may do less pastoral care.
- Agent chooses e_1 and e_2 at cost $C(e_1 + e_2)$.
  - Performance measures $z_i = e_i + x_i$
  - Employee's CE
$$\alpha + \beta_1 e_1 + \beta_2 e_2 - C(e_1 + e_2) - \frac{1}{2} r \mathrm{Var}(\beta_1 x_1 + \beta_2 x_2)$$
  - If $\beta_1 > \beta_2$ then $C'(e_1) = \beta_1$ and $e_2 = 0$.
- If employee is to perform both activities need marginal return to be the same ($\beta_1 = \beta_2$).

The Ratchet Effect

"Accomplishing the impossible means only that the boss will add it to your regular duties." [Doug Larson]

- A worker in a Soviet TV company:

  "We never use a screwdriver in the last week. We hammer the screws in. We slam solder on the connections, cannibalise parts from other televisions if we run out of the right ones, use glue or hammers to fix switches that were never meant for that model. And all the time the management is pressing us to work faster, to make the target so we all get our bonuses."

- Each year, 2000 TVs exploded in Moscow alone.

Ratchet Effect cont.

- Agent works for two periods, $z_i = e_i + x_i$, $i \in \{1, 2\}$.
  - Noise x_i is correlated over time.
- Period 1 measure, z_1, tells manager about x_2
  - Thus in period 2, should link pay to z_1
  - Problem: agent will shirk in period 1 to lower z_1.
- Ways around ratchet effect
  - Contract not to use z_1 in period 2.
  - Develop reputation e.g. Lincoln electric.
  - Self–employment
  - Job rotation.

Compensation and Agent Selection

- There are two windscreen installing companies
  - Firm A pays a piece–rate: \$25 per windshield.
  - Firm B pays a fixed salary: \$150 a day.
- An average worker can install 6 windscreens a day.
  - Which firm will the productive agents go to?
  - Which firm will the risk averse agents go to?
  - Which firm will the overconfident workers go to?