Lecture 7: Relative Performance Evaluation

Compensation in Organizations

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Relative Performance Evaluation is Not Teamwork

- Sometimes multiple people's effort goes into the final product
- When we only observe total output ($y = e_1 + e_2$) and we cannot tell how much each person contributed
- We call this teamwork and study it after the midterm but not now.
- We care about when we observe output for each but with uncertainty
- For example: $y_1 = e_1 + \epsilon_1$, $y_2 = e_2 + \epsilon_2$
- Question: what is the point of grouping the workers at all?

Relative Performance Evaluation: A Model

- Suppose there are two workers labeled 1 and 2 with the same cost of effort $c(e_i)$.
- Output for each $y_1 = e_1 + \epsilon_1$, $y_2 = e_2 + \epsilon_2$
- The noise terms are distributed:
  - $\epsilon_1 = v_s + v_1$
  - $\epsilon_2 = v_s + v_2$
  - where $v_s \sim N(0, \sigma_s^2)$, $v_1 \sim N(0, \sigma_1^2)$ and $v_2 \sim N(0, \sigma_2^2)$[1]
- Let's focus just on worker 1.
- The firm can offer linear wages:
  - $w(y_1, y_2) = \alpha + \beta(y_1 - \gamma y_2)$

1. Technical note: All are also jointly independent.

Interpreting the Model

$$\epsilon_1 = v_s + v_1 \qquad \epsilon_2 = v_s + v_2$$

How can we interpret v_s, v_1, v_2 when workers 1 and 2 are at the same company?

Interpreting the Model

$$\epsilon_1 = v_s + v_1 \qquad \epsilon_2 = v_s + v_2$$

How can we interpret v_s, v_1, v_2 when workers 1 and 2 are at different companies?

Interpreting the Model

$$\epsilon_1 = v_s + v_1 \qquad \epsilon_2 = v_s + v_2$$

How can we interpret the variances of v_s, v_1, v_2? i.e. what does it mean if $\sigma_s^2 > \sigma_1^2$?

Some Observations

$$w(y_1, y_2) = \alpha + \beta(y_1 - \gamma y_2)$$

1. If $\gamma = 0$ we have no relative performance evaluation (back to base model)
   - Since γ is a choice, access to relative performance evaluations must weakly improve profit!

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2. γ does not influence effort.
   - Question: Why?
3. Y_2 contains information about Y_1
   - Question: Why?

Solving the Model

See the board!

Solving the Model

Theorem 1

Under relative performance evaluation, worker 1's wage is $w(y_1, y_2) = \alpha_{rel} + \beta_{rel}(y_1 - \gamma_{rel} y_2)$ *where*

$$\gamma_{rel} = \frac{\sigma_s^2}{\sigma_s^2 + \sigma_2^2}$$

$$\beta_{rel} = \frac{1}{1 + r(\sigma_1^2 + (1 - \gamma_{rel})^2\sigma_s^2 + \gamma_{rel}^2\sigma_2^2)c''(e_1)}$$

$$\alpha_{rel} = \bar{u} - \beta_{rel}(e_1 - \gamma_{rel} e_2) + \frac{r\beta_{rel}^2[\sigma_1^2 + (1 - \gamma_{rel})^2\sigma_s^2 + \gamma_{rel}^2\sigma_2^2]}{2}$$

A nice comprehension check is to figure out how these would change for worker 2.

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Thinking More Generally

- We thought of Y_2 as the output of a coworker or comparable worker.
- But we just showed that it does not matter for incentives.
- The firm only uses it to reduce the noise in performance evaluations.
- What if we think of Y_2 as just some extra information?
  - Question: What are some examples?

Working It Out

See the board!

The Informativeness Principle

Theorem 2

The firm should use additional information Y_2 to set pay for worker 1 whenever the information is informative about worker 1's output: $\sigma_s^2 > 0$.

- The firm uses Y_2 to purge Y_1 of noise/luck/etc.
- This reduces the effective variance the worker faces for each level of bonus β.
- This relieves the risk-incentive trade-off.
- Therefore it improves profit and total surplus!