

# Midterm: Econ 490 Compensation in Organizations

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## Instructions

You have 75 minutes to complete this exam. Please stop writing when told to do so. Write all answers in the space provided, and show your work. If you run out of room, make a note and use the additional pages attached at the end of the exam. This is a closed book exam. The only materials you may use are a pen and paper. By taking this exam, you agree to follow the UNC Chapel Hill honor code, in particular the standards of academic integrity. All academic dishonesty will be reported to the Office of Student and the Student Attorney General.

All questions in section 1 are worth 7 points. All questions in sections 2 and 3 are worth 4 points. There are 100 points possible.

## 1 Readings

Answer these questions in 3 sentences or less.

1. Describe the main two channels through which productivity improved in “Performance Pay and Productivity” by Lazear (2000).
  2. Describe the “gaming” that Larkin finds in his paper “The Cost of High-Powered Incentives: Employee Gaming in Enterprise Software Sales”. Be specific.
  3. Which form of performance pay was most effective at increasing student test scores across the distribution in Loyalka et. al. (2019)? (One phrase is fine)

4. Describe the main finding in “Moral hazard and risk spreading in partnerships” by Gaynor and Gertler (1995). Does it support or contradict the risk-incentive trade-off discussed in class?

## 2 Models

This problem is the same as the one we solved in class, with the cost of effort explicitly given as  $c(e) = e^2/2$ . Even though you may remember the answer from class or your problem set, please show all work. You may immediately plug in  $c(e) = e^2/2$  or you can solve it all just using a generic  $c(e)$  and plug it in at the end. Here is the setup:

### Setup

#### Players

- There is a firm (the principal) who is risk neutral.
- There is a worker (the agent) who is risk averse (exponential utility with parameter  $r > 0$ ).

#### 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  $c(e) = e^2/2$

#### Output

- Output is effort ( $e$ ) plus noise/luck ( $\epsilon$ ):  $y = e + \epsilon$  where  $\epsilon \sim N(0, \sigma^2)$
- This implies output is normal with mean  $e$  and variance  $\sigma^2$

#### Payoffs

- If accepted, the firm’s payoff  $\pi$  is expected output minus expected wages:  $E[y - w]$
- If accepted, the worker’s payoff is expected utility of the wage minus effort cost:  $E[u(w) - c(e)]$
- If rejected, the worker receives an outside option of  $\bar{u}$  and firm receives an outside option of 0

#### Timing

The same as in class. The firm proposes a wage schedule, the worker accepts or rejects, the worker exerts effort, output occurs, and then the wage is paid out.

## Questions: Effort Based Pay

For this question, suppose the firm can pay based on effort  $w(e) = \alpha + \beta e$ . Put a star superscript next to all the final solutions you derive, for example  $\beta^*$ .

1. Write the worker's certainty equivalent for a wage with fixed  $(\alpha, \beta)$  and fixed effort  $e$ .

2. For a fixed wage  $(\alpha, \beta)$  what level of effort does the agent choose?

3. For what  $\alpha, \beta$  does the worker accept the job?

4. What  $\alpha$  will the firm choose, and why?

5. Write the firm's profit. DO NOT simplify or plug anything in.

6. Simplify the firm's profit. You should get an expression that is a function of only  $\beta$  or  $e$  (either is fine)
7. What is the profit-maximizing  $\beta$ ? What is the profit maximizing effort  $e$ ?
8. Write down the firm's profit (make sure to substitute out  $\beta, e, \alpha$ ).
9. If the worker becomes more risk averse, which parameter (not choice variable) changes, and how does firm profit change? You can argue this verbally or mathematically.

### Questions: Performance Based Pay

For this question, suppose the firm can pay based on performance  $w(y) = \alpha + \beta e$ . Put a  $p$  subscript next to all the final solutions you derive, for example  $\beta_p$ .

1. Write the worker's certainty equivalent for a wage with fixed  $(\alpha, \beta)$  and fixed effort  $e$ .

2. For a fixed wage  $(\alpha, \beta)$  what level of effort does the agent choose?

3. For what  $\alpha, \beta$  does the worker accept the job?

4. What  $\alpha$  will the firm choose, and why?

5. Write the firm's profit. DO NOT simplify or plug anything in.
6. Simplify the firm's profit. You should get an expression that is a function of only  $\beta$  or  $e$  (either is fine)
7. What is the profit-maximizing  $\beta$ ? What is the profit maximizing effort  $e$ ?
8. Write down the firm's profit (make sure to substitute out  $\beta, e, \alpha$ ).

9. If the worker becomes more risk averse, which parameter (not choice variable) changes, and how does firm profit change? You can argue this verbally or mathematically.





