

# Lecture 15: Relational Contracts

Compensation in Organizations

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Relational Contracts

Discussion: Cheveleir and Ellison (1998)

## Aside: Discounting

- ▶ The discount rate  $\delta$  captures how much a dollar tomorrow is worth (to someone) today.
- ▶ If  $\delta = 0.9$ , a dollar tomorrow is worth 90 cents today.
- ▶ If  $\delta = 0.99$ , a dollar tomorrow is worth 99 cents today.
- ▶ Interpretation 1: If I have a higher  $\delta$ , I am more patient.
- ▶ Interpretation 2:  $\delta$  is the chance we meet again tomorrow.
  - ▶ Then the probability we meet again  $T$  times (assuming independence) is just  $\delta^T$

## Aside: Discounting

- Suppose I receive a payment (or utility)  $u$  for  $T$  periods. The present value of this stream of payments is:

$$\sum_{t=0}^T \delta^t u = u + \delta u + \delta^2 u + \dots + \delta^T u$$

## Aside: Discounting

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- Suppose  $T \rightarrow \infty$ . Then:

$$\begin{aligned} \sum_{t=0}^{\infty} \delta^t u &= u + \delta u + \delta^2 u + \dots \\ &= u + \delta(u + \delta u + \delta^2 u \dots) \\ &= u + \delta \sum_{t=0}^{\infty} \delta^t u \end{aligned}$$

$$\sum_{t=0}^{\infty} \delta^t u = u + \delta \sum_{t=0}^{\infty} \delta^t u \leftrightarrow (1 - \delta) \sum_{t=0}^{\infty} \delta^t u = u \leftrightarrow \sum_{t=0}^{\infty} \delta^t u = \frac{u}{1 - \delta}$$

# Model

- ▶ A firm and a worker both have discount rate  $\delta$  and interact for many periods ( $t = 1, \dots, \infty$ )
- ▶ At each period  $t$  the following occur:
  - ▶ First the firm offers a flat wage  $w$
  - ▶ Second the worker chooses high (H) or low (L) effort
- ▶ High effort has cost  $c$ , low effort has cost 0.
- ▶ High effort yields revenue  $v$ , low effort yields revenue 0.
- ▶ Firm outside option is 0, worker outside option is  $\bar{u}$ .
- ▶ Assume the firm wants to motivate high effort.

## Quick Tutorial: Infinitely Repeated Games

- ▶ We will not fully cover how to solve infinitely repeated games.
- ▶ For this class you only need to be able to solve variants of the exact problem in this lecture.
- ▶ The procedure is as follows:
  - ▶ We guess a simple strategy for the firm and the worker.
  - ▶ We verify that there are no one-shot deviations.
- ▶ For more information on infinitely repeated games see the slides from my game theory course.



## Step 1: Guess a simple strategy

- ▶ Nothing stops the firm and worker from choosing different wages and efforts at each point in time.
- ▶ They can even condition their choices on the past in complicated ways!
- ▶ We will look for equilibria where strategies are simple.
- ▶ We guess that the firm pays a wage  $w_H$  as long as the worker exerts high effort, and a wage  $w_L$  forever after the worker does not exert high effort (outside option or low effort).
- ▶ We guess that the worker exerts high effort as long as they are paid  $w_H$ . As soon as they are paid anything else, they either exert low effort or take the outside option.

## Step 2: Verify

- ▶ We now need to verify that our guess is an equilibrium.
- ▶ This means we need to check that both the firm or the worker cannot gain from using some other strategy.
- ▶ We will focus on the worker's incentives to deviate.
- ▶ In general there are many other possible strategies, many of which can be complex.
- ▶ We have a shortcut: the one shot deviation principle.

## Step 2: Verify

### Definition 1

The **one-shot deviation principle** states that a strategy profile is a subgame-perfect Nash equilibrium if and only if no player can increase their payoff by changing a single decision in a single period.

- ▶ Our guess generates a very simply set of outcomes.
- ▶ On path: the worker exerts high effort and is paid  $w_H$  forever.
- ▶ Off path: the worker slacked off in the past, is paid  $w_L$  forever and exerts low effort forever.
- ▶ The one-shot deviation principle means we only need to check for deviations in these two cases.
- ▶ Further, we only need to consider one-shot (single period) deviations.

## Solving the Model

See the board!

# Model Solution

## Theorem 2

*If  $\delta(v - \bar{u}) \geq c$ , there is a subgame perfect Nash equilibrium where the firm offers a wage of  $w_H^* = \frac{c}{\delta} + \bar{u}$  as long as the worker exerts high effort, and a wage of  $w_L^* = 0$  forever after the worker exerts low effort once.*

- ▶ We say “there is” because this is only one of many equilibria.
- ▶ Notice that whenever the firm offers  $w_L^* = 0$  the worker takes the outside option.

## Why is this “Relational”?

- ▶ The firm pays the worker a high wage and “trusts” the worker will work hard.
- ▶ The worker then works hard because they value the future relationship with the firm.
- ▶ Suppose one party breaks this trust (by exerting low effort or not paying a high wage).
- ▶ Both players stop working together forever after.
- ▶ In this way the value of employment encourages high effort.
- ▶ Employment is valuable because the worker is paid more than their outside option.

## Working Hard to Keep a Good Job

- ▶ The firm does not use performance pay in this model.
- ▶ There is a fixed wage that is paid regardless of output.
- ▶ The worker works hard because they want to keep their job.
- ▶ But the worker only wants to keep their job because it pays better than “the market.”
- ▶ Thus high salaries paired with the possibility of termination can work like performance pay!
- ▶ I would argue most US workers are motivated this way.

## When Do Relational Contracts Work?

Recall that our result only holds when:

$$\delta(v - \bar{u}) \geq c$$

Relational contracts are more likely when...

- ▶ everyone is more patient ( $\uparrow \delta$ )
- ▶ the value of working together is higher ( $\uparrow v$ )
- ▶ the worker's outside option is worse ( $\downarrow \bar{u}$ )
- ▶ effort is less costly ( $\downarrow c$ )



## Other Equilibria

- ▶ The firm's strategy we studied is rather harsh: if the worker slacks, they are essentially fired forever.
- ▶ Sometimes there are other equilibria with less severe or less eternal consequences.
- ▶ For example: after low effort pay the low wage for some  $T < \infty$  periods, then revert to high wage.
- ▶ However these work “less of the time” (for fewer values of  $c, \delta, v, \bar{u}$ )
- ▶ Our harsh strategy works “more of the time” (for many values of  $c, \delta, v, \bar{u}$ )
- ▶ It is a grim trigger strategy (discuss this).

# Efficiency Wages

## Definition 3

Efficiency wages refers to the practice of paying workers above the market rate in order to improve productivity.

- ▶ We can think of a worker's productivity as their effort.
- ▶ On path, the worker exerts high effort and is productive.
- ▶ If they ever exert low effort (are unproductive) they never work with the firm again.
- ▶ Thus the worker is more “efficient” when wages are higher.
- ▶ This is a microfoundation (discuss this word) for efficiency wages.