

Efficiency Wages

Wages and Productivity

- Standard models suggest that wages **reflect** productivity
- But wages may also **directly affect** productivity
 - nutrition (developing countries)
 - attract better job applicants
 - reduce turnover
 - gift exchange
 - deter shirking

- Five factors that affects earnings from employment:
 - the agreeableness or disagreeableness of the employments themselves
 - the easiness and cheapness, or the difficulty and expense of learning them
 - the constancy or inconstancy of employment in them
 - the small or great trust which must be reposed in those who exercise them
 - the probability or improbability of success in them
- Goldsmith vs. ironsmith

Henry Ford

- Henry Ford used assembly line method with unskilled labor to make Model T
- He paid \$2.5 per day
 - turnover rate was high (annual rate of 370%)
 - absenteeism was high (10% a day)
 - but is is easy to find replacement workers at that wage
- In 1914, Ford doubled the wage to \$5.0 per day for workers who had been with the company for at least six months
 - quits fell by 87%; discharges fell by 90%; absenteeism fell by 75%
 - morale and productivity improved
 - perhaps productivity gain was less than increase in wage cost
 - no evidence for better applicant pool
 - his motive may be paternalism or rent sharing

Shirking

- A worker produces a good outcome with probability π_H and a bad outcome with probability $1 - \pi_H$ if he **exerts effort**
- He produces a good outcome with probability π_L and a bad outcome with probability $1 - \pi_L$ if he **shirks**
- Cost of exerting effort is C ; cost of shirking is 0
- Outside option for the worker is u_0
- Both worker and employer are risk-neutral
- The employer does not observe whether the worker exerts effort or not

Optimal Contract

- The employer designs a contract to induce the worker to exert effort
- Worker's pay depends on whether the outcome is good (W_G) or bad (W_B)
- Incentive compatibility constraint:

$$\pi_H W_G + (1 - \pi_H) W_B - C \geq \pi_L W_G + (1 - \pi_L) W_B$$

- Participation constraint:

$$\pi_H W_G + (1 - \pi_H) W_B - C \geq u_0$$

Analysis

- IC constraint reduces to

$$(\pi_H - \pi_L)(W_G - W_B) \geq C$$

- Participation constraint can be written as

$$W_B + \pi_H(W_G - W_B) \geq C + u_0$$

- Solution:

- choose lowest “bonus” $W_G - W_B$ to satisfy IC
- choose lowest “base wage” W_B to ensure participation

$$W_B^* = u_0 - \frac{\pi_L}{\pi_H - \pi_L} C$$

$$W_G^* = u_0 + \frac{1 - \pi_L}{\pi_H - \pi_L} C$$

Limited Liability

- But the optimal contract (W_B^*, W_G^*) may not be feasible if W_B^* is too low
- Suppose the **limited liability constraint** requires $W_G \geq 0$ and $W_B \geq 0$
- Solution is:
 - if $u_0 \geq \frac{\pi_L}{\pi_H - \pi_L} C$, then $W_B = W_B^*$ and $W_G = W_G^*$
 - if $u_0 < \frac{\pi_L}{\pi_H - \pi_L} C$, then $W_B = 0$ and $W_G = \frac{C}{\pi_H - \pi_L}$ (efficiency wages)

- Under efficiency wages, the worker's utility from employment in the firm is:

$$\pi_H W_G - C = \pi_H \frac{C}{\pi_H - \pi_L} - C = \frac{\pi_L}{\pi_H - \pi_L} C > u_0$$

- He is **strictly better off** working for the firm than choosing the outside option
- The possibility of losing his rent motivates the worker to exert effort

Sticky Wages

- Employers set wages to deter shirking; so fluctuations in marginal product may not be reflected in fluctuations in wages
- Even when the labor market is slack (with reduced outside option u_0 for workers), employers may not adjust wages downward
- The labor market may not clear due to sticky wages, leading to unemployment

Present Value

- A worker cares about the **present value** of his lifetime earnings in his firm, not just the earnings each year
- Suppose a worker works from year 0 until year T (retirement) for a firm.
- His opportunity cost of working for the firm each year is $v_0 = u_0 + C$. The efficiency wage needed to deter shirking is $\omega = \pi_H W_G > v_0$.
- How should the firm structure the worker's wages over time?

Deferred Compensation

- One solution is to pay ω every year from year 0 to year T ; this will deter shirking every year
- The PV of the cost to the firm (over and above what is needed to keep the worker) is quite substantial:

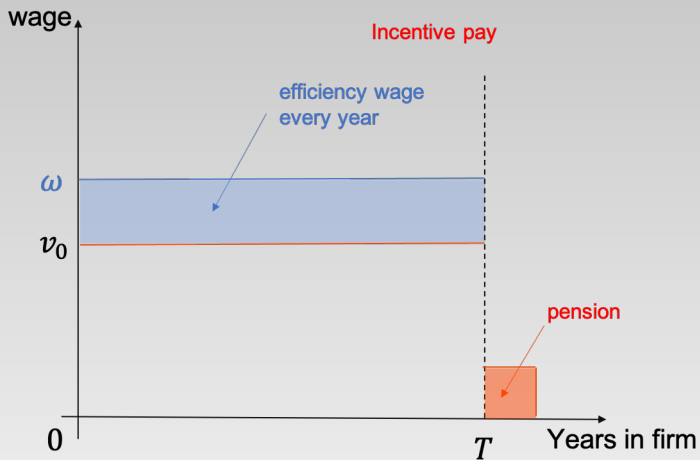
$$\sum_{t=0}^T \frac{\omega - v_0}{(1+r)^t}$$

- Is there a better (cheaper) way to structure the worker's compensation?

Recycling Incentives

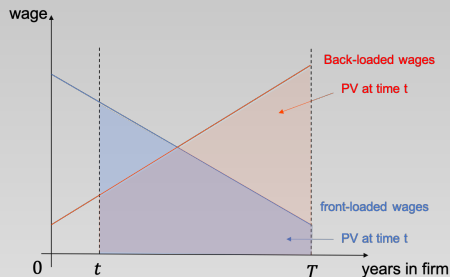
- The firm needs to give $\omega - v_0$ to induce the worker to exert effort
- But it doesn't need to do it every year. The key observation is that incentives can be **recycled**.
- The firm pays a wage of v_0 every year and offers a **pension** (or gratuity payment) with value $(1+r)^T(\omega - v_0)$ to the worker if he retires by year T and has not been fired for shirking before that.
 - in year 0, the PV of the pension is $\omega - v_0$, just enough to deter shirking in year 0
 - in year 1, the PV of the pension is $(1+r)(\omega - v_0)$, more than enough to deter shirking in year 1
 - and so on until year T
- The PV of the cost to the firm is just $\omega - v_0$, much lower than the earlier solution

Pension vs. Wages



Seniority-Based Compensation System

- More generally incentives may be **front-loaded** or **back-loaded**



- If two wage schedules have the same PV at time 0, the back-loaded schedule will have a higher PV at time $t > 0$
- The back-loaded schedule will provide more incentive to deter shirking at time t
- Seniority-based compensation with back-loaded wages can provide the same incentive (as front-loaded wages) but at a lower present value of costs

Lifetime Wages and Productivity

- Front-loaded wages may entail paying a worker less than his productivity near the end of his career
 - the worker will not have an incentive to stay
- Back-loaded wages may entail paying a worker more than his productivity near the end of his career
 - the worker may have too much incentive to stay
 - firms may use [mandatory retirement](#) to overcome this problem

Breach of Trust

- But workers must guard against breach of trust by the firm
 - workers put in effort in their earlier career because they expect to be well-paid when they become older or when they retire
 - but the firm lays off the older workers when it downsizes because older workers are more expensive than younger ones under a seniority-based compensation system