Wages and incentives.

Labour Economics - set 4

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April 2013

Wages and incentives

In this lecture we look at several reasons for wages are too high and sticky all linked to incentives motivations

- efficiency wage
- moral hazard and wages
- personnel economics: career, teams, tournaments

Efficiency wage I

- Assume that wages incentive workers to be more productive, i.e. to provide more effort e
- Assume that there exists a function $e(W)$, the effort function, increasing and concave
- Thus, wages are not only a cost to the firm but can be a tool to reduce unitary costs of production
- Note: in this case, the firm is free to set its optimal wage and it is not price taker anymore
- In the simplest model, the firm maximizes profits by choosing W and L

$$\pi = F(Le(W)) - WL$$

Efficiency wage II

- Define $\lambda = Le(W)$ and rewrite profits as

$$\pi = F(\lambda) - \frac{W}{e(W)}\lambda$$

Note: the problem is separable.

- Indeed, the first order conditions yield

$$-\lambda \left[\frac{e(W) - e'(W)W}{e(W)^2} \right] = 0 \rightarrow e'(W^*) = \frac{e(W^*)}{W^*}$$

and

$$F'(\lambda^*) = F'(L^* e(W^*)) = \frac{W^*}{e(W^*)}$$

Note:

- wages depend only on the effort function

Efficiency wage III

- $->$ wages do not react to shocks in productivity or in the price of the final product
- wages remain higher than the reservation wage: even if there are workers willing to work at W_R, wages will not fall and employment will not rise, because of the negative effect of a wage fall on workers productivity. This is an explanation for the empirical observation of sticky wages and involuntary unemployment.
- all shocks in productivity reflect on occupation only

Mechanisms I

Several mechanisms have been proposed to motivate the existence of a positive relationship between effort and wages.

Problems of adverse selection

1) the most able have better outside opportunities:

- in order to attract their applications, the firm has to offer better wages.
- Ability is unobservable to the firm, but the more able are more productive.
- The abler have higher reservation wages $W_R(\alpha)$.
- Given W only those with $W_R(\alpha) < W$ apply
- Thus, given W, average ability of the employees is $\overline{e} = e(W)$

2) workers might receive offers from other employers (offers are sort of outside option)

Mechanisms II

- in order to discourage turnover and losing previous investments in training, firms have to offer better jobs
- each firm hires L workers and each worker costs k to be trained
- once trained he might receive an offer from a competitor W_a distributed according to $H(W_a)$
- when $W_a > W$ the worker quits
- thus the proportion of workers that remains into the firm is $\Pr(W_a < W) = H(W)$ and the corresponding workforce is $\lambda = H(W)L$
- the total cost (wage + training) per "effective" worker is

$$c(W) = \frac{\lambda W + kL}{\lambda} = \frac{WH(W) + k}{H(W)}$$

Mechanisms III

- firms' profit is
$$\pi = F(\lambda) - c(W)\lambda$$
- Example: Ford 1913: 50,000 hirings per year to keep 14,000 employees on average. 1914: wages doubled and turnover reduced to only 16%, productivity up of 40-70 percent and profits up of 20 percent.

Problems of moral hazard

1) The Shapiro & Stiglitz (1984) model.

To incentive workers to exert high effort, firms randomly monitor their productivity. If caught to shirk, workers are fired. Wages need to be high for firing imply a loss to the worker

- effort causes disutility to the worker –> when hired, the optimal level of effort to the worker is zero.

Mechanisms IV

- to induce effort, firms monitor workers. If workers are caught to shirk they are fired.
- if all firms pay the competitive wage (= the reservation wage) then there will be no unemployment and the threat of being fired is empty.
- this is not an equilibrium: if one firm rises its own wage above the competitive level, then there is an incentive to its employees to avoid being fired
- all firms realize this opportunity and increase their wage: there will be no difference between firms anymore. But at the higher wage there will be involuntary unemployment and there will be a difference between the employed and the unemployed.
- wages will not fall to the competitive level, because this would not induce workers to provide enough effort.

Mechanisms V

- Note: why using wages as a discipline device? there are other strategies, e.g. tournaments, wages linked to the tenure or asking workers an initial depot (bonding critique)

Fairness and psychological motivations
1) wages are a signal of appreciation to the worker that workers reciprocate by means of higher effort (workers internalize firms' objective, share firms' purposes)
2) fairness: wages signal how fair is the firm compared to its competitors. Higher wages signal that the firms cares of workers' interests
3) gift exchange: "the firm gives me a job when so many people are unemployed. This is a gift of great value that I have to reciprocate"

Mechanisms VI

- All these motivation can be formalized by means of an endogenous utility function which allows the worker to internalize firm's objective (altruism). The degree of "altruism" α depends positively on wages, $\alpha = \alpha(W)$.

$$u = v(W) - c(e) + \alpha \left[\beta F(e) - W\right]$$

optimal effort is

$$c'(e^*) = \alpha\beta F'(e^*)$$

This implies that e^* will be increasing with W since α is increasing with W.

Empirical analysis I

It is very difficult to test the efficiency wage hypothesis

1. difficult to measure effort
2. unobservable variables enter into the relationship between effort and wages (e.g. ability, specific characteristics of the job)
3. are wages inducing a higher productivity or is it the opposite (reversed causation)?
4. third variables (e.g. human capital) can explain why higher wages are associated to higher productivity (or effort)

- one possibility to directly test the wage efficiency model (actually, Shapiro and Stiglitz version) is that of looking at the dismissals because of discipline reasons. Cappelli and Chauvin (1991) find that the number of dismissals is lower when the local unemployment rate is higher.

Empirical analysis II

- few studies have interviewed workers, employers and union officers and asked the reasons behind wage stickiness. There is support for the "fairness" explanation

Asymmetric information.

- Firms do not perfectly observe workers' characteristics (hidden type) and are not able to observe workers' actions (hidden action).
- They use wage schedules to either select the best workers or inducing more effort.
- We shall consider only the hidden action case
- Under risk aversion, wages do not fully react to productivity shocks

Basic Model I

- contract between firm and worker
- both firm and worker are risk neutral
- output is verifiable by a third party
- no hidden type
- only hidden action (it is impossible to infer e by observing Y)

- the worker accepts the contract if the net utility it receives under the contract is larger than a reservation utility W_R (participation constraint)
- if the worker accepts the contract, he decides e
- the cost of effort to the worker is $z(e)$ (increasing and convex)
- output is $Y \in \{0, 1\}$
- $\Pr(Y = 1) = \pi(e)$ with $\pi' > 0$ and $\pi'' < 0$

Basic Model II

- the firm observes only Y and not e
- the firm goal is that of maximizing expected profits

- Thanks to firms' risk-neutrality, the optimal wage schedule is linear in Y
- Let it be $W = S + bY$, where S is the fixed part and bY the variable part.

- Worker's expected utility is $A = S + \pi(e)b - z(e)$
- Worker decides e given S and b and given his own participation $A \geqslant W_R$
- First order condition implies $\pi'(e^*)b = z'(e^*)$
- Note: from firm's viewpoint, the maximum effort is for $b = 1$ and more generally e^* is increasing in b

Basic Model III

- Anticipating worker's reaction, the firm maximizes its own expected profit by choosing S and b.

$$\max_{S,b}(1-b)\pi(e^*)-S$$

- S should be kept as minimum as possible, as it does not influence worker's effort and it is a cost to the firm
- Actually, the firm will set S such that $S+\pi(e^*)b-z(e^*)=W_R$.
- Therefore firm's profit becomes

$$\Pi=(1-b)\pi(e^*)+\pi(e^*)b-z(e^*)-W_R=\pi(e^*)-z(e^*)-W_R$$

$$\frac{\partial\Pi}{\partial b}=\left[\pi'(e^*)-z'(e^*)\right]\frac{\partial e^*}{\partial b}>0\rightarrow b^*=1$$

and

$$S^*=W_R-\left[\pi(e^*)-z(e^*)\right]<0$$

Basic Model IV

- Note: $\pi(e) - z(e)$ is the total expected surplus that can be produced by the firm-employee relation. It is maximized for e° such that $\pi'(e^\circ) - z'(e^\circ) = 0$.
- Note: at $b = 1$, $e^*(b) = e^\circ$ (given worker's FOC). This means that at the equilibrium, total surplus is maximized, as in the case of perfect information, the worker is held residual claimant of his effort to maximally incentive him to exert effort. The firms extracts all surplus with the fixed component of the wage schedule and leaves the worker at his reservation wage.
- Note: practically, this solution suggests to lease the firm to the worker: he keeps the profits but pays a fixed rent
- Note: when output is a continuous variable, the same effect of this wage schedule can be obtained by means of: 1) a positive fixed wage plus a percentage of the output, if the realized output is high enough; and 2) no payment at all (dismissal) if that level of output has not been realized.

Extensions - risk aversion I

The previous result rests entirely on the hypothesis of risk neutrality. If the worker was risk averse and the firm risk neutral, the firm could optimally reduce wage variability by reducing b below its first best level

- let us assume that the output is given by

$$Y = e + \varepsilon$$

  where e is effort and ε is a random noise with mean 0 and variance σ_ε^2. Therefore, $E(Y) = e$ and $Var(Y) = \sigma_\varepsilon^2$
- suppose also that $v(W) = W - \frac{r}{2}W^2$ where r is a measure of risk aversion (though not standard). Worker's expected utility is $A = E(v(W)) - z(e)$.
- firm is risk neutral.
- suppose that the wage schedule is linear so that $W = S + bY$.

Extensions - risk aversion II

- therefore, worker's expected utility can be rewritten as

$$A = S + be - z(e) - \frac{1}{2} r b^2 \sigma_\varepsilon^2$$

  up to a quadratic approximation around $E(W)$. (Note: this quantity is also equal to the certainty equivalent).
- the worker maximizes his expected utility w.r.t. to e so that

$$b = z'(e^*)$$

- given this condition, the firm maximizes its expected profit.
- as above $S^* = W_R - be + z(e) + \frac{1}{2} r b^2 \sigma_\varepsilon^2$

Extensions - risk aversion III

- firms expected profits are

$$\Pi = E(Y) - E(W) = (1-b)e - S^* = e^* - z(e^*) - \frac{1}{2} r b^2 \sigma_\varepsilon^2$$

$$\begin{aligned} \frac{\partial \Pi}{\partial b} &= \left[1 - z'(e^*)\right] \frac{\partial e}{\partial b} - rb\sigma_\varepsilon^2 = \\ &= [1-b] \frac{1}{z''(e^*)} - rb\sigma_\varepsilon^2 = 0 \end{aligned}$$

since $\frac{\partial e}{\partial b} = 1/\frac{\partial b}{\partial e} = 1/z''(e^*)$ and $z'(e^*) = b$

- finally,

$$b = \frac{1}{1 + z''(e^*) r \sigma_\varepsilon^2}$$

Extensions - risk aversion IV

- Compared to the first best, workers proportion of output is less than 100%. The firm is partly insuring the worker against output and wage volatility.
- Note: in this case wages do not equal marginal productivity.
- Note: the higher is σ_ε^2 - output volatility - the lower is b (the less informative is Y about e, the smaller the link between output and wages)

Non verifiability I

Suppose that Y is not verifiable by a third party, for instance, because Y is not directly measurable
–> therefore worker's compensation cannot be linked to Y.

- suppose we observe X, a proxy of Y, correlated with Y but only imperfectly.
- if wages are linked to X, the worker will care only of the elements that influence X and will not care of Y.
- the same occurs when there are multiple tasks and the compensation reflects only a subsample of these: the worker will not care of all the tasks that are be remunerated.
- the *informativity principle* states that any measure that reveals/signals worker's effort should be included into the wage schedule.

Relative performance I

Even when production is not perfectly measurable, often it is possible to tell whether a worker has produced more or less than another one.

- in this case it could be useful to link one worker's retribution with his own performance and the performance of the other.
- moreover, if the purpose is that of incentive effort, positive or negative shocks to workers productivity ought to be removed (otherwise effort could be hidden by shocks and the worker has opportunities to shirk). If shocks are correlated among workers, remuneration based on relative performance is the solution:

$$Y_1 = e_1 + \varepsilon_1$$

$$Y_2 = e_2 + \varepsilon_2$$

$$corr(\varepsilon_1, \varepsilon_2) = \rho > 0$$

Relative performance II

In the setting described above with risk aversion, the optimal contract is

$$W_i = S + \frac{1}{1 + z''(e_i^*) r \sigma_\varepsilon^2 (1 - \rho^2)} Y_i - \frac{\rho}{1 + z''(e_j^*) r \sigma_\varepsilon^2 (1 - \rho^2)} Y_j$$

- If $\rho = 0$, no information from other worker's performance $->$ no influence
- if $\rho = 1$, $W_i = S + (Y_i - Y_j)$ only the relative performance matters

- Problems
  - if workers are too different in terms of innate ability, the relative performance responds little to workers' effort
  - the purpose of relative performance schemes is that of promoting competition. However competition can imply also deliberate boycottage
  - workers can collude to reduce performance

Teams

Suppose that the only observable performance is that of a team of workers, while individual contributions are unobservable.

- a contract linking individual performance to the team performance would not be optimal.
- each individuals contributes only for 1/N to the final outcome and have a strong incentive to shirk (opportunistic behavior, free riding)
- a possible solution to this problem is that of fidelizing the worker to the team or the firm (e.g. Japan)

Why are wages typically increasing with tenure? I

There is a number of possible answers

1. human capital theory: workers increase their human capital while they remain in a given job and become more productive
2. in order to incentive effort, firms promote workers at higher positions (often firms organize tournaments to select who promoting) –> the longer one stays in a given firm the more probable is that soon or later he is promoted
3. firms do not perfectly observe workers' productivity. This is eventually observed after sometime. At this point the less productive workers are fired. This creates endogenous self-selection of more productive workers and induces a correlation between tenure and productivity
4. in teams it is important to induce cooperation and discourage boycottage among workers. Linking promotions with tenure (in case besides merit) reduces excessive competition among workers (soon or later all will be promoted).

Why are wages typically increasing with tenure? II

5. linking promotions to tenure is also an objective criterion that reduces boss' discretion - a sort of assurance of fairness that favours contracting between firms and workers
6. linking promotions to tenure reduces competition among cohorts and favours the transmission of competencies from seniors to juniors
7. wages increasing with tenure (e.g. differed compensation: part of current wages will be paid in the distant future) is a way to incentive workers: if fired, workers will loose future higher wages

All these explanations imply that wages are stick and that wages are not simple a price that clears a market.