Efficiency wages

- Neoclassical theory treats labor as a hired input in much the same way as capital
- but workers, unlike capital, can chose levels of effort
- and such choice has important effects when information is imperfect

Main feature in efficiency wages: firms unilaterally set wages, and choose not to cut wages down to the market-clearing level, because of the detrimental effect that this would have on worker effort, motivation, recruitment, retention, and ultimately on firm profits.

Several efficiency wages mechanisms have been put forward in the literature:

- Higher wages help reduce shirking when effort is not perfectly observed (Shapiro and Stiglitz AER 1984);
- Higher wages improve worker morale and effort; "gift exchange" (Akerlof QJE 1982);
- Higher wages reduce worker quits and labor turnover costs (Salop AER 1979);
- Higher wages attracts more applicants and increase hires (Weiss JPE 1980).

1 The shirking model

Shapiro C. and J Stiglitz (1984) "Equilibrium Unemployment as a Worker Discipline Device", *American Economic Review*.

- Involuntary unemployment is driven by problems of imperfect information characterizing employee-employer relationships:
  - workers (unlike capital) choose level of effort
  - employers are unable to costlessly monitor worker effort.
- In the competitive paradigm all workers are paid their reservation wage and there is no unemployment.
- Whenever a worker is caught shirking, he is dismissed and immediately rehired in the outside labor market at the pre-layoff wage.

- With imperfect monitoring and full employment, workers will choose to shirk, as shirking involves zero costs and saves workers some effort.
- A firm willing to reduce shirking would pay more than the ongoing wage, so as to inflict a cost on those who are found shirking and need to look for jobs in the outside labor market.
- but this would also be the optimal wage strategy of all other firms, and again incentives not to shirk disappear.
- but as average wages rise, labor demand falls, and unemployment results. With unemployment, even if all firms pay the same wage, a worker has an incentive not to shirk. For if he is fired, he will not immediately obtain a new job.
- Unemployment creates its own penalty for shirking ("unemployment as a worker discipline device").
- Monitoring, unemployment and wages are substitutes.

1.1 Workers

- L identical infinitely-lived workers, with instantaneous utility function

$$U(\text{income}, \text{effort}) = \text{income} - \text{effort}$$

- Employed workers receive income w, and decide whether to spend positive or zero effort on the job (discrete effort choice).
  - If e is chosen the worker receives w for the duration of the job, until an exogenous separation occurs (at rate δ).
  - If 0 is chosen, the worker receives the same wage w, but is caught and fired at rate q (effectiveness of monitoring technology), and can still be exogenously separated at rate δ.
- Unemployed workers receive income b and spend zero effort. They find new jobs at rate a.
- Workers maximize lifetime utility in continuous time.

- Selecting the optimal effort level involves comparing the lifetime utility when shirking (V_E^S) with the lifetime utility when not shirking (V_E^N) - dynamic optimization problem.
- Flow utility for shirkers, non-shirkers, and the unemployed is given by Bellman equations (in steady state):

$$\begin{aligned} rV_E^S &= w + (\delta + q)(V_U - V_E^S) \\ rV_E^N &= w - e + \delta(V_U - V_E^N) \\ rV_U &= b + a[\text{max}(V_E^S, V_E^N) - V_U] \end{aligned}$$

- V_E^S and V_E^N can be expressed each as a function of V_U :

$$\begin{aligned} V_E^S &= \frac{w + (\delta + q)V_U}{r + \delta + q} \\ V_E^N &= \frac{w - e + \delta V_U}{r + \delta}. \end{aligned}$$

- A worker will choose not to shirk if $rV_E^S > rV_E^N$, which defines the following no-shirking condition:

$$w \geq rV_U + \frac{(r+\delta+q)e}{q} \equiv \widehat{w}. \tag{1}$$

- The efficiency wage $\widehat{w}$ is higher the higher V_U, r, δ and e, and the lower q.
- $\widehat{w}$ is strictly higher than $rV_U + e$ (reservation wage)
- Need to find rV_U, which depends on hiring rate a and ultimately on what firms do.

1.2 Firms

- M identical firms with production functions $Y_i = f(N_i)$ each.
- N_i is a firm's effective labor force. Each worker who spends effort e (respectively, 0) contributes 1 unit of effective labor (respectively, 0 units).
- The aggregate production function is $Y = F(N)$, with $F'(L) > e$. (efficiency of full employment)
- Firms set wages. Each firm pays wages that are just sufficient to induce worker effort: $w = \widehat{w}$.
- Firm-level labor demand is given by the solution to the condition $f'(N_i) = \widehat{w}$, and aggregate labor demand is given by the solution to the condition $F'(N) = \widehat{w}$.

1.3 Equilibrium

- Each firm, taking as given the wages and employment levels of other firms, finds it optimal to offer the going wage rather than an alternative wage
- Given that the ongoing wage is the efficiency wage $\widehat{w}$, $V_E^S \leq V_E^N$, and no worker shirks. V_E^N and V_U are determined in equilibrium by the system

$$\begin{aligned} rV_E^N &= w - e + \delta(V_U - V_E^N) \\ rV_U &= b + a(V_E^N - V_U), \end{aligned}$$

with solution

$$V_E^N = \frac{(a+r)(w-e) + \delta b}{r + a + \delta} \tag{2}$$

$$V_U = \frac{a(w-e) + (r+\delta)b}{r + a + \delta}. \tag{3}$$

- q has "disappeared" because no one shirks in equilibrium. But it still affects the wage:
- substituting (3) into (1) gives the aggregate no-shirking condition:

$$w \geq b + e + \frac{(a + r + \delta)e}{q} = \widehat{w}. \tag{4}$$

- 2 additional implications: $\widehat{w}$ increases with a and b.
- hardly surprising given that both a and b raise V_U

- In equilibrium a is endogenous: the inflow of workers into unemployment, δN, equals the outflow from unemployment, $a(L-N)$

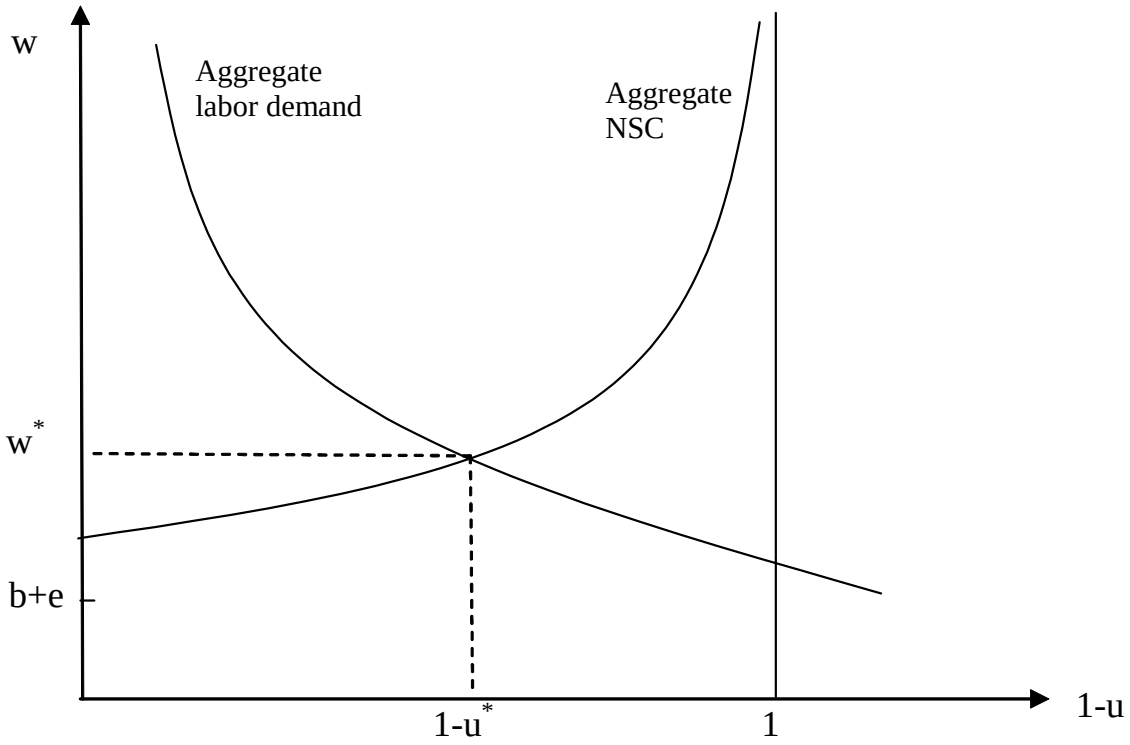
$$a = \frac{\delta N}{L-N} = \delta \frac{1-u}{u} \tag{5}$$

- Substituting (5) into (4) gives

$$w \geq b + e + \frac{e}{q}\left(\frac{\delta}{u} + r\right) \equiv \widehat{w}. \tag{6}$$

- $\widehat{w}$ falls with u (discipline device), and is not consistent with full employment (as $u \to 0$, $\widehat{w} \to \infty$).

- Equilibrium employment and wages can be solved for by combining the aggregate no-shirking condition (6) with the aggregate labor demand equation $F'(N) = \widehat{w}$.


w
Aggregate
labor demand
Aggregate
NSC
w*
b+e
1-u*
1
1-u

- This is a Nash equilibrium:
  - Firms have no incentive to raise wages (workers provide effort e, and firms can hire all labor they want at w^*); nor to lower wages (as lower wages imply shirking and losses)
  - Job seekers strictly prefer work to unemployment. Would be happy to work at w^* or lower, but cannot credibly commit not to shirk at $w < w^*$, and are thus not hired.
- Key results
  - involuntary unemployment
  - recessions raise unemployment (after an inward shift in labor demand, due to the NSC, wages cannot fall enough to compensate)
  - wage rigidity (wage cuts by individual firms will only become attractive as the unemployment pool gradually grows)

1.4 Welfare analysis

Equilibrium in the shirking model is not Pareto efficient. Sources of inefficiency:

- Each firm employs too few workers because it faces private cost of hiring w^* rather than the social cost $e < w^*$.
- There are also negative externalities: each hiring firm raises V_u for all other firms.
- The first effect dominates and unemployment is inefficiently high.

1.5 Conclusions

- With a simple and sensible set of assumptions (workers choose effort, firms cannot monitor them costlessly), this paper can potentially explain a key set of stylized facts that the competitive paradigm could not address.
- It became very influential and generated a huge literature
- It also introduced into labor economics a set of tools that feature prominently in job search models
- Drawback: individuals are "rational cheaters", and can only be motivated by carrot (wages) and stick (firing).
- Alternative efficiency wage models offer similar predictions but different assumptions on human behavior, e.g. Akerlof (1982) gift exchange model.

2 Evidence

- Efficiency wage models have proved very difficult to test and direct evidence for the central features of the theory is rare.
- Existing evidence comes from various sources

2.1 Economic incentives

2.1.1 Wages and effort

Cappelli and Chauvin (1991), "An interplant test of the efficiency wage hypothesis", *Quarterly Journal of Economics*.

- Test the hypothesis $\partial e/\partial \widehat{w} > 0$: do workers shirk less if they are better paid?
- Identification problem: higher wages could be both the cause or the result of higher effort (productivity).
- Strategy: large manufacturing company (United Auto Workers, 1982), adopting company-wide collective bargaining.

- Same wage package across plants - wages cannot be affected by productivity.
- But wage premia above local wages differ widely across plants.
- Findings: fewer disciplinary dismissals in plants located in low-wage areas.
- The wage-effort elasticity is positive.
- This is consistent with the shirking model, but not only with that one.
- Showing that incentives matter is not the same as validating the main claim of the shirking model, i.e. that imperfect information problem forces employers to offer wages strictly above outside option.
- Alternatives: incentive contracts may be negotiated with the union; competitive compensating differentials for jobs/employers that require different effort.

2.1.2 Wages and monitoring

Krueger (1991), "Ownership, agency and wages: a study of the fast-food industry", *Quarterly Journal of Economics*.

- Test the hypothesis $\partial \widehat{w}/\partial q < 0$: are monitoring and wages substitutes?
- Survey of fast food employers: stores selling identical goods, with different ownership structures.
- Franchisee-owned stores: closer monitoring, better information.
- Company-owned stores: more likely agency problems.

- Findings:
  - Higher wages and steeper wage-tenure profile (back-loaded compensation and bonding) at company-owned stores.
  - PDV of wage differences at company-owned versus franchise stores is \$1,250 for assistant managers and \$75 for full-time crew workers (1982\$)
    - shirking easier to detect for manual jobs, and more serious consequences for managerial jobs (more opportunity to exercise discretion).
  - Company-owned stores more likely to hire part-time workers above the minimum wage
  - Company-owned stores more generous with non-wage benefits
- Criticism: this is also consistent with "expense preference" of managers, i.e. managers making their life easier at expenses of company. Same implications as EW but not efficient pay.

2.2 Inter-industry wage differentials

Krueger and Summers (1988), "Efficiency wages and the interindustry wage structure", *Econometrica*.

- Evidence of persistent inter-industry wage differentials, which cannot be explained by usual controls included in wage equations.
- Evidence hard to reconcile with competitive wage determination; better explained by rent sharing in the presence of efficiency wage considerations.
- However: there are dissenting voices on inter-industry wage differentials (see e.g. Gibbons and Katz, RES 1992), and the link between inter-industry wage differentials and efficiency wage models is only an indirect one.

2.3 Case studies

Raff and Summers (1987), "Did Henry Ford Pay Efficiency Wages?", *Journal of Labor Economics*.

- Henry Ford introduced a 5$ a day min wage in 1914, doubling pay of most employees.
- Very valuable source of info in (labor) economics, though underexploited: asking business managers about their practices
- Ford (1922): "... no charity involved ... We wanted to pay these wages so that the business would be on a lasting foundation ... A low wage business is always insecure ... The payment of 5$ a day was one of the finest cost-cutting moves we ever made".

- Effects:
  - substantial queues for Ford jobs
  - significant increases in profits and productivity
- (although hard to fully attribute to 5$ a day policy)
- Convincing, direct evidence available on efficiency wages, although external validity of single case studies is problematic.

2.4 Norms, trust and effort

Fehr and Gachter (2002), "Do incentive contracts undermine voluntary cooperation?", WP 34, University of Zurich.

- Test hypothesis that explicit incentives may undermine voluntary cooperation, as viewed as a sign of distrust.
- Trust may elicit effort better than incentives when agents' norms include reciprocity and inequity aversion
- "You treat me well, I treat you well" (Akerlof 1982)
- "norms" best tested in experimental environment, which allows tight control of incentives

Set-up: buyers (principals) and sellers (agents)

- buyer offers take-it-or-leave-it contracts - specifying price p and desired quality $\widehat{q}$
- seller provides some level of quality q at stated price p
- one-shot deals - no individual reputation
- buyer's payoff: rising in q, falling in p
- seller's gain: rising in p, falling in effort required to deliver q, $c(q)$, with $c'(q) > 0$.
  $q^* =$ quality that maximizes seller's payoff.
- excess supply of sellers: sellers do not have power to hold up buyers for a contract

2 types of contract arrangement:

1. Trust Treatment (TT): no punishment if $q < \widehat{q}$
   - if seller only cares about p and $c(q)$ (selfish seller): $\widehat{q}$ is never enforceable.
2. Incentive Treatment (IT): punishment if $q < \widehat{q}$, provided shirking is verified, which happens with probability $s < 1$.
   - with selfish seller $\widehat{q}$ is enforceable with appropriate punishment design

With selfish sellers, TT is predicted to deliver lower quality than IT, so offer prices are likely to be lower in TT than in IT

Experiment:

- model is fully parameterized
  - functional forms for payoffs.
  - functional form for effort cost function $c(q)$
  - values for s and fine f in case of shirking
- In each treatment: 6 buyers and 8 sellers who play game described above.

Results of experiment:

- in TT, buyers offer on average higher prices and demand higher quality than in IT
- quality q and voluntary cooperation $q - q^*$ are lower in IT than in TT. $q - q^*$ almost zero in IT
- in TT, $q - q^*$ responds strongly to p. In IT there is no gradient
- total surplus is higher in TT than in IT, but buyer profits higher in (incentive compatible) IT
- problem re-framed using Bonus Treatment (BT): buyer pays seller a bonus if seller is detected not shirking. (same scope as IT, but bonus less hostile than punishment of IT)
  - under BT, cooperation larger than in IT, lower than in TT, and responds to p

- Results hard to reconcile with selfish seller behavior.
- Easier to reconcile with "social preferences", i.e. individual does not only care about the material resources allocated to her but also cares about the material resources allocated to relevant reference agents.
- Sources of social preferences
  - Reciprocity: "you treat me well, I treat you well". Two reciprocal players who meet will outperform two purely selfish players
  - Inequity aversion: sellers get direct disutility from outcomes that do not benefit both sides equally.

2.5 "Gift exchange": evidence from a field experiment

Gneezy and List (2006), "Putting behavioral economics to work: testing for gift exchange in labor markets using field experiments". *Econometrica* 74: 1365-1384.

- Evidence based on lab experiments may not be ideal to assess how real effort responds to treatment
- Choosing an effort level by circling a number on a form not the same as spending real effort in the labor market
- This is better replicated in field experiments
- Cold decision making (field experiments) versus hot decision making (lab environment)

The experiment (I):

- Undergraduate students invited to take part in an effort to computerize holdings of small library
- Job advertised as *one-time* work that would last 6 hours and pay $12 per hour.
- Participants not informed that they were taking part in an experiment
- 10 students assigned to 1st treatment (*noGift*): pay $12 per hour
- 9 students assigned to 2nd treatment (*Gift*): pay $20 per hour

The experiment (II):

- Undergraduate students invited to take part in a door to door fundraising for victims of natural hazards
- Job advertised as *one-time* work that would pay $10 per hour.
- Participants not informed that they were taking part in an experiment
- 10 students assigned to 1st treatment (*noGift*): pay $10 per hour
- 13 students assigned to 2nd treatment (*Gift*): pay $20 per hour
- why is experiment II different from I?

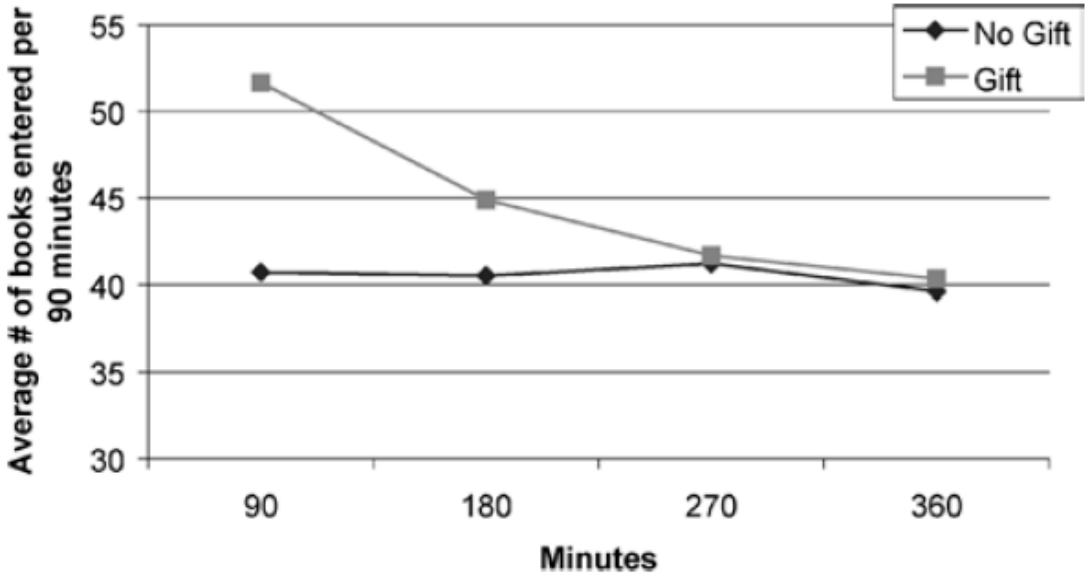


FIGURE 1.—Average books logged per time period.

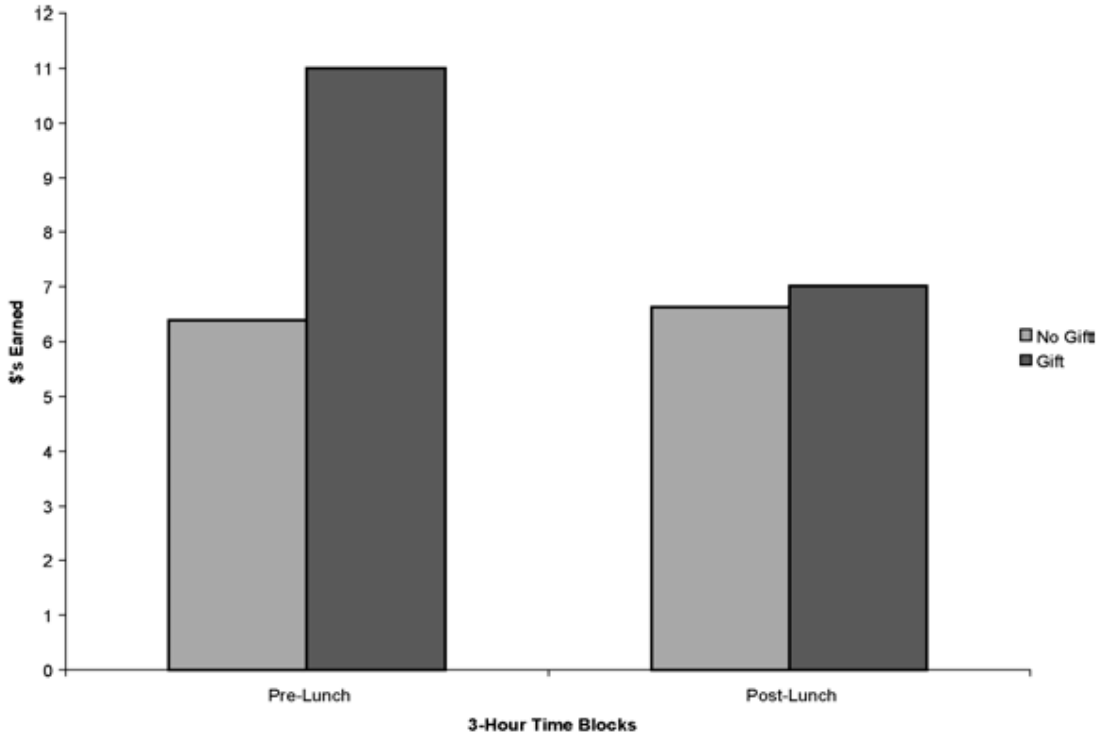


FIGURE 2.—Average earnings by 3-hour block.

Conclusions

- Higher wages reciprocated by higher effort, only during early hours of task.
- Later on effort spent under *Gift* or *noGift* treatment is equivalent
- care should be taken before making inference from laboratory experiments ("hot decision making"), to field environments ("cold decision making").
- gift exchange may differ in cases of *positive reciprocity* from cases of *negative reciprocity*

EC423 exam 2006, question 6

Assume that firms with imperfect monitoring technologies are paying efficiency wages to their workers in order to prevent shirking. Workers' utility function is

$$U(y, e) = y - e$$

where y represents income and e represents the cost of effort spent on the job. Workers earn wages w while employed and unemployment insurance b while unemployed. When employed, they may spend effort e or zero. If they spend zero effort, they are caught at Poisson rate q and fired. If fired, new job offers arrive at Poisson rate a. When employed, workers may also lose jobs for exogenous reasons at Poisson rate δ. Assume that workers are infinitely lived and maximize lifetime utility.

(a) Compute worker lifetime utility in alternative labour market states. Show that the wage that prevents shirking is

$$w \geq b + e + \frac{(a + r + \delta)e}{q} \qquad ((1))$$

where r denotes the discount rate (show the result intuitively, without need to compute each single step). Give intuition for condition (1).

(b) Show that in steady state the no-shirking condition becomes

$$w \geq b + e + \frac{e}{q}\left(\frac{\delta}{u} + r\right)$$

where u denotes the unemployment rate. Why is unemployment a "worker discipline device"?

(c) What kind of direct or indirect evidence (if any) could you provide in favour of efficiency wage models? Motivate your answer.