

ECON 5110 Class Notes
Shapiro and Stiglitz (1984)
“Equilibrium Unemployment as a Worker Discipline Device”

1 Introduction to Efficiency Wages

This is the seminal paper in the area of “efficiency wages”. The model can be used to explain

- involuntary unemployment.
- above market wages.
- shirking on the job.

The important idea is that above-market wages exist as an optimal, equilibrium response to imperfect monitoring and the incentive to shirk.

2 Model

2.1 Workers

There are N identical workers with utility function

$$U = w - e, \tag{1}$$

where w is the wage and e is effort. There are two effort choices: $e = 0$ or $e > 0$. When unemployed, a worker receives unemployment benefits \bar{w} and $e = 0$. When employed, a worker receives wage w and $e > 0$.

An employed worker may be exogenously separated from his job with probability b . Workers maximize lifetime utility that is discounted at rate r .

2.2 Effort Decision

Workers can choose $e = 0$ (to shirk) or $e > 0$ (to not shirk).

- If $e > 0$, the worker gets paid w .
- If $e = 0$

- and he does not get caught shirking (with probability $1 - q$), he gets paid w .
- and he gets caught shirking (with probability q), he gets fired and receives \bar{w} .

The first-order condition for a shirker is

$$rV_E^S = w + (b + q)(V_u - V_E^S) \quad (2)$$

while for a non-shirker it is

$$rV_E^N = w - e + b(V_u - V_E^N), \quad (3)$$

where V_E^S , V_E^N and V_u are the discounted, expected lifetime utility for a shirker, non-shirker and unemployed person, respectively. Solving for V_E^S and V_E^N gives

$$V_E^S = \frac{w + (b + q)V_u}{r + b + q} \quad (4)$$

and

$$V_E^N = \frac{(w - e) + bV_u}{r + b}. \quad (5)$$

Workers will shirk unless $V_E^N > V_E^S$. The no-shirking constraint (NSC) is therefore

$$w \geq rV_u + (r + b + q)e/q = \hat{w}. \quad (6)$$

The NSC can also be written as

$$q(V_E^S - V_u) \geq e, \quad (7)$$

which implies that unless $V_E^S > V_u$ and there is a penalty involved with shirking, everyone would shirk.

The critical wage (\hat{w}) is increasing in

- effort (e)
- lifetime utility of unemployment (V_u)
- probability of not being caught ($1 - q$)
- discount rate (r)
- exogenous quit rate (b).

2.3 Employers

There are M identical firms with production function

$$Q_i = f(L_i) \tag{8}$$

where L_i is effective labor. Assume that

$$F'(N) > e \tag{9}$$

so that full employment is efficient. Firms offer workers a compensation package $(w = \hat{w}, \bar{w})$, where \bar{w} is the legal minimum set by law. Assuming for simplicity that $\bar{w} = 0$, the aggregate labor demand curve is

$$w = F'(L). \tag{10}$$

2.4 Market Equilibrium

The first-order condition for unemployment is

$$rV_u = \bar{w} + a(V_E - V_u) \tag{11}$$

where a is the job-aquisition rate. Solving (5) and (11) simultaneously gives

$$rV_E = \frac{(w - e)(a + r) + \bar{w}b}{a + b + r} \tag{12}$$

and

$$rV_u = \frac{(w - e)a + \bar{w}(b + r)}{a + b + r}. \tag{13}$$

Substituting (13) into the NSC gives

$$w \geq \bar{w} + e + e(a + b + r)/q = \hat{w}. \tag{14}$$

We can remove a by noting that in the steady state, we must have

$$bL = a(N - L). \tag{15}$$

Solving for a , and substituting into (14) gives the NSC

$$w \geq \bar{w} + e + (e/q)(b/u + r) = \hat{w} \quad (16)$$

where $u = (N - L)/N$ is the unemployment rate. The market equilibrium is found by equating NSC with the demand for labor to give

$$F'(L) = \bar{w} + e + (e/q)(b/u + r) \quad (17)$$

as shown in Figure 2. Unemployment is involuntary but lowering the wage is not an option because workers cannot make credible promises not to shirk.

2.5 Comparative Statics

Using Figure 2, we can consider the effects of changes in

- the quit rate (b)
- the monitoring intensity (q)
- the level of unemployment compensation (\bar{w})
- technology shocks (i.e., shifts in $F'(N)$)

2.6 Welfare Analysis

The decentralized unemployment equilibrium above is sub-optimal. The central planner's problem with $\bar{w} = 0$ is to choose w and L to maximize

$$(w - e)L \quad (18)$$

subject to the NSC

$$w \geq e + (e/q)(b/u + r) = \hat{w} \quad (19)$$

and the resource constraint

$$wL \leq F(L). \quad (20)$$

The optimum occurs where the average product of labor (APL) is set equal to the NSC (\hat{w}). This results in less unemployment than the decentralized equilibrium and a higher wage.

The centralized Pareto optimum could be reached by a tax on profits that can be used to finance a wage subsidy (τ). See Figure 4.

The decentralized equilibrium is inefficient because

- each firm sees the private cost of hiring another worker as w when the social cost is e (higher too few workers).
- each firm fails to recognize that hiring another worker reduces u and therefore makes it more attractive to shirk (hire too many workers).

The former effect outweighs the latter so that equilibrium unemployment is too high in this model.

3 Extensions

- Endogenous Monitoring
- Risk Aversion
- Endogenous Turnover

4 Alternative Enforcement Mechanisms

- Performance Bonds
- Other Costs of Dismissal
- Heterogeneous Workers

5 Summary

This paper presents a model where unemployment (through above-market wages) serves as a worker discipline device. However, the decentralized equilibrium is not generally efficient – firms don't recognize how their level of monitoring and wages impact other firms. Government intervention in the form of a subsidy on wages can improve efficiency.