Efficiency wages and union–firm bargaining

Gaia Garino*, Christopher Martin

*Corresponding author. Tel.: +44-189-5718-357; fax: +44-189-5203-384.
E-mail address: gaia.garino@brunel.ac.uk (G. Garino).

Department of Economics and Finance, Brunel University, Uxbridge UB8 3PH, UK

Received 19 July 1999; accepted 25 April 2000

Abstract

This paper combines the efficiency wage and union–firm bargaining approaches to wage determination to produce a unified model that leads to higher wages, confirming an original insight of Summers (Am. Econom. Rev. 78 (1988) 383). Increases in monopoly power on the goods market also have a stronger impact on wages when there are efficiency wage effects, but the proportional effect of bargaining and market power on the wage is independent of the proportional effect of efficiency wages. We also find that efficiency wage effects alter the form of the labour demand curve to make it backward bending. © 2000 Elsevier Science S.A. All rights reserved.

Keywords: Wages, Bargaining, Unions, Efficiency wages

JEL classification: E3; F4

Union–firm bargaining and efficiency wages are the two main non-competitive theories of the real wage; regarded as substitutes by most economists. Union–firm bargaining is commonly used to analyse European labour markets while efficiency wages are used for less unionised US markets. However, these theories provide very different accounts of wage determination so that, following Summers (1988), it might be more natural to regard them as complements rather than substitutes: “in any plausible bargaining environment [...] efficiency wages [...] make it easier to extract concessions” (Summers, 1988, p. 386). This approach is supported by empirical evidence of efficiency wages (Layard et al., 1991; Levine, 1992; Campbell, 1993; Konings and Walsh, 1994) coming from both unionised and non-unionised labour markets. Despite the advocacy of Summers, there have been few attempts to combine efficiency wages and wage bargaining theory. Existing models (Lindbeck and Snower, 1991; Sanfey, 1993; Romer, 1996) can appear complex and lack intuitive appeal. More fundamentally, Summer’s insight that efficiency wages and unionisation are mutually reinforcing has been questioned. Lindbeck and Snower (1991) find that “the greater [...] [is]... bargaining strength,
the less incentive . . . [firms] . . . have to drive up the wage due to efficiency-wage considerations” (Lindbeck and Snower, 1991, pp. 193–196, emphasis added). In this paper we present a simple model that combines union–firm bargaining and efficiency wages. In accordance with Summers, we find that efficiency wage and union–firm bargaining theories are mutually reinforcing, i.e., the ability of workers to extract higher wages from firms can be significantly higher when efficiency wage effects are in place. The intuition is straightforward: as efficiency wages offset the cost of higher wages through higher productivity or lower turnover, they make profits less sensitive to the wage, which may induce firms to make more concessions in wage bargains. This results in higher wages. Similarly, we show that monopoly power on the goods market has a stronger effect on wages when there are efficiency wage effects: higher wages generate more output which — *ceteris paribus* — is more valuable to firms with market power, where the mark-up of price over costs is high. These firms can then make more concessions to their workers, which again leads to higher wages. The proportion by which union–firm bargaining and/or market power increases the wage is, however, independent of the proportion by which efficiency wage effects increase the wage. Finally, we show that efficiency wages alter the form of labour demand. A wage rise increases the marginal cost of labour, reducing employment; but with efficiency wages a higher wage also increases the marginal product of labour, tending to increase employment. As a result, labour demand is less elastic when there are efficiency wage effects. Indeed, we find that the second effect dominates when wages are low, so that the labour demand curve slopes up and becomes backward-bending.

1. The model

We consider wage determination at the firm level. The production function is \( Y = A(EN)^\alpha \), \((0 < \alpha < 1)\), where \( N \) is employment, \( E \) effort per worker and \( A \) captures all other factors that influence output. The firm faces a demand function \( Y = Y(P) \), where \( P \) is output price with constant elasticity of demand \( \varphi \). Effort supplied by workers is a function of the wage paid by the firm, \( W \), relative to the wage workers expect to earn on the general labour market, \( W^0 \). Following Summers (1988) we assume \( E = (W - W^0 / W^0) \beta \), \((\beta < 1)\); the elasticity of effort with respect to the wage is then \( \varepsilon = (\beta W / W - W^0) \). Wages are determined by negotiations between the firm and a union with utility function \( U = (W - W^0)N \). The firm then chooses employment, output and price. Assuming an asymmetric Nash bargain the wage is chosen to maximise \( U^\gamma \pi^{1-\gamma} \), where \( \pi \) is profit and \( \gamma \) is the union’s relative bargaining power. The interior first order condition is:

\[
\frac{W}{W - W^0} = \lambda + \frac{1 - \gamma}{\gamma} \eta
\]

(1)

where \( \eta = - (W\pi_w / \pi) \) and \( \lambda = - (WN_w / N) \) are the elasticities with respect to the wage of profits and employment, respectively (Manning, 1993). We then show that:

\[
\eta = \frac{\alpha}{m - \alpha} (1 - \varepsilon)
\]

(2)

\[
\lambda = \frac{m - \alpha \varepsilon}{m - \alpha}
\]

(3)
where \( m = 1/(1 - 1/\varphi) \) is the mark-up of price over marginal cost. Using (2), (3) and \( \varepsilon = \beta W / W - W^0 \) in (1) we obtain:

\[
W = \mu W^0; \quad \mu = \frac{\gamma m + (1 - \gamma)\alpha}{\alpha(1 - \beta)}
\]  
(4)

The wage is set as a mark-up \( \mu \) over the outside wage, where \( \mu \) is increasing in the strength of efficiency wage effects, \( \beta \); union bargaining power, \( \gamma \);\(^1\) and the mark-up of price over marginal cost, \( m \).

2. Discussion

If there are no efficiency wage effects (\( \beta = 0 \)) the wage is:

\[
W = \mu^{UB} W^0; \quad \mu^{UB} = \frac{\gamma m + (1 - \gamma)\alpha}{\alpha}
\]  
(5)

giving a standard wage bargaining model, where the wage mark-up is an increasing function of the mark-up of price over marginal cost and of union bargaining power.\(^2\) If the firm determines the wage unilaterally (\( \gamma = 0 \)) the wage is:

\[
W = \mu^{EW} W^0; \quad \mu^{EW} = \frac{1}{1 - \beta}
\]  
(6)

giving a pure efficiency wage model.\(^3\) This is in contrast to the earlier models that sought to unify efficiency wages and union–firm bargaining (e.g., Sanfey, 1993) but did not satisfy the Solow Condition.\(^4\) We then consider Summer’s conjecture that the wage is higher when efficiency wages and union–firm bargaining models are combined. Eqs. (4), (5) and (6) imply:

\[
\mu = \mu^{UB} \mu^{EW}
\]  
(7)

i.e., the wage mark-up in our composite model is simply the product of the mark-ups from its constituent parts. Four results can be drawn from (1)–(7):

(i) Wages can be higher when efficiency wages and union–firm bargaining co-exist: the marginal impact of union bargaining power on the wage,

\[^1\text{As}\]

\[
m - \alpha = \frac{(1 - \alpha + \alpha/\varphi)}{(1 - 1/\varphi)} > 0.
\]

\[^2\text{Romer (1996) has a model that combines efficiency wages and bargaining which is a useful illustration, but assumes that unions care only about the wage, implying employment is driven towards zero and wages are driven to infinity as \( \gamma \) increases.}\]

\[^3\text{Eq. (6) is also obtained by applying the Solow Condition (Solow, 1979) that at a maximum \( \varepsilon = 1 \) to the effort function.}\]

\[^4\text{These models use effort functions of the form } E = (W/W^0)^{\varepsilon}; \text{ where } \varepsilon = \beta; \text{ so the Solow Condition cannot be satisfied except where } \beta = 1, \text{ in which case the wage is indeterminate.}\]
is positive and increasing in $\beta$; while from (2) and

$$v = \frac{\beta W}{W - W^0},$$

efficiency wage effects make profits less sensitive to the wage. Higher wage costs are offset by higher output, so the reduction in profits is lower, which makes firms more willing to make concessions in the wage bargain.

(ii) In a pure efficiency wage model firms minimise labour costs irrespective of conditions on the goods market; but here the marginal impact of monopoly power on the wage,

$$\mu_m = \frac{\gamma}{\alpha(1 - \beta)},$$
is positive and increasing in $\beta$. So monopoly power has a greater impact when efficiency wage effects are stronger. From conventional wage bargaining theory monopoly power increases wages by increasing the surplus available to be divided between workers and firms. With efficiency wages there is an additional effect: increased output generated by higher wages is more valuable to the firm when the price-cost mark-up is higher, hence the cost of conceding higher wages for more monopolistic firms is lower.

(iii) Union–firm bargaining and goods market power have therefore a larger impact on wages when efficiency wages are stronger: $\mu = \mu^\text{UB} + \mu^\text{EW}$ where

$$\mu_{\beta} = \frac{(1 - \alpha + \alpha/\varphi)}{\alpha(1 - \beta)^2(1 - 1/\varphi)} > 0, \quad \mu_{m\beta} = \frac{\gamma}{\alpha(1 - \beta)^2} > 0;$$

but from (7) $\mu^\text{UB}$ and $\mu^\text{EW}$ are independent of $\beta$ and of $\gamma$, $m$, respectively. Hence in a baseline model the magnitude of the efficiency wage parameter has no impact on the proportion by which bargaining and/or market power raise the equilibrium wage; similarly, the strength of bargaining and/or market power does not affect the proportional impact of efficiency wages on the equilibrium wage. In this sense, we find no interesting interactions between efficiency wage and union–firm bargaining effects (although, of course, this may be due to the specific parametrisations we have chosen to use).

(iv) Efficiency wages reduce the elasticity of labour demand, thus improving the trade-off between jobs and wages facing the union: from (3) and $v = (\beta W/W - W^0)$, labour demand is vertical where $W = [W^0/1 - (\alpha \beta/m)]$, and slopes upwards when the wage is lower than this. Overall, therefore, the labour demand curve in our example is backward-bending. The intuition is as follows: when wages rise, both marginal revenue and marginal cost increase. Since effort is highly wage-

---

1. The wages implied by (4) and (6) are both on the downward-sloping portion of the labour demand curve.
2. This possibility was noted by Weiss (1990) but has not been analysed in detail since the labour demand curve is irrelevant in pure efficiency wage models.
responsive when wages are close to the outside wage, a wage rise increases marginal revenue more than marginal cost and thus leads to higher employment when wages are low. When wages are high, by contrast, effort is relatively unresponsive to the wage, so higher wages increase marginal cost more than marginal revenue and thus result in lower employment.

References