

Efficiency Wages and Local Wage Bargaining*

Joan Muysken and Tom van Veen

University of Limburg, NL-6200 MD Maastricht, The Netherlands

Abstract

In the literature on wage drift, it is often argued that strikes or work-to-rule practices are used to force employers to pay a wage rate that exceeds the contract wage. Here, we introduce the efficiency wage argument as a foundation for bargaining about wage drift. Contrary to the view in most bargaining models, where firms and unions struggle to divide a fixed pie, given employment, we take the relation between wages and revenues explicitly into account. The implications for wages and employment appear to differ, not only with respect to the order of magnitude, but also in a qualitative sense.

I. Introduction

In most European countries, wage levels are not determined solely by wage bargaining between a firm (employer) and employees. Often, there is a contract wage, resulting from negotiations between national or industry unions and employers federations. Within the firm, (firm) unions or individuals bargain about a markup on the contract wage — wage drift.

In this paper we incorporate efficiency wages into a local bargaining model. Our model is based on Moene (1988) and Holden (1988). In their models the scope for wage bargaining at the firm level follows from the threat of strikes and go-slow actions from employees. We argue that an alternative motivation can be provided by efficiency wage theory. In that case, revenues are no longer independent of the distribution between wages and profits and this, in turn, has interesting repercussions on employment.

The paper is organized as follows. In Section II, we show how an efficiency wage argument changes the setup and the analyses of the Moene/ Holden model. The consequences for both wages and employment are also discussed. In Section III we compare both models and end with some concluding remarks.

* We would like to thank Peter de Gijzel, Hans Peters, Erik de Regt and two anonymous referees for their comments on an earlier version of this paper. Of course, the usual disclaimer applies. An extended version of this article is Muysken and van Veen (1993).

II. An Efficiency Wage Based Model of Local Bargaining

Holden's (1988) aim was to analyze local and central wage bargaining within a single framework. In his model, two levels of negotiation are involved, while wage and employment determination consists of three stages. In the first stage a tariff wage is set or negotiated by the central union, according to some kind of bargaining model (central level). Next, firms set employment (local level). Finally, firms and local unions bargain about wage drift, given this employment level. The model has two characteristic features. First, employment is set before bargaining about wage drift takes place. Second, all parties have full information about each other's positions.

Our model is related to that of Holden: it has a similar setup in which both central and local wage bargaining exist. However, whereas Moene and Holden focused on the threat of industrial conflicts, we use an efficiency wage foundation for the explanation of wage drift. We begin our analysis with the final stage: the wage-drift bargaining process. We derive the wage rate while employment is given, i.e., the bargained wage function. We then discuss the determination of employment and wages simultaneously.

Determination of the Wage Employment Function at the Local Level

As in the Moene/Holden model, the result of the local bargaining process is assumed to be the outcome of the asymmetric Nash bargaining model. Employers strive for maximization of profits above a threshold π_{\min} , and workers maximize the difference between the final wage w and the threshold wage. We assume that the threshold wage is equal to the tariff wage bargained at the central level q . Employers have set employment at L , after which wage bargaining starts at the local level. The parameter c indicates the bargaining power of the employers. Hence, the problem can be defined as follows:

$$\text{Max}_w [\pi(w, L) - \pi_{\min}(L)]^c (w - q)^{1-c} \quad 0 \leq c \leq 1 \quad (1)$$

with

$$\pi(w, L) = R[e(w)L] - wL \geq \pi_{\min}(L) \quad \text{and} \quad w \geq q \quad (2a)$$

$$\pi_{\min}(L) = \pi(q, L) = R[e(q)L] - qL. \quad (2b)$$

Effort e is assumed to depend on the wage rate, such that $e' > 0$ and $e'' < 0$ above some minimal level of effort $e(s)$, while the tariff wage q ensures at least this minimum level, i.e., $q > s$. Moreover we assume $e'(q) > e(q)/q$ (we elaborate on this assumption in Section III). The production function R is

assumed to be well behaved. The minimum profit level, π_{\min} , is defined as the level corresponding to the effort that prevails when the tariff wage is paid. This is the minimum level since, in case of disagreement, workers will decrease their effort to some minimum level, $e(q)$, corresponding to the wage q that will be reached in this situation.

The difference between our setup and the Moene/Holden model is that now total revenue depends not only on employment, but also on wages. Because of the positive relation between the revenue of the firm and the effort of the employees, firms may be willing to pay a wage that lies above the tariff (threshold) wage.

Given employment, wages are set such that (1) is maximized with respect to (2). A necessary condition for the unconstrained maximum is:

$$c \left[\frac{\pi(w, L) - \pi_{\min}(L)}{w - q} \right]^{r-1} (R'[e(w)L]e'(w) - 1)L + (1 - c) \times \left[\frac{\pi(w, L) - \pi_{\min}(L)}{w - q} \right]^r = 0. \tag{3}$$

However, the constraints should be taken into account. It can easily be seen that when starting from q , an increase in wages leads to an increase in profits, wage drift will always result in our model; see also Hoel (1989). Thus we will find $w > q$. However if, when starting from q , an increase in wages leads to a decrease in profits, the employers will set the wage at q and accept the minimum level of profits. Hence local bargaining will not lead to any change in the central bargaining result, given the level of employment. However, as will be explained below, employers will always set employment such that $w > q$ holds.

When employers have all the power, $c = 1$, we see from (3) that the wage is set at a level w_1 , such that

$$R'[e(w)L]e'(w) = 1 \tag{4}$$

holds given L . Equation (4) is the wage offer curve which shows the wage rate that maximizes profits at a given level of employment. Any increase in wages above w_1 will lead to a lower profit, given L .

It is obvious that when employees have more bargaining power, a higher wage will result at the expense of a lower profit. Thus, when the employees have full bargaining power, wages will be such that employers are left with the minimum profit. Hence when $c = 0$, the wage rate is set at a level w_0 which yields minimum profits. Then:¹

¹ Note that equation (5) does not result from substituting $c = 0$ in (3), but from the constraint to the maximization problem: $\pi(w, L) \geq \pi_{\min}(L)$.

$$R[e(w)L] - wL = R[e(q)L] - qL \quad (5)$$

holds. And we find $q < w_1 < w_0$.

When looking at the solution of equation (3) in more general terms, it can easily be shown that total wages and profits equal their minimum level plus a markup.² The markup is proportional to the difference between the revenue when a wage w will be paid, and the revenue associated with an effort when the wage equals q . Further we note that wages depend on c , the bargaining power. The higher the bargaining power of the employers, the lower wages will be at a given level of employment. Finally, the bargaining setup implies that $w > q$, hence wage drift occurs at a given level of employment.

Determination of Employment and Wages

Before entering the local bargaining process on wages, employers will set employment such that profits are maximized, taking into account the repercussions on the wage rate according to equation (3).

When employers have full bargaining power, they will set the wage rate and level of employment such that both are consistent with profit maximization. The profit maximizing demand for labor at a given wage rate, L_1 , is such that:

$$R'[e(w)L]e(w) = w \quad (6)$$

holds. Equation (6) is the demand curve for labor. As before, in the case of full bargaining power, employers will set wages according to (4). Combining equations (4) and (6) then yields the optimal combination of wages and employment: w^* and L^* , respectively. In this case the Solow condition holds, i.e., the wage rate w^* is determined by $w^*e'(w^*) = e(w^*)$. And L^* results from substituting w^* in equation (6). The assumption $e'(q) > e(q)/q$ ensures that $w^* > q$.

This situation is depicted in Figure 1, which shows the wage offer curve and the demand curve for labor, equations (4) and (6), respectively. The (local) concavity assumptions of the functions R and e guarantee that the wage offer curve (4) is downward sloping. It can also be shown that the demand curve for labor (6) is downward sloping around w^* and intersects

²For wages, this results in the bargained real wage curve:

$$w = q + \frac{1-c}{1-\alpha c} \frac{R[e(w)L] - R[e(q)L]}{L}$$

with $0 < \alpha = R'[e(w)L]e'(w) \leq 1$. A similar relation can be found for profits.

the wage offer curve from above in w^* ; cf. point P in the figure. However, the demand curve for labor is only downward sloping until some wage w_- below w^* . At still lower wages it is upward sloping. In the figure, the tariff wage q is assumed to be set above w_- ; hence it is consistent with the downward sloping part of the demand curve for labor. (The other case is discussed at the end of this section.)

We have also drawn isoprofit curves in the figure. In an efficiency wage framework, isoprofit curves are ellipses, since two wage levels yield the same level of profit, given employment.³ Note that the closer the isoprofit curve is to w^* , the higher the level of profit is.

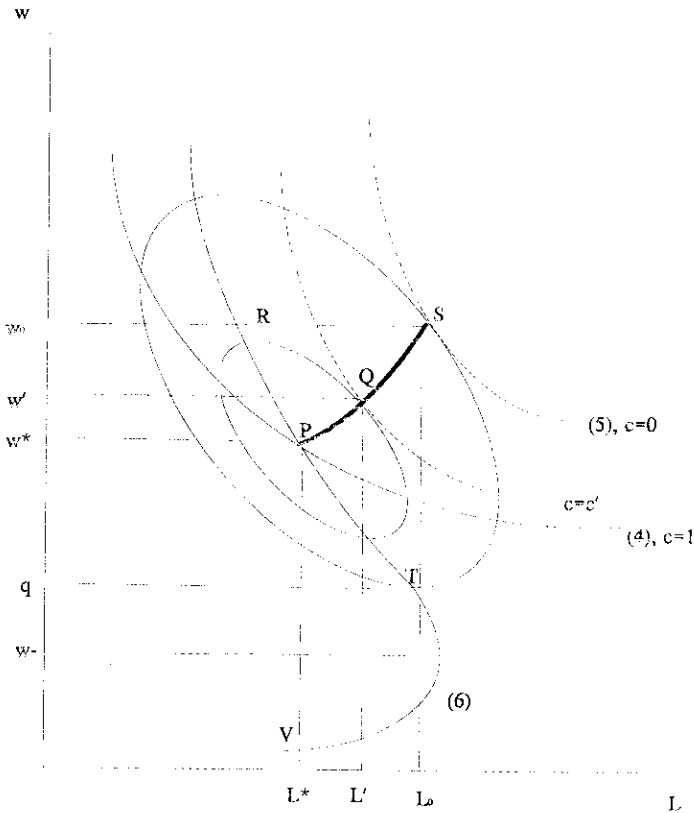


Fig. 1. Wages, employment and profits in the efficiency wage model.

³By definition both the maximum and the minimum of these ellipses with respect to the L and w axis, respectively, lie on the demand curve for labor (6) and the wage offer curve (4), respectively.

Our results imply that if employees gain bargaining power (c decreases), both wages and employment increase. This may be elaborated on in a few steps. From our discussion above it is obvious that when employers have full bargaining power ($c = 1$), they will set wages and employment according to the Solow condition; cf. point P in Figure 1. That is, w^* and L^* will result. On the other hand, when employees have full bargaining power ($c = 0$), employers will only get the minimum acceptable level of profits. This level π_{\min} is defined in (2b) and varies with employment.

It is obvious then that when the employers have no bargaining power, they will set employment such that π_{\min} will be maximized — we denote the resulting employment by L_0 . From equations (2b) and (6) it follows that

$$R'[e(q)L_0]e(q) = q \quad (7)$$

should hold.

In Figure 1 the minimum level of profits is maximal at $\pi_{\min}^1 = \pi_{\min}(L_0)$ in point T on the demand curve for labor, and consequently L_0 is the corresponding level of employment. It is obvious that $L_0 > L^*$ when $w - < q < w^*$, which is assumed to be the case in Figure 1.

However, since employees have full bargaining power at employment L_0 , a wage will be paid that is much higher than the tariff wage and also higher than w^* . This wage, w_0 , can be found by substituting L_0 in equation (5).⁴ In Figure 1 this corresponds to the highest wage consistent with profits π_{\min}^1 and employment L_0 , which is point S. The bargained wage curve at $c = 0$ is defined by (5).⁵ This curve is tangent to the isoprofit curve of π_{\min}^1 at point S. Hence at this point employers also maximize their profits.

A similar result is obtained when bargaining power is $c' < 1$. Then employers set employment at the point of tangency O between the bargained wage curve at c' and the isoprofit line. The corresponding level of employment is L' , and the wage outcome will be w' . Next, by combining all points of tangency of the isoprofit curves and the bargained wage curves, we find the curve PQS. Hence, employers are forced to a point off the demand for labor curve PR.⁶ It is now also obvious that employers will set employment such that $w \geq w^* > q$, as indicated earlier.

In Figure 1 we assume that $w - < q$ holds. However, this is not necessarily the case. It is obvious that wage drift will always occur when $q < w^*$,

⁴ Since $q < w^*$, there exists a wage rate $w^* > q$ at which profits are maximal given L_0 ; cf. (4). That is, given L_0 profits will increase when the wage increases from q to w^* and will decrease to π_{\min}^1 when wages increase further to w_0 .

⁵ It can easily be shown that this curve is downward sloping — at least above and around point S — and lies above equation (4) in Figure 1.

⁶ Note that this result stems from the assumption that employment is determined before wages and is not caused by the efficiency wage argument; see also Holden (1988) and Muysken and van Veen (1993).

hence also when $q < w_{--}$. It is only when q is set far enough below w_{--} , i.e., below the level at point V in Figure 1 — that L_0 will lie to the left of L^* . In that case an increase in employers' power will lead to an increase in wages on the one hand, but a decrease in employment on the other.

At first sight the result that when employers' power decreases, both employment and wages will increase may seem somewhat counterintuitive. However, this occurs at a given level of the tariff wage. If the tariff wage is higher when employees' power at the central level increases, which seems a plausible notion, employment will be lower — this follows immediately from Figure 1. Hence a negative tradeoff exists between the tariff wage and employment at the central level. Such a tradeoff is highly plausible and it will counteract the increase in employment at the decentralized level.

III. Evaluation of the Model and Concluding Remarks

A drawback of the Moene/Holden type of models is the exogeneity of disagreement. We have developed a modification of this point by replacing the exogenous notion of minimum profits, due to slowdown activities or strikes in case of disagreement, by the notion of efficiency wages. Provided that the contract wage sets the minimum level of wages, the effort consistent with that wage then defines the minimum level of profits in a natural way. Wage drift results automatically at a certain level, because initially both employers and employees have incentives to increase wages above the contract wage. Further, wage drift will be higher, the greater the employees' bargaining power. The resulting effort of employees will also be higher, which expresses their satisfaction with the bargained wage. Contrary to the models used by Moene and Holden, we no longer need an exogenous factor to explain (dis)satisfaction. This comes naturally, once efficiency wages are assumed.

When we compare the results of our model with those of Holden, two striking differences can be observed. First, in the Holden model, employment increases when the power of employers increases, whereas in our model the opposite occurs (as long as the tariff wage is above point V in Figure 1). The dissimilar development of employment results from a different reaction to the wage decreases that correspond to greater bargaining power of employers. In Holden's model, these wage decreases allow for higher profits at a higher level of employment. However, in our efficiency wage model there is one combination of employment and wages that results in maximum profit in an absolute sense — which is, of course, defined by the Solow condition. Whenever employers have less than full bargaining power, the actual wage/employment combination will deviate from the optimal one and both wages and employment will be at a higher

level than the optimal level. Hence, when employers gain bargaining power, both wages and employment will decrease.⁷

The second difference concerns wage drift. Assuming that the tariff wage is set such that it is lower than w^* , employers will set the wage at w^* when they have full bargaining power. Hence, wage drift will occur in our model, even when employers have full bargaining power. In the Moene/ Holden type of model, wage drift is zero in the latter case. A related difference between the Moene/ Holden model and the efficiency wage model lies in the motivation of wage drift. In the Moene/ Holden model, wage drift occurs independent of q , due to exogenous dissatisfaction. In the efficiency wage model, however, wage drift depends on the difference between the bargained wage and the tariff wage. There is a negative relation between the tariff wage and wage drift because the higher the tariff wage, the higher the minimum acceptable level of profits.⁸ Hence there is less scope for wage drift results.

Our model provides a framework for the analysis of efficiency wages in a two-tier wage bargaining system, but it should be kept in mind that the way the incentive structure is modelled is important. Two observations are relevant in this respect.

First, we have assumed that $e'(q) > e(q)/q$ holds once the tariff wage is determined — this obviously restricts the incentive structure.⁹ As we have seen, this assumption implies $w^* > q$. When $q \geq w^*$, the outcome of the bargaining process will always be a wage rate at q — and the corresponding employment is found on the demand curve for labor (4). In this case bargaining about wage drift makes no sense since wage drift will not occur, regardless of how great the employees' power is. Therefore it is reasonable to assume that the efficiency wage structure satisfies $e'(q) > e(q)/q$ when analyzing wage drift.¹⁰

A second observation can be made on the basis of Moene *et al.* (1992), who also incorporated efficiency wages into a model with central and local

⁷Note that this result only refers to wage drift, given a certain contract wage. Moreover, it is a partial equilibrium result and does not imply that unemployment will be solved by increasing the bargaining power of the unions.

⁸This is also found in empirical analyses. See e.g. Driehuis (1975) and Lever (1993) who found a negative relation between the contract wage and wage drift for the Netherlands for the periods 1953-72 and 1972-83, respectively.

⁹In this respect it should also be noted that one of the effort-inducing mechanisms behind efficiency wages may require unemployment in equilibrium.

¹⁰An additional argument is that the wage rate $q > w^*$ can be suboptimal for employers since they no longer have the opportunity to increase the wage rate in order to gain higher profits. Moreover, by accepting a wage rate below w^* at the central level, employees create an opportunity to end up with both a wage rate above w^* and higher employment. Therefore it seems reasonable to assume $q < w^*$.

wage bargaining. However, contrary to our setup, where unions aim at maximal wages while ignoring the costs of effort, Moene *et al.* assumed that the utility of the union consists of wages minus the costs of effort for employees. The latter is an increasing function of effort, and effort is also subject to bargaining. Moene *et al.* showed that the optimal level of effort is determined in such a way that marginal revenues of increasing effort for the firm equal marginal costs of increasing effort for the union. Consequently, contrary to our findings, they concluded that the equilibrium level of effort is independent of the bargaining power. This result holds regardless of whether wage bargaining is fully decentralized or whether wages are determined in a two-tier system. Hence, the way the incentive structure is modeled is relevant in these efficiency wage models.

Some remaining problems with Holden's model are not solved by our model. The major problem is that the tariff wage q is determined outside the firm — it is determined at the central level. However, it is not clear how the tariff wage is set. Unions must have some kind of utility function with wages and employment as arguments. Moreover, in equilibrium, there is a negative relation between the tariff wage and employment — this result is found in both models. Hence, in setting the tariff wage, the central union must trade wages against employment. Solving this problem is a question for further research.

References

- Driehuis, W.: Inflation, wage bargaining, wage policy and production structure: Theory and empirical results for the Netherlands. *De Economist* 123 (4), 638–79, 1975.
- Hoel, M.: Efficiency wages and local versus central wage bargaining. *Economics Letters* 30, 175–9, 1989.
- Holden, S.: Local and central wage bargaining. *Scandinavian Journal of Economics* 90 (1), 93–9, 1988.
- Holmlund, B.: Centralized wage setting, wage drift and stabilization policies under trade unionism. *Oxford Economic Papers* 38, 243–58, 1986.
- Lever, M. H. C.: *Union Wage Formation and (Un)employment*. Ph.D. thesis, University of Limburg, 1993.
- Moene, K. O.: Unions' threats and wage determination. *Economic Journal* 98, 471–83, June, 1988.
- Moene, K. O., Wallerstein, M. and Hoel, M.: Bargaining structure and economic performance. *Memorandum from Department of Economics*, University of Oslo, 1992.
- Muysken, J. and van Veen, T.: Efficiency wages and local wage bargaining. *Research Memorandum* RM 93-035, Faculty of Economics, University of Limburg, 1993.
- Rødseth, A.: Efficiency wages and local versus central bargaining. *Oxford Economic Papers* 45, 470–81, 1993.

First version submitted July 1993;
final version received June 1995.