The Open Shop Union, Wages and Management Opposition.

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No. 332

November 1989

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Warwick Economic Research Paper no. 332
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Coventry, UK

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I Introduction

The purpose of this paper is to develop a theoretical model in which the level of union membership and the union wage mark-up are determined endogenously. This contrasts with most of the recent work on the economic theory of the trade union which has assumed a union closed shop and then focussed on the union objective function and the bargaining framework. We would argue that the empirical evidence on the pattern of union density across establishments, in the UK at least, indicates the importance of explaining the existence of the open shop, where union membership exists but can be less than 100% of the workforce. For example, Millward and Stevens (1986) in their report on the 1984 Workplace Industrial Relations Survey show that union density is at some intermediate level in as many as 50% of all private sector establishments. A closed shop is present in fewer than half the establishments in which union members are present. Furthermore, it is likely that the ability of the union to obtain a wage mark-up will depend, amongst other things, upon the level of union membership and the associated bargaining arrangements in the establishment.[1] This underlines the need to explain the determinants of density in analysing union wage effects. We are interested to see how the results of the traditional model are affected by allowing union density to be endogenous.

Modelling the open shop, however, has presented theoretical difficulties given the public good characteristics of the union-negotiated wage mark-up. As Olson (1965) has demonstrated, in such circumstances there is a dominant free-rider incentive for the rational economic agent not to join the union. Booth (1985) offers an escape from this dilemma of collective action in proposing a social custom model of trade union membership. In this model workers derive utility from the reputation effects of belonging to the union and hence conforming with the social custom invoking workers not to free-ride. In common with the formal analysis of Schelling (1978), individuals in Booth's model are identical and hence the intermediate equilibrium, in which some but not all workers join, is unstable (for a proof of this, see Naylor (1989)). If, instead, workers are assumed to be heterogeneous, as in the model of Akerlof (1980), then it is possible to derive an intermediate level of union membership which has the properties of a stable equilibrium (see Naylor and Cripps (1988)).

A shortcoming of these social custom models of union membership is that they have tended to concentrate exclusively on the socio-economic characteristics of the workers and of the workplace with no role ascribed to market influences such as the supply and demand for labour, or the behaviour of the firm. This is a problem for two important reasons. First, an economic analysis of unionisation must consider such influences if it is to be more than a very partial analysis. This is especially the case if, as here, we are interested in the interdependence between unionisation and economic

[1] See Stewart (1987)

parameters such as the wage level. Second, there is strong empirical evidence that employer behaviour, in the form of management opposition, is a key determinant of unionisation. Drawing on Freeman and Medoff (1984), Dickens and Leonard (1985), Freeman (1986) and Farber (1987), Freeman and Kleiner (1988) argue that, "Many have come to believe that the growth of opposition has been a major, if not the major, direct cause of the decline in private sector unionism in the U.S.." Management opposition to unions in the U.S. is most obvious during NLRB elections when either unions are attempting to unionise an establishment or the employer is seeking de-unionisation. In the U.K., representation elections of this kind do not occur, but firms still have the option of spending resources to deter or diminish union organisation. For example, firms can oppose unions by hiring legal advisers, instituting non-union collective voice mechanisms, laying off activists or by their choice of technology or production process. Lazear (1983) hypothesises the firm making contributions to employee funds to appease non-unionised labour. He also includes the possible Harvard-type foregone productivity gains of opposing unions. Finally, we can think of the firm's location decision as influenced by spatial differences in the probability of unionisation. At a cost, the firm can re-locate an establishment following its unionisation. We discuss this further later in the paper. Each method is likely to be costly. The firm must balance this cost against any reduction in profits which it expects to follow from unionisation or an increase in union density.

In this paper we allow a base level of union membership to be influenced by the resources, R_m, devoted by management to opposing unionisation. The base level derives from the parameters suggested by the social custom model of union membership and hence can be shown to be a stable equilibrium under specified conditions. The firm chooses R_m to maximise profits. It also chooses employment, given the wage: this is consistent with a right-to-manage model of wage determination. The wage depends upon the level of union membership, represented by the wage-locus, and this provides the firm with a possible incentive for choosing $R_m > 0$. Within the model we determine simultaneously the levels of; R_m, the wage and union density. We are thus able to investigate the effects on wages and density of changes or differences in labour demand, the competitive wage, the base level of membership and the parameters of the wage and density functions. This extends the representative model of union-firm bargaining which calculates comparative static effects assuming a constant union density.

We find that there is a critical level which the base level of union membership must at least equal if union density in the establishment is to be at a level sufficiently high for the union to obtain a positive wage mark-up. If the base level satisfies this condition then actual density will be equal to the base level and the firm will not allocate resources to oppose union membership. We can think of this as the case where the firm 'recognises' the union. If, however, the base level is less than the critical level then the firm will spend just sufficient resources to reduce membership to that level at which the firm is able to pay no more than the competitive wage - the case of non-recognition. The size of the critical level depends upon various parameters relating to the union's bargaining power and the firm's production technology and market power. The existence of a union in the establishment depends, therefore, upon the relative magnitude of the base level of membership and the critical level, and therefore upon both social custom effects and the behaviour of the firm. The actual level of density, given the presence of a union in the establishment, depends only on the strength of the social custom forces. From the comparative static exercises we derive the following results.

(i) An increase in the costs of union membership or a reduction in the force of reputation effects, which causes a fall in the base level of union membership, either leaves the wage and density unaffected or produces a fall in each.

(ii) The higher is the product price the higher is the wage mark-up for any given level of union density, but the lower is the likelihood of union presence. Therefore, we would expect, ceteris paribus, a higher mark-up but a lower probability of union presence the greater the degree of market power possessed by the establishment.

(iii) A rise in the competitive wage increases both the negotiated wage and the likelihood of union presence.

(iv) The shape of the wage locus is an important determinant of both union density and the wage outcome.

(v) A rise in unemployment benefit which increases the negotiated wage renders unionisation less likely.

The next Section develops the formal model, Section III considers some comparative static exercises, in Section IV there is an extension of the model to the case of a non-monotonic wage locus, and the final Section draws together conclusions and suggestions for further work.

II The Determination Of Wages and Union Density

The sequence of decision-making to be analysed in this paper is as follows. First, a latent or base level of union density, μ^o, in the establishment is determined by exogenous forces such as the private costs of union membership and the characteristics of the workforce, including the strength of reputation and social custom effects. Second, the firm chooses the amount of resources, R_m, to allocate to prevent or diminish union membership. This choice is made taking into account the subsequent stages of the process. Third, the actual level of membership, or union density, μ, follows from the values of μ^o and R_m.

Fourth, the firm and the union negotiate over the wage. The negotiated wage is assumed to be increasing in union density and equal to the competitive wage if density is zero or, in a later extension of the model, below some threshold level. Thus, union 'power' to obtain a wage mark-up increases with density, over the appropriate range. One justification for this assumption is that the higher is union density the lower is the disagreement payoff to the firm in the event of conflict and when the firm is more effectively hit during a dispute, the union receives a higher wage.[2] Our model is consistent with a wide range of assumptions about union preferences as all we require is that at the negotiated wage the union would prefer a higher wage settlement. It would be sufficient, though not necessary, to follow, amongst others, Moene (1988) who, citing Oswald (1985) and Weitzman (1987), justifies the assumption that the local union's utility function be the wage level per worker. However, we do not attempt to model union objectives explicitly in this paper. Initially, we take as given the dependence of the wage on density in what we term the wage locus. In the comparative static exercises we consider the effects of shifts in this wage locus on the wage and density outcomes and allow the insights of traditional bargaining models to predict some of the reasons for such shifts.

Fifth, the firm chooses the level of employment taking the negotiated wage as given. This assumption is consistent with the right-to-manage class of bargaining models (see, for example, Nickell and Andrews (1983)). We assume that the base level of union density is independent of the wage and employment outcomes. This follows from the public goods characteristics of the negotiated outcome - any wage increase is paid to both union members and non-members and any redundancies are distributed randomly across the workforce. There is no preferential treatment for union members and hence no private benefit accruing from membership. This generates the free-rider problem of explaining the existence and persistence of the open shop, which is a major focus of interest in this paper.

The sequence of decision-making is chosen to emphasise how firms can affect unionisation. The results are not sensitive to the assumption that employment is determined after the wage is negotiated. The marginal payoff to the firm from spending resources is still the reduction in labour costs (see equation (2) below) if employment is chosen by the firm before the wage is determined, as in Moene (1988) and Horn and Wolinsky (1988). What is crucial, however, is the assumption that the firm spends resources affecting subsequent unionisation and wage bargaining. It seems natural to consider unionisation as given when wages are negotiated since campaigns by the firm to affect union membership are unlikely to cause immediate changes in workers' attitudes towards unions. Changing the importance of social customs and reputation effects is likely to be a long-term process for the firm. We now turn to a more formal exposition of the model.

[2]See Raaum (1989)

Formal Model

II. 1. *The Base Level of Union Membership.*

For the purposes of this paper we shall assume a base level of union membership, μ^o, in the establishment. This can be thought of as reflecting the underlaying propensity of workers to join the union in the absence of management opposition. It is likely to depend upon the private cost of membership and the attitudes of workers to unions. This has been modelled formally elsewhere (see Naylor (1989)) and so we restrict to Appendix 1 a description of the formal exposition. We note, however, that we can derive from the social custom model a μ^o which has the properties of a unique stable equilibrium.

II. 2. *Union Density and Management Opposition.*

We assume that the firm is able to reduce actual density below any positive latent or base level by allocating resources R_m to opposing membership of a union. We specify:

$$\mu = \begin{cases} \min [\, 1, \mu^o - \phi(R_m)] & \text{if } \mu^o > \phi(R_m) \\ 0 & \text{if } \mu^o \leq \phi(R_m) \end{cases}$$

We allow μ^o to take values above 1 to capture the possibility that the firm might have to allocate a high value of R_m to offset the social custom forces driving the latent density level. However, actual density must be bounded from above by the unit value, and hence μ is the minimum of one and μ^o minus $\phi(R_m)$, where the latter term describes the sensitivity of membership to the firm's anti-union expenditure. We assume that:

$$d\phi/dR_m = \phi_R > 0.$$

i.e. that an increase in R_m tends to diminish union density.

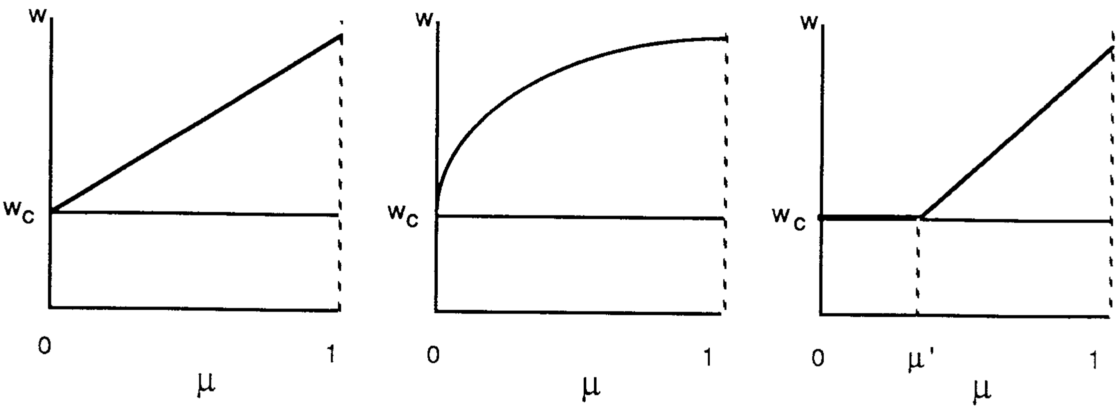
II. 3. *Wages and Union Density.*

The negotiated wage is assumed to be increasing in union density. Formally,

$$w = \begin{cases} w^c & \text{if } \mu = 0 \\ w(\mu, \alpha) > w^c & \text{if } \mu > 0 \end{cases}$$

where w^c is the competitive wage and α is a vector of variables affecting the negotiated wage. α may include the product price, the competitive wage, productivity, unemployment benefit and market power. We assume $\partial w/\partial\mu = w_\mu > 0$. The precise relationship between w and μ will be a key determinant of R_m and hence of both μ and w. In Figure 1 below we consider three possible wage loci.

Figure 1 (a) (b) (c)



In case (a) in Figure 1 $w_{\mu\mu} = 0$, in case (b) $w_{\mu\mu} < 0$, and in case (c) w is not monotonic in μ. The essential characteristic of case (b), in contrast to case (a), is that the expected marginal increase in profits of a reduction in union density is decreasing in density. In case (c) there is a critical level of membership necessary for the union to affect the wage. This is not consistent with the wage locus defined formally above, but will be considered in Section IV, below. In practice, the shape of the wage locus will depend upon the firm's choice of technology and we are assuming this to be exogenous. The wage locus is likely to vary across firms and in Section IV of this paper we consider how such variations might affect μ and w.

II. 4. *The Profit Function.*

We can write the profit function as:

$$\pi = pf(L) - wL - R_m,$$

where,

$$L = L(w)$$

$$w = w(\mu, \alpha) \quad = w^c \text{ for } \mu = 0$$
$$\qquad\qquad\qquad > w^c \text{ for } \mu > 0$$

$$\mu = \mu(R_m, \emptyset, \mu^o) = \min[1, \mu^o - \emptyset(R_m)]$$

pf(L) = Revenue.

Substituting, we obtain:

$$\pi = pf\{L[w(\mu(R_m, \emptyset, \mu^o), \alpha)]\}$$
$$- w(\mu(R_m, \emptyset, \mu^o), \alpha)L[w(\mu(R_m, \emptyset, \mu^o), \alpha)] - R_m \qquad (1)$$

The firm chooses R_m to maximise profits, given the values of the exogenous parameters, and this determines the union density level and the wage. We turn now to derive this outcome.

II. 5. *The Choice of R_m and the Determination of the Density and Wage Levels.*

From (1) we see that:

$$\partial\pi/\partial R_m = \pi_R = pf_L L_w w_\mu \mu_R - w_\mu \mu_R L - wL_w w_\mu \mu_R - 1$$

Hence,
$$\pi_R = - w_\mu \mu_R L - 1 = - (dw/dR)L - 1 \qquad (2)$$

since,
$$pf_L = w.$$

The intuition behind equation (2) is clear: $(w_\mu \mu_R)$ is the reduction in the wage brought about by a marginal increase in R_m. The reduction in labour costs is $-L(dw/dR)$. Turning to the second-order derivative:

$$\pi_{RR} = -w_{\mu\mu}(\mu_R)^2 L - w_\mu \mu_{RR} L - w_\mu \mu_R L_w w_\mu \mu_R$$

or,
$$= -w_{\mu\mu}(\mu_R)^2 L - w_\mu \mu_{RR} L - (w_\mu)^2(\mu_R)^2 L_w.$$

$$= - \{d^2w/dR^2\}L - (w_\mu)^2(\mu_R)^2 L_w. \qquad (3)$$

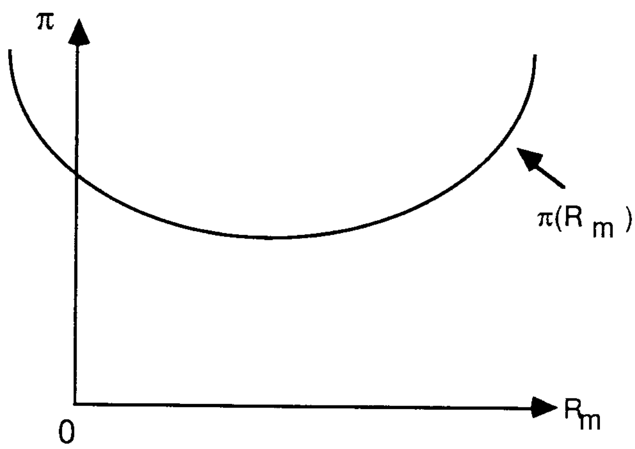
If dw/dR is constant, the marginal payoff to the firm from a higher R_m is increasing because, ceteris paribus, the higher is R_m the lower is the wage and, therefore, the higher is both employment and the reduction in labour costs. From (3), it follows that π_{RR} is positive if $d^2w/dR^2 \leq 0$, i.e. if the reduction in the wage, caused by a higher R_m reducing μ, is non-decreasing in R_m. The sign of d^2w/dR^2 depends on the shape of the wage locus, i.e. on $w_{\mu\mu}$, and on the marginal effectiveness of management resources on union density, μ_{RR}. We have $d^2w/dR^2 \leq 0$ if:

(i) $w_{\mu\mu} \leq 0$

and (ii) $\mu_{RR} \leq 0$.

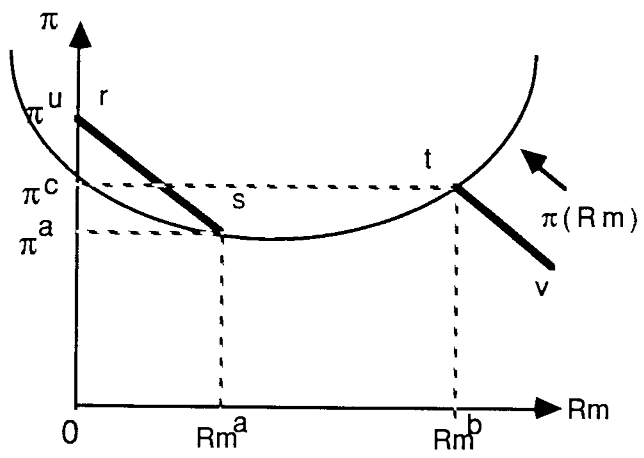
Hence, (i) and (ii) are sufficient conditions for π to be convex in R_m. Necessary conditions for $\pi_{RR} > 0$ are derived in Appendix 2. In what follows we shall assume that $\mu_{RR} = 0$, i.e. that μ is linear in R_m. In Figure 2 we represent the profit function diagrammatically.

Figure 2.



Convexity of the profit function implies that the firm has a dichotomous choice between setting R_m at zero, and hence allowing union density to be determined as the base level, or at a level sufficiently high to exactly offset the base level of membership, and hence forcing density to zero. To see this, suppose that the base level of density is greater than one, i.e., that there is a positive amount of R_m that the firm can spend before having any effect on the level of membership. More precisely, if the firm spends $R_m = R_m{}^a$ such that $\phi(R_m{}^a) = \mu^o - 1$, then the base level of union density will have just been reduced to one. $R_m{}^a$ is represented in Figure 3, where it is shown to be associated with a profit level of π^a. As actual density can never be greater than one, it is clear that the firm can increase profits by reducing R_m to zero. This is shown by the line segment r-s which lies above the convex function and represents true profits for $R_m < R_m{}^a$. Similarly, if the firm is spending $R_m = R_m{}^b$ such that $\phi(R_m{}^b) = \mu^o$, then there is no incentive for the firm to increase R_m as density at $R_m{}^b$ is just equal to zero. Further expenditures reduce profits without having any offsetting marginal benefit to the firm. This is represented in Figure 3 by line segment t-v which shows the true level of profits laying below the convex function for $R_m > R_m{}^b$.

Figure 3.



Given the parameter values implicit in the example depicted in Figure 3 it is clear that the firm will optimally choose to set $R_m = 0$, as $\pi^u > \pi^c$, from which it follows that $\mu = 1$ with consequent implications for w depending on the $w(\mu)$ function. In general, our conclusion is that the convex profit function implies that:

$$R_m^* = \begin{cases} 0 & \text{if } \pi^u \geq \pi^c \Rightarrow \mu = \min[\,1, \mu^o] \\ R_m{}^b & \text{if } \pi^u < \pi^c \Rightarrow \mu = 0 \end{cases} ,$$

where $R_m{}^b$ satisfies $\mu^o = \phi(R_m{}^b)$, i.e. $R_m{}^b$ represents that level of expenditure by the firm which is just sufficient to offset the base level of union membership so that actual union density is zero.

From (1), we have that:

$$\pi^u = \pi(R_m = 0) = pf(L^u) - w(\mu, \alpha)L^u \qquad (4)$$

and

$$\pi^c = \pi(R_m = R_m{}^b) = pf(L^c) - w^c L^c - R_m{}^b \qquad (5)$$

Where π^u and π^c are the profits when unions are present or absent, respectively, and L^u, L^c are the respective employment levels: $L^u = L(w(\mu, \alpha))$, $L^c = L(w^c)$. Both π^u and π^c depend upon the value of μ^o. π^u depends directly on μ^o since μ^o determines the wage rate. π^c depends on μ^o since μ^o affects the resources necessary to avoid a union. Clearly, if $\mu^o = 0$, then $\pi^u = \pi^c$. We can now derive the relationships between each of π^u and π^c, and μ^o.

From equation (4) we find,

$$\partial\pi^u/\partial\mu^o = \pi^u_{\mu^o} = pf_L L_w w_\mu - w_\mu L - wL_w w_\mu = - w_\mu L < 0.$$

Hence, $$\pi^u_{\mu^o\mu^o} = - w_{\mu\mu}L - w_\mu L_w w_\mu > 0, \quad \text{since } w_{\mu\mu} \leq 0.$$

Thus, π^u is convex in μ^o.

Similarly, for π^c we derive from (5),

$$\pi^c = pf(L(w^c)) - w^c L - R_m{}^b,$$

where $R_m{}^b$ is such that $\mu^o = \phi(R_m{}^b)$. Given that $\mu_{RR} = 0$,

let $$\mu = \min[1, \mu^o - \Omega R_m], \text{ where } \Omega = \phi_R(R_m) \text{ is constant.}$$

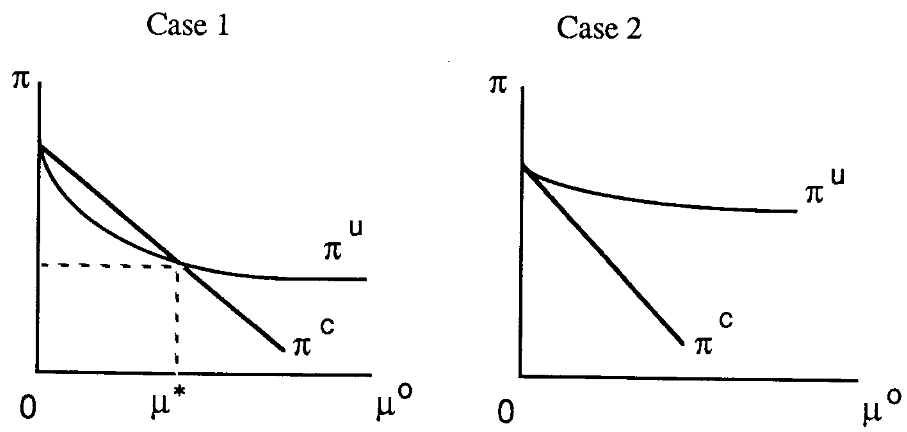
Hence, $$R_m{}^b = \mu^o/\Omega.$$

Thus, $$\pi^c_{\mu^o} = -1/\Omega$$

and $$\pi^c_{\mu^o\mu^o} = 0\,.$$

Therefore, π^c is linear in μ^o. We now represent the π^u and π^c functions in μ^o in Figure 4.

Figure 4



In Case 2 in Figure 4, π^u exceeds π^c for all $\mu^o > 0$. This occurs when the resources needed to reduce membership are sufficiently large that the firm will accept unionisation and hence density will be equal to the base level of membership (or to 100% if $\mu^o > 1$). Case 1 is the more interesting. Here it emerges that there is a critical level of μ^o, say μ^*, which if exceeded by the base level will induce the firm not to oppose the union. This will result in an actual level of union density equal either to the base level, μ^o, or to unity, whichever is the lower. If the firm chooses to oppose unions it does not do so 'marginally' - membership is either unaffected or reduced to zero. The π^u-schedule is flat for $\mu^o \geq 1$. If, however, $\mu^o \leq \mu^*$ then it will pay the firm to spend just sufficient resources to equate the actual level of density to zero. In this case there will be no union wage effect, whereas in the case where $\mu^o > \mu^*$ membership is at a positive level and the wage mark-up depends upon the shape of the wage locus. It is clear that the higher is the critical level μ^*, the higher must be the base level of union membership for density to be non-zero. It is to be noted that union membership is still possible for $\mu^* \geq 1$, so long as $\mu^o \geq \mu^*$.

In the next Section of the paper we turn to look at the comparative static properties of the model to see how μ^*, and therefore the wage and density outcomes, vary with the different paramenters of the model.

III Comparative Static Results.

So far we have assumed that:

$$w = w(\mu, \alpha) \begin{array}{l} = w^c \text{ if } \mu = 0 \\ > w^c \text{ if } \mu > 0 \end{array}$$

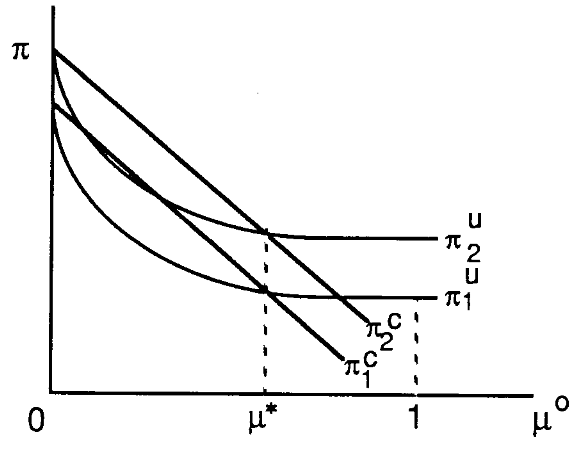
Let us now specify the wage locus more fully as:

$$w(\mu, \alpha) = w(\mu, p, w^c, b) \qquad (6)$$

where b is the level of public unemployment benefit. Hence, we allow for the possibility that at, any given level of membership, the negotiated wage will vary with changes in p, w^c and b. Existing models of union-firm wage bargaining, see Oswald(1985) and Ulph and Ulph (1989) for surveys, discuss the effects of changes in p, w^c, and b (implicitly) holding μ constant. We show that as these parameters differ, the amount of resources spent by the firm to oppose unions is also likely to vary, thereby inducing differences in both union density and the wage.

Changes in the values of the parameters which are exogenous to the model will be likely to affect the value of μ^*, the critical level of union density, and thereby have possible effects on the actual level of density and on the wage and employment outcomes. Our method for analysing such effects is to consider how the profit schedules, π^u and π^c, respond to the exogenous changes. If, for any level of μ^o, the profit schedules are affected identically then μ^* will remain unchanged. We show this case in Figure 5 below, where we assume that the two π-schedules shift equally throughout. The same result goes through if the changes in π^u and π^c are only locally equivalent. However, if, in response to an exogenous parameter change, π^c increases by more (less) than π^u at each level of μ^o then μ^* will increase (decrease). The intuition behind this result is as follows. Suppose that there is an initial base level of union membership, μ^o such that $\mu^o = \mu^*$, the critical base level. Then the profit to the firm of opposing unionisation is equal to that accruing if the firm accepts μ^o. There is then an exogenous parameter change as a result of which we find that π^c is unaffected but that, for all $0 < \mu^o < 1$, the π^u schedule shifts downwards representing a lower level of profit at each base level of union density. The firm will now strictly prefer to oppose unions as the profit from accepting μ^o has decreased. Hence, the critical base level of union density needed to establish or retain unionisation has increased. In the example represented in Figure 5, μ^* is unaffected because π^u and π^c remain equal for $\mu^o = \mu^*$.

Figure 5



We now proceed to consider particular comparative static results.

III. 1. *The base level of union membership*

The base level will differ across establishments as either reputation and social custom effects or the costs of membership vary. For example, if there is an increase in the cost of membership then the base level, μ^o, will fall.[3] The effect of this on the

[3]See Appendix 1

actual level of union density in the establishment will depend upon the initial base level relative to the critical level, μ^*. We can consider the following possibilities:

(i) $\mu^o \geq \mu^* > 1$. In this case union density is 100% initially and stays at this level as μ^o falls until $\mu^o < \mu^*$ when density jumps to zero.

(ii) $\mu^o \geq 1 > \mu^*$. Again density is 100% at first, but falls below this level for $\mu^* < \mu^o < 1$. Density collapses to zero for $\mu^o < \mu^*$.

(iii) $1 > \mu^o \geq \mu^*$. Density is initially less than 100% and falls with μ^o until $\mu^o < \mu^*$ when density falls to zero.

(iv) $\mu^o < \mu^*$. Density is initially zero and is unaffected by the reduction in μ^o.

Thus, we see that the fall in the base level is consistent with density remaining unchanged - at either one or zero - or falling continuously to the critical level, or jumping to zero from the critical level. The converse occurs for the case of a rise in the base level of union membership. Accordingly, the wage is likely to fall with a reduction in the base level of membership.

Allowing union density to be determined not only by the parameters of the social custom model but also by the behaviour of the firm has affected the predictions one would make about the level of union density in the establishment. In the simple social custom model density is equal to the base level. Membership is zero only if the base level is zero which can arise if the cost of membership is sufficiently high or if the reputation effects of membership are sufficiently weak. In the extended model, membership can be zero for the additional reason that it pays the firm to offset the base level of union density.

III. 2. *The product price*

We now consider the case of a change in the value of the parameter p, implying a change in the price level of the firm's product. It is clear from equation (4) that a change in p will affect π^u in two ways. First, through a, the change in p may cause a shift in the wage locus. We allow for the possibility that $\partial w/\partial p = w_p \geq 0$. Second, there is a direct effect on the firm's revenue when p changes. Only this second effect operates for π^c. We derive from (4) that:

$$\partial \pi^u/\partial p = \pi^u{}_p = f(L(w(\mu, a))) - w_p L$$

and from (5) that:

$$\partial\pi^c/\partial p = \pi^c{}_p = f(L(w^c)).$$

Given that $w_p \geq 0$, it follows that $\pi^u{}_p < \pi^c{}_p$. That is, an increase in product price causes an increase in profits which is of a greater magnitude in the absence of unions. Where unions are present they are able to share in the increased price. In terms of Figure 5, the upward shift in the π^c schedule is greater than that in the π^u schedule and so μ^* rises. Thus, following an increase in product price there is a rise in the base level of union density needed to support union membership in the establishment. The general conclusion from this is that we are less likely to observe positive levels of union membership following an outward shift in labour demand brought about by an increase in product price.

The effect on the wage outcome is indeterminate. On the one hand, the increase in p pushes up the level of the wage if $\partial w/\partial p > 0$. But, on the other hand, if μ^* rises above the base level of density in the establishment actual density will fall and, consequently, there will be a reduction in the wage.

We have, then, interpreted the shift in the labour demand schedule as reflecting an increase in product price. However, we could think of an increase in productivity having the same effect and also entering as an argument in the wage locus. Let P denote productivity. Then for an increase in productivity consistent with a horizontal shift in labour demand, union density will be non-increasing throughout and decreasing over certain ranges, as we found for a change in product price, at least for $\partial w/\partial P \geq 0$. That is, μ^* is increasing in both price and productivity. One corollary of this is that we would expect to observe from cross-section analysis that union presence is less likely, ceteris paribus, the greater is productivity. This suggests the need for care in the interpretation of any negative correlation between union presence and productivity.

III. 3. *The competitive wage*

An increase in the competitive wage causes a reduction in the profit that the firm earns in the case where membership is zero, since:

$$\partial\pi^c/\partial w^c = \pi^c{}_{w^c} = - L(w^c) < 0$$

Similarly, it can be shown that π^u depends upon w^c, but if, and only if, the negotiated wage is affected by the competitive wage. In equation (6) we have that the competitive wage is a shift parameter in the wage locus. We assume that $0 < w_{w^c} \leq 1$.

Hence, $$\partial\pi^u/\partial w^c = \pi^u{}_{w^c} = - L(w(\mu))w_{w^c} < 0$$

Given that $w(\mu) > w^c$, for $\mu > 0$, and that $0 < w_{w^c} < 1$, it follows that $\pi^u{}_{w^c} < \pi^c{}_{w^c}$. Hence, the downward shift in the π^u profit schedule is less than that for π^c with the consequence that the critical base level of union density, μ^*, falls. The higher competitive wage has reduced the net benefit of not having a union and so unionisation is more likely. Therefore, a positive union wage mark-up is more probable.

If we now consider the likely behaviour of union membership over the business cycle, we observe that if the product price and the competitive wage move together, then they will have counterveiling effects on union density. The net effect, therefore, is indeterminate.

III. 4. *Unemployment benefit*

As long as the competitive wage is constant, higher unemployment benefits, b, leave π^c unaffected. A higher b, however, may increase the negotiated wage via either union objectives or the disagreement payoff to the union. Hence, π^u is reduced at each level of membership,

$$\pi^u{}_b = - L(w(\mu))w_b < 0.$$

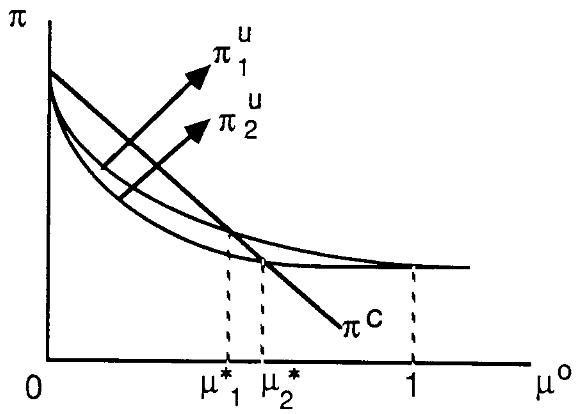
Higher unemployment benefits reduce the profit of firms with unions and provide stronger incentives for management to oppose union membership. Consequently, μ^* increases and unionisation is less likely.

A policy of reducing unemployment benefits to promote employment is therefore a double-edged sword. It will reduce the wage and stimulate employment in organised firms but will be likely to generate unionisation elsewhere and hence have a positive effect on wages and a negative impact on employment.

III. 5. *The Wage Locus*

We have assumed that $w_{\mu\mu} \leq 0$. Two possible cases for wage loci satisfying this condition are illustrated in Figures 1(a) and 1(b). We are interested in comparing these two cases for their implications for μ and w. Suppose, as in Figure 1, that in the case of each wage locus the competitive wage is the same and also that the wage associated with 100% density is common to both. Then it follows that for any intermediate level of union density profits are lower when $w_{\mu\mu}< 0$ than when $w_{\mu\mu}= 0$.Hence, for $0 < \mu < 1$, the π^o schedule shifts downwards. This is shown in Figure 6 below. π^b is, of course, unchanged. Consequently, the critical level of union density, μ^*, increases reflecting the increased incentive for the firm to oppose unions. Thus, we predict from this that an important determinant of union membership in establishments is the shape of the wage locus and hence the nature of the production process. What drives this result is not the sign of $w_{\mu\mu}$ *per se*, but the implication that the sign has for the wage mark-up at each density level given that both the maximum mark-up and the competitive wage are assumed fixed.

Figure 6



IV. An Extension: Non-Monotonicity of the Wage Locus

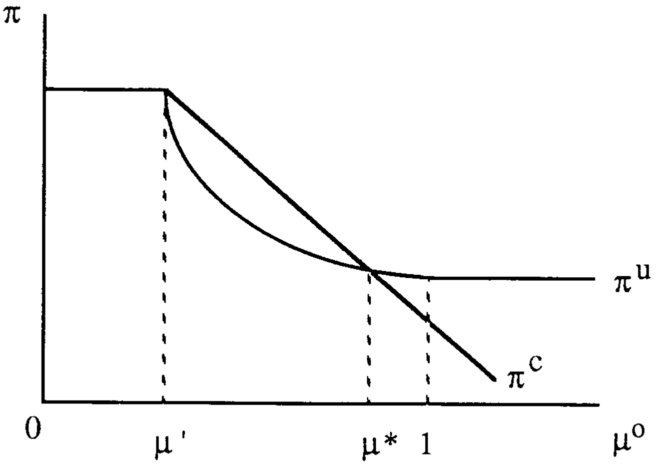
So far, we have discussed cases where the wage is a monotonic, increasing function of union density for all values of μ. Consider now the wage locus described by:

$$w = \begin{cases} w^c & \text{if } \mu \leq \mu' \\ w(\mu) & \text{if } \mu > \mu'. \end{cases}$$

This is the locus represented diagrammatically in Figure 1(c) in Section II. In this case the union is unable to influence the wage unless its support among the labour force exceeds a threshold level μ'. We may consider a union with a density below or equal to μ' as being not recognised by the firm for wage bargaining purposes. A discussion of this possibility is given in Raaum (1989).

Obviously, for $\mu \leq \mu'$, $\pi^c = \pi^u$ since $w(\mu) = w^c$. The shapes of the profit schedules in μ^o are unchanged from our previous examples. π^c is linear in μ^o as μ_{RR} is zero. π^u is convex in μ^o, essentially because higher density reduces profits more when density - and therefore wages - are low and employment is high. Thus, in place of Case 1 in Figure 4, the profit schedules now appear as in Figure 7, below.

Figure 7



The implications which follow from this are quite straightforward. There are three regimes:

(i) $0 < \mu^o < \mu'$: The firm spends no resources, $\mu = \mu^o > 0$, but $w = w^c$. This corresponds to the empirical evidence on establishments where union density is non-zero, but where unions are not recognised.

(ii) $\mu' < \mu^o \leq \mu^*$: The firm spends just sufficient resources, $R_m{}^c$, defined by: $\mu' = \mu^o - \phi(R_m{}^c)$, to reduce μ to the level (μ=μ') where w=w^c.

(iii) $\mu^o \geq \mu^*$: The firm recognises the union, spending no resources to reduce membership below the base level, μ^o.

V. Conclusions

We have developed a model of the open shop trade union which builds on the social custom model of Booth (1985), Naylor (1989) and Naylor and Cripps (1988) by integrating the explanation of union density within the framework of union-firm bargaining. This represents an extension of the traditional bargaining models which typically assume a union closed shop. We do not model the bargaining process explicitly. We assume that the firm sets the level of employment and, other than in the extended case discussed in Section IV, that the wage is a monotonically increasing function of union density (for a discussion of this see Raaum and Naylor(1989)). Traditional models which assume a closed shop fail to allow for any indirect effects on the negotiated wage of differences in union density which might occur as a result of different values of the exogenous parameters.

Our main findings are the following. First, union density in the establishment will be equal to the base level of membership (or 100%, whichever is the lower) as determined in the social custom model if, and only if, the base level is at least as high as some critical level. This critical level depends upon the profit function of the firm, and will vary with the parameters of that function. If the critical level exceeds the base level of union density then the firm will find it profitable to allocate sufficient resources to reduce membership to zero, or, in terms of the extended model of Section IV, to some level sufficiently low for the union to be unable to affect the wage. Therefore, union presence will vary across establishments according to the relative magnitudes of the base and critical levels of union membership.

Second, an increase in the product price raises the union wage mark-up, but causes an increase in the critical level of union density and therefore makes union presence less likely. In a cross-section context, if the price level a firm faces reflects its product market power, then we would conclude that the union wage mark-up will be greater amongst firms with high market power, but that union presence will be less likely in such firms. This is consistent with empirical evidence on the union wage mark-up (see Stewart (1987)). In the US context of NLRB elections, we would expect rising prices, ceteris paribus, to be associated with a rising incidence of union de-recognition. In the UK the dramatic fall in aggregate union membership in recent years has been associated not with reductions in density within establishments, although there is evidence of a growing incidence of de-recognition, but with the disproportionate closure of unionised establishments. In terms of our model, we could interpret this as expenditures, R_m, at the level of the firm to switch production away from unionised establishments.

Third, a rise in the competitive wage raises wages in both sectors, but less in the union sector. The relative wage mark-up falls, but unionisation becomes more likely. If in a boom both product prices and the competitive wage are rising there will be an indeterminate effect on union density.

Fourth, we expect that the shape of the wage locus will be crucial in determining the degree of unionisation and therefore the wage mark-up. This shape is likely to vary across firms according to the nature of the firm's technology. In terms of Figure 1, we have shown that, ceteris paribus, a given level of union density yields a higher wage mark-up in the case depicted in 1(b) than in 1(a), but in the former case unions are less likely to be present.

Appendix 1

Here we show the derivation of μ^o, the stable equilibrium base level of union membership in the establishment. We follow the approach of Naylor (1989).

Let, $$U_i = w(\mu) - ds + \varepsilon_i(t + v\mu)s$$

where,

- w is the wage which depends on actual union membership in the establishment.
- d represents net costs to the worker of membership.
- ε_i represents the individual i's sensitivity to reputation effects of membership.
- $t + v\mu$ is the generalised linear reputation function, where $t,v > 0$.
- $s = \begin{cases} 1 & \text{if the individual joins the union} \\ 0 & \text{otherwise} \end{cases}$

Hence,
$$U_i^J = w(\mu) - d + \varepsilon_i(t + v\mu)$$
$$U_i^{NJ} = w(\mu)$$

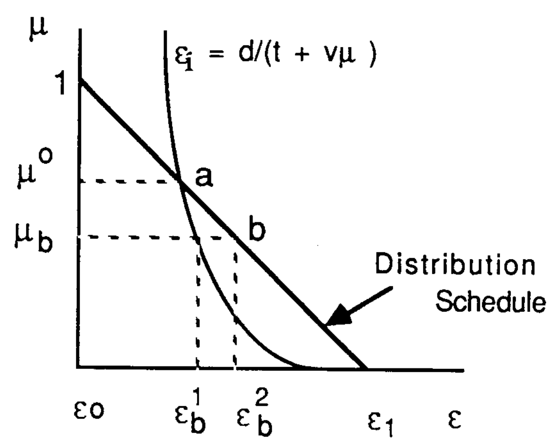
We assume that the individual i will join the union if $U_i^J \geq U_i^{NJ}$, i.e.;

$$w(\mu) - d + \varepsilon_i(t + v\mu) \geq w(\mu)$$

or $$\varepsilon_i \geq d/(t + v\mu).$$

Let ε_i be distributed uniformly between ε_0 and ε_1. This is not crucial (see Naylor and Cripps (1988)). Then we can represent diagrammically the decision and distribution schedules as in Figure 8.

Figure 8



$\varepsilon_i = d/(t + v\mu)$ is the decision schedule. We can show that μ^o is the unique stable equilibrium base level of union membership. Suppose that $\mu = \mu_b$. Then the distribution schedule tells us that the joiners are characterised by $\varepsilon_i \geq \varepsilon^2{}_b$. The decision schedule shows that at $\mu = \mu_b$ any individual with $\varepsilon_i \geq \varepsilon^1{}_b$ will choose to join the union. This is true for more than μ_b of the population and so we assume that μ grows. Similarly, if $\mu > \mu^o$ membership will fall until $\mu = \mu^o$. We conclude that μ^o is a stable equilibrium. This stable equilibrium base level of membership will grow as the distribution schedule shifts to the right (because of an increase in ei across the population) or as the decision schedule shifts to the left (because of a reduction in the net costs of membership). If ε_o is sufficiently greater than zero, i.e. if the individual least concerned about reputation effects is sufficiently sensitive to the repuation term, then μ^o will be greater than or equal to one.

Appendix 2

Here we show necessary conditions for the convexity of the profit function.

$$\pi_{RR} = - Lw_{\mu\mu}(\mu_R)^2 - Lw_\mu\mu_{RR} - (w_\mu)^2(\mu_R)^2L_w$$

If we define $\partial w/\partial R = \mu_R w_\mu < 0$, then simple manipulation yields:

$$\pi_{RR} = - (L/R)(\partial w/\partial R)\Lambda, \text{ where:}$$

$$\Lambda = \lambda + \omega\eta \quad ,$$

$$\eta = L_w(w/L) < 0 \, ,$$

$$\omega = (\partial w/\partial R)R/w < 0 \text{ and}$$

$$\lambda = (\partial^2 w/\partial R^2)R/(\partial w/\partial R) \, .$$

Hence, π_{RR} is positive if, and only if,

$$\Lambda > 0, \text{ or } \lambda/\omega < |\eta| \, .$$

Recall that $\omega < 0$, so $\pi_{RR} > 0$ unless λ is far below zero. Thus, π is convex in Rm unless the marginal reduction in w as Rm increases falls sharply.

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