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WAGE BARGAINING AND MONOPSONY

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Abstract

This paper identifies three possible outcomes of higher relative firm bargaining power in a unionized firm facing an upward sloping labor supply curve. The conventional regime with reduced wage and higher employment corresponds to firm bargaining power below a certain critical value. A supply constrained regime where increased firm bargaining power reduces both wages and employment occurs when the bargaining power is above another critical level. A novel result is that we identify a third regime, with firm bargaining power between these critical levels, where changes in relative bargaining power does not affect wages and employment.

JEL Classification: J3; J5

Keywords: Monopsony; Unions; Wage bargaining

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1. Introduction.

This paper analyses the effect of union bargaining power on wages and employment in a labor market where single firms are faced with an upward sloping labor supply curve. Conventional wage bargaining models assume that without union bargaining power, the outcome occurs at the competitive solution where demand and supply of labor is equalized, and firms move up their labor demand curve as union bargaining power increases. In this paper, we take a different approach and assume that the relevant reference point is the monopsony solution and formalizes the idea that the bargaining solution can be on the supply schedule. The idea that firms may have some wage-setting power has wide appeal both from an empirical and theoretical point of view, see Manning (2003) for a comprehensive discussion. In addition to the textbook local labor market monopsony model, an upward sloping labor supply curve towards individual firms can be explained by search frictions of various forms in the labor market.

A large empirical literature has documented that unions increase wages, see for example Blanchflower and Bryson (2002). While some discussion has existed on the actual magnitude of the union wage gap, there is considerable agreement that a positive union wage differential exists. However, a much smaller literature has been devoted to the empirical investigation of union employment effects. The findings in Blanchflower et al. (1991), Leonard (1992) and Wooden and Hawke (2000) indicate that unionism hurt employment growth, while the evidence in Machin and Wadhvani (1991) is quite mixed. DiNardo and Lee (2002) estimates small union impact on employment, with large standard errors. Other studies claim that empirical evidence on wage-employment outcomes are consistent with the view that unions have bargaining power over employment, see for example Alogoskoufis and Manning (1991) and de la Croix et al. (1996). Further, several studies find insignificant or positive union employment effects in the local public sector, see for example Valetta (1993) and the review of Gregory and Borland (1999). The conclusion in Pencavel (1991) seems still to be valid: “At the moment, the evidence regarding the effect of unionism on employment is not only meagre, but also quite inconclusive” (p. 44).

The lack of robust evidence on the union effect on employment is puzzling. At least three different explanations of a positive association between employment and unionism have been suggested. First, efficient bargaining theory suggests that the bargaining outcome is on a

contract curve that can be positively sloped in wage-employment space [McDonald and Solow (1981)]. The main argument against this kind of models is that one rarely observes bargaining over both employment and wages; most real world union contracts specify wage rates, not employment levels. Second, some authors have suggested that employment-wage outcomes are on the labor demand curve, but that unions induce a positive shift in the firms' labor demand. If these shifts are of significant size, even a positive association between employment and unionism can arise. This argument has been particularly popular in explaining findings of positive union employment effects in the public sector [Zax and Ichniowski (1988), Valetta (1993)]. Evidence for such effects is found by Chandler and Gely (1995) and Marlow and Orzechowski (1996).¹ In addition, Manning (2003) has recently noticed that under monopsony employment rises along the supply curve as the union increases the wage from a low level.

We develop a wage bargaining model with the pure monopsony and pure monopoly union models as special cases, and analyze how wage and employment outcomes depend on the relative bargaining power of the bargaining parties. Since the labor supply curve is upward sloping, the workers must be heterogeneous in some respect. Our specification of the labor supply function based on heterogeneity in workers' alternative income is in line with the model formulation of Bulkley and Myles (2001) who consider union behavior within a model where the outcome is restricted to be on the demand curve.

The model allows us to distinguish between three possible outcomes of higher relative firm bargaining power. The conventional demand constrained regime where higher firm bargaining power reduces wages and increases employment occurs when the bargaining power is below a certain lower critical level. On the other hand, a supply constrained regime where increased firm bargaining power reduces both wages and employment occurs when the bargaining power is above an upper critical level. Manning (2003) recognizes both these regimes, although he only models the supply constrained case. A novel result of our model is that we identify a third regime, with firm bargaining power between this lower and upper critical levels, where the bargaining outcome equals the 'competitive' solution, and changes in firm bargaining power does not affect wages and employment. This regime may occur for a

¹ Since union members are also members of the electorate they can influence the decisions taken by politicians on the size of the public sector with a resulting increase in public sector employment as first suggested in the seminal paper by Courant et al. (1979) and further discussed in Babcock et al. (1997).

significant range of possible bargaining power parameter values, depending on the slope of the labor supply curve and the level of competitiveness in the product market. The fact that the model generates a highly nonlinear relationship between employment and firm bargaining power is consistent with the lack of evidence of negative union employment effects.

The paper is organized as follows. The model and basic results are presented in Section 2, while Section 3 discusses the robustness of the results with regard to the union preferences. Section 4 concludes.

2. The model

To investigate the relationship between bargaining outcomes and the relative bargaining power of the bargaining parties involved, we use a simple partial equilibrium model of wage bargaining between a trade union and a firm facing a less than perfectly elastic labor supply curve.

Worker preferences

When the labor supply curve to the firm is upward sloping, workers must be heterogeneous in some aspect. As Bulkley and Myles (2001), we will assume that the workers have equal productivity, while the utility from alternative employment differs across workers. Variation in the utility level in alternative employment may be due to differences in mobility costs, differences in the connections to the firms, differences in the propensity to be unemployed, or different information level across workers.

Assuming that the workers are risk neutral, the utility level can be represented by their income level. We assume that the alternative income of potential workers in a particular firm is uniformly distributed on support $[A^L, A^H]$ with density $\frac{1}{A^H - A^L}$. Then the labor supply function faced by the firm is given by the cumulative distribution of the alternative income times the number of potential workers, L .

$$N^S = \phi(W - A^L) \quad (1)$$

where $\phi = \frac{L}{A^H - A^L}$. This is a simple linear supply schedule with slope ϕ due to worker heterogeneity.

Trade union preferences

In this section we will rely on the utilitarian approach that has been common in the literature, see for example McDonald and Solow (1981). Within this approach, the union cares about both wages and employment. This is in accordance with existing empirical studies on union preferences, see Clark and Oswald (1993) and the overview in Pencavel (1991). Alternative utility functions are discussed in Section 3.

We initially assume that union membership is equal to the number of potential workers, L . Assume that in the case of excess supply, the number of workers employed in the firm, denoted N , is a random draw of the workers who want to work in the firm. With risk neutrality, the expected utility level of a randomly chosen worker i can be written

$$U_i = \frac{N}{L} W + \frac{N^S - N}{L} \frac{W + A^L}{2} + \frac{L - N^S}{L} \frac{A^H + W}{2} \quad (2)$$

The first part of the expression is the probability of employment in the firm times the utility level in that case. The second term is the probability of not being employed in the firm even though the worker wants to be employed in the firm (there is excess supply) times the expected utility level. The last term of the expression is the probability that the worker do not want to be employed in the firm times expected utility.

Collecting terms and utilizing (1), (2) can be written

$$U_i = \frac{N}{L} \frac{W - A^L}{2} + \frac{A^L + A^H}{2} \quad (3)$$

The first term in (3) is the expected utility gain for the workers in the firm while the second term is the expected outside utility level for the union members. In order to use a Nash bargaining solution, we also need to specify the utility level during a dispute in the bargaining process. Assuming that a dispute in the wage bargaining implies $N = 0$ and that the union members get their alternative income, the net union utility in utilitarian terms is

$$U - U^0 = \sum_{i=1}^L \left(\frac{N}{L} \frac{W - A^L}{2} + \frac{A^L + A^H}{2} \right) - \sum_{i=1}^L \frac{A^L + A^H}{2} = N \frac{W - A^L}{2} \quad (4)$$

This utility function is qualitatively equal to the traditional rent maximizing formulation. The union maximizes total rent in expectation terms. Notice that membership size L is not included in (4). Thus, the interpretation of L is not important for the model. One may think of

L as (i) a large number, (ii) the number of workers in the firm when supply equals demand as in Bulkeley and Myles (2001), or (iii) as the supply of labor faced by the firm².

Competitive solution

Turning to the firm, assume that employment is the only input and $R(N)$, $R'(N) > 0$, $R''(N) < 0$, is the revenue function. The profit is $\Pi = R(N) - WN$, and the labor demand function is given by

$$R'(N^D) = W \quad (5)$$

Upper letter D indicates that the outcome is on the demand curve. Define W^* and N^* as the wage and employment for which supply equals demand. Equalizing (1) and (5) gives the competitive solution as

$$W^* = R'(\phi(W^* - A^L)) = R'(N^*). \quad (6)$$

Wage bargaining

We follow the tradition in the wage bargaining literature by using a ‘right to manage’ model where employment is determined after the wage bargaining.³ The bargaining outcome is illustrated by the Nash bargaining solution,

$$\underset{W}{\operatorname{argmax}} (\Pi - \Pi^0)^\gamma (U - U^0)^{(1-\gamma)} \quad (7)$$

where γ and $(1-\gamma)$ are the relative bargaining powers of the firm and the union, respectively, and Π^0 is the profit during a dispute. Since we assume that $N = 0$ during a dispute, $\Pi^0 = 0$. The bargaining solution is given by the first order condition to the Nash product

$$\gamma \frac{\partial \Pi / \partial W}{\Pi} + (1-\gamma) \frac{\partial U / \partial W}{U - U^0} = 0. \quad (8)$$

To illustrate the range of possible outcomes of the model it is instructive to use Figure 1 where Π^1 , Π^2 and Π^3 denotes isoprofit curves and U^1 , U^2 and U^3 denotes union indifference curves. The monopsony solution is at point A at the tangency of an isoprofit curve and the labor supply curve, and the monopoly union solution is at point B at the tangency of a union

² Notice that the expected income of a randomly chosen union member during a conflict in the case where union membership is equal to labor supply is $(W+A^L)/2$. Equivalently, when union membership is equal to employment when labor supply equals labor demand, the expected income is $(W^*+A^L)/2$, where W^* is the wage for which demand equals supply.

³ This implicitly implies that employment is more flexible than wages, which, however, is not a universal assumption, see for example Grout (1984) and Falch (2001a).

indifference curve and labor demand. Point C illustrates the competitive solution with $W = W^*$ and $N = N^*$. Initially, two regimes may be identified. First, in the traditional case the outcome is on the labor demand curve, which we will denote REGIME 1. In this case the outcome moves towards point B as γ approaches zero. An outcome on the labor supply curve will be denoted REGIME 2. As γ approaches unity, the outcome moves towards point A. We now characterize these regimes in more detail and investigate the possibility of moving between the regimes as the relative bargaining power of the firm changes.

Figure 1 about here

REGIME 1. The demand constrained case

Consider the case when $W > W^*$ and (5) holds. Define $\kappa = R'(N) \frac{N}{R(N)}$ as the revenue elasticity with respect to employment and $\varepsilon = R''(N) \frac{N}{R'(N)} < 0$ as the elasticity of the marginal revenue with respect to employment. The wage outcome can then be written

$$W^D = A^L \left(1 + \frac{(1-\gamma)(1-\kappa)\varepsilon}{\gamma\kappa\varepsilon - (1-\gamma)(1-\kappa)(1+\varepsilon)} \right) \quad (9)$$

An internal solution requires that $\kappa \leq 1$. In traditional union models, the bargained wage is a mark-up over the alternative wage. In the present model, the wage is a mark-up over the alternative wage of the worker with the lowest alternative wage, A^L .

REGIME 2. The supply constrained case

Obviously, the outcome in (9) with the corresponding employment level in (5) is not feasible when the implied wage is less than the competitive wage, W^* , and excess demand occurs. To see what happens, consider the case when γ is sufficiently large to generate a solution with $W < W^*$. In this case the firm is constrained by the supply curve and the bargaining solution (8) can be written

$$\gamma \frac{((R'(N) - W)dN/dW - N)}{R - WN} + (1-\gamma) \frac{N + (W - A^L)dN/dW}{N(W - A^L)} = 0 \quad (10)$$

where $dN/dW = \phi$ and $R'(N) > W$. Collecting terms yields

$$W^S = \frac{1}{2} \gamma A^L + \frac{R(N)}{N} \left((1-\gamma) + \frac{1}{2} \gamma \kappa \right) = \gamma W^M + (1-\gamma) \frac{R(N)}{N} \quad (11)$$

where $W^M = \frac{1}{2}(R'(N) + A^L)$ is the monopsony wage, and $R(N)/N \geq W$ in order for $\Pi \geq 0$. Upper letter S indicates that the outcome is on the supply curve. In this case, the bargained wage is an average of the monopsony wage and the zero-profit wage, weighted by the bargaining powers.

The following proposition compares demand and supply constrained cases, characterized by (9) and (11), respectively.

Proposition 1

$$\text{Define } \hat{\gamma} = \frac{(1-\kappa)W^*}{(1-\kappa)W^* + \frac{1}{2}\kappa(W^* - A^L)} \quad (12)$$

$$\text{and } \tilde{\gamma} = \frac{(1-\kappa)(A^L - (1+\varepsilon)W^*)}{(1-\kappa)(A^L - (1+\varepsilon)W^*) - \kappa\varepsilon(W^* - A^L)}. \quad (13)$$

$$(i) \quad \text{For } \gamma < \hat{\gamma}, \quad W > W^*, \quad \frac{\partial W}{\partial \gamma} < 0, \quad \frac{\partial N}{\partial \gamma} > 0.$$

$$(ii) \quad \text{For } \gamma > \tilde{\gamma}, \quad W < W^*, \quad \frac{\partial W}{\partial \gamma} < 0, \quad \frac{\partial N}{\partial \gamma} > 0.$$

Proof: $\hat{\gamma}$ is the value of γ for which the bargained wage in Regime 1 is equal to the competitive wage, W^* , calculated utilizing (9) and (6). Below this critical value the wage (employment) is decreasing (increasing) in firm bargaining power. Correspondingly, $\tilde{\gamma}$ is the value of γ for which the bargained wage in Regime 2 is equal to W^* , calculated utilizing (11) and (6). Above this critical value both the wage and employment are decreasing in firm bargaining power. \square

Proposition 1 implies that the effect of bargaining power is discontinuous. Starting from an initial point where the firm's bargaining power is at its maximum ($\gamma = 1$), i.e. at point A in Figure 1, a marginal *decrease* in firm bargaining power increases the employment as the outcome moves up the supply curve in the supply constrained case. Next, consider the opposite case, where the initial position is at the point where the firm's bargaining power is at its minimum, ($\gamma = 0$), i.e. at point B in Figure 1. In this case a marginal *increase* in the firm's

bargaining power increases employment as the outcome moves down the demand curve in demand constrained case.

REGIME 3. The quasi-competitive case

To give a more complete characterization of the discontinuity, the next proposition compares the two critical values of the bargaining power, $\hat{\gamma}$ and $\tilde{\gamma}$.

Proposition 2:

(i) $\hat{\gamma} > \tilde{\gamma}$

(ii) For $\hat{\gamma} \geq \gamma \geq \tilde{\gamma}$, $\frac{\partial W}{\partial \gamma} = \frac{\partial N}{\partial \gamma} = 0$.

Proof: From Proposition 1 it follows that $\hat{\gamma} > \tilde{\gamma}$ if

$$(1-\varepsilon)(W^*)^2 - (2-\varepsilon)W^*A^L + (A^L)^2 = (W^* - A^L)((1-\varepsilon)W^* - A^L) > 0 \quad (14)$$

This is always fulfilled with strict inequality because $W^* > A^L$ and $\varepsilon < 0$, proves part (i) of the proposition. Part (ii) of the proposition follows from the fact that for $\hat{\gamma} \geq \gamma \geq \tilde{\gamma}$, $W^D < W^*$ and $N^D > N^S$, which is an impossible solution, and $W^S > W^*$ and $N^S > N^D$, which also is an impossible solution. Increased bargaining power of the firm cannot result in decreased wage and employment along the demand schedule, and increased bargaining power of the union cannot result in increased wage and employment along the supply schedule. Thus, nothing happens when the bargaining power changes within the interval $\hat{\gamma} \geq \gamma \geq \tilde{\gamma}$. \square

To explain the intuition behind this result, consider a gradual increase in the bargaining power of the firm from the situation where the firm has no power ($\gamma = 0$), i.e., the monopoly union solution. In this demand-constrained case, the outcome moves down the demand schedule until the wage reaches W^* from above. The union is forced to accept a lower wage, but gain higher employment, although the union utility level is reduced. When the wage reaches $W = W^*$, the firm react to a further reduction in the wage by reducing the employment because it is now constrained by the labor supply curve. Thus the union loses both in terms of wage and employment, and the marginal loss of the union makes a jump upwards.

Figure 2 illustrates the bargaining solution (8) with the relative union utility change and the bargaining power weighted relative profit change with respect to wages, $(\partial U/\partial W)/(U - U^0)$ and $-\gamma(\partial \Pi/\partial W)/((1-\gamma)\Pi)$, respectively, on the vertical axes and the wage level on the horizontal axes. At the bargaining solution, the wage is such that the quantities on the vertical axes are equal. As to the slope of the curves, the relative increase in union utility with respect to wages is decreasing in the wage level. On the other hand, the slope of the absolute value of the relative profit change with respect to wages may differ between the bargaining regimes. It is increasing in the wage level when the outcome is supply constrained, while the effect of increased wage has in general an ambiguous sign when the outcome is demand constrained. In Figure it is drawn with a negative slope to the right of W^* and consistent with the second order condition for a bargaining solution. It is important to notice that while the curve representing the relationship between $-\gamma(\partial \Pi/\partial W)/((1-\gamma)\Pi)$ and W is continuous because the slope of the isoprofit curve is equal to zero when $W = W^*$ and $N = N^*$, this is not the case for the curve representing the relationship between $(\partial U/\partial W)/(U - U^0)$ and W . At $W=W^*$ the relative utility gain from a further wage increase makes a downward discrete jump since a wage increase now implies the conventional employment loss since the union will be constrained by the labor demand curve. In Figure 2, the bargaining power weighted change in relative profits is drawn for the two critical levels of the bargaining power. When the wage reaches W^* from above, and $\gamma = \hat{\gamma}$, a marginal increase in γ is not enough to further reduce the wage. For $\hat{\gamma} \geq \gamma \geq \tilde{\gamma}$, marginal changes in the bargaining power do not alter the bargaining outcome; both the wage and employment is independent of marginal changes in γ . Only if firm bargaining power is increased to the next critical level, $\gamma = \tilde{\gamma}$, a marginal reduction in γ again reduces the wage as the supply-constrained case now applies.

Figure 2 about here

The relationship between employment and the bargaining power of the firm implied by Propositions 1 and 2 is presented in Figure 3, where A and B is the monopsony and monopoly union solutions, respectively. How relevant is the case where changes in the bargaining power have no effect? Within the present setup, the factors influencing the relevance of the quasi-competitive case are the competitiveness of the labor and product markets. In addition, union objectives are important as discussed in the next section. Here we first look at the marginal

effects of changes in the competitiveness of the labor and product markets, and thereafter we undertake a simple numerical illustration.

Figure 3 about here

Assume that product demand is $X = kP^{-\eta}$ and the technology is simply $X = N$, i.e. the revenue function is given by $R(N) = P(X)X(N) = kN^\kappa$, where $\kappa = (1 - \eta^{-1}) \in (0, 1]$ is a constant and can be interpreted as a measure of product market competitiveness. In this case, $\varepsilon = \kappa - 1$.

The probability that the quasi-competitive case will occur is related to $\hat{\gamma} - \tilde{\gamma}$. From (12) and (13) it follows that

$$\hat{\gamma} - \tilde{\gamma} = \frac{\kappa(W^* - A^L)}{(1 - \kappa)A^L} \frac{(1 - \frac{1}{2}\kappa)W^* - \frac{1}{2}A^L}{(1 - \frac{1}{2}\kappa)W^* - \frac{1}{2}\kappa A^L} \quad (15)$$

Obviously, changing the demand and supply parameters in (6) changes the competitive wage W^* . Here we evaluate the effect of changes in ϕ and κ while keeping W^* constant, i.e., we analyze the effect on $\hat{\gamma} - \tilde{\gamma}$ for given wage in the quasi-competitive case. For labor supply this is done by changing ϕ via changes in $A^H - A^L$. It follows from (15) that reduced market power for the firm in the labor market, that is decreased ϕ measured by a rise in A^L , has a negative effect on $\hat{\gamma} - \tilde{\gamma}$.⁴ At the margin where $\phi = 0$, the traditional union model applies, and the quasi-competitive regime is not relevant.

To evaluate the effect of reduced market power of the firm in the product market, we change the constant term k in the production function along with changes in κ in order to keep W^* fixed. The marginal effect is simply found by the derivative of (15) with respect to κ for given W^* . The effect is positive; Increased competitiveness increases $\hat{\gamma} - \tilde{\gamma}$. This is partly due to the fact that the negative effect on profit of increased employment becomes smaller when the price of the product is less sensitive to output.

⁴ Alternatively this effect could be evaluated by reducing the number of potential workers L to the firm. From (6) this will increase the competitive wage W^* , which in turn has a positive effect on $\hat{\gamma} - \tilde{\gamma}$ from (15).

In order to illustrate the potential importance of the quasi-competitive case, Figure 4 presents the relationship between $\hat{\gamma} - \tilde{\gamma}$ and κ for two different labor supply curves.⁵ As evident from (15), $\hat{\gamma} - \tilde{\gamma}$ is increasing in κ . This is because as κ increases, $\tilde{\gamma}$ is reduced more than $\hat{\gamma}$. For plausible market powers in the product market, the quasi-competitive case is important. When $\kappa = 0.6$ and the wage mark-up over the alternative wage for the worker with the lowest alternative wage ($W^* - A^L$) is equal to 0.2, $W = W^*$ for relative bargaining power of the firm in the range 0.70–0.89. By reducing A^L such that $(W^* - A^L)$ increases to 0.4, $W = W^*$ for relative bargaining power of the firm in the range 0.25–0.80.⁶

Figure 4 about here

Notice that under some conditions, the outcome may never be demand-constrained because W^* may be equal to the monopoly union wage.⁷ On the other hand, when relative bargaining power of the firm is close to unity, the outcome will always be supply-constrained as long as ϕ has a finite value, i.e., as long as the firm has some market power in the labor market. In this case, the outcome will be $W = W^*$ for some range of γ .

3. Alternative union utility functions

To check the generality of our results we now investigate how the model results depend on the formulation of union preferences. The relative weight the union put on the wage compared to the employment can be described by the concavity of the utility function with respect to the wage relative to the concavity of the utility function with respect to employment. Several

⁵ We would ideally like to use empirical estimates of the slope of the labor supply schedule, represented by ϕ , in the numerical experiments. However, as noted by Manning (2003), there exist few estimates of this parameter. Two studies using exogenous wage variation, Staiger et al. (1999) and Falch (2001b), find different results. While Staiger et al. find a supply elasticity for nurses in Veteran Administrated hospitals of 0.1, Falch finds an elasticity of unity for teachers. Some studies have used an indirect approach by calculating the monopsony power of the firms. When using estimated parameters from an equilibrium search model, van den Berg and Ridder (1998) calculate the monopsony power to be in the range 0.10-0.17, which is equal to the inverse of the supply elasticity, see Boal and Ransom (1997). It seems fair to conclude that the evidence on the slope of the labor supply function is rather mixed. In our setup, the labor supply elasticity at $W = W^*$ depends on the constant term in the production function because A^H are scaled to secure a given W^* .

⁶ There exist few empirical estimates of the value of γ . Svejnar (1986) estimates union bargaining power $1-\gamma$ in the range 0.06 to 0.72 for different US companies. Using data on men in Australia, McDonald and Suen (1992) estimate $1-\gamma$ to the range 0.4 to 0.5 over the period 1966–1989.

⁷ This is easy to see in the extreme case with perfect competition in the product market ($\varepsilon = \kappa = 1$) for which the labor demand is flat and the monopoly union solution is equal to the competitive solution.

alternative formulations of the union utility function are specified in the literature. McDonald and Solow (1981) assume that the utility function of each worker is concave in the wage level. With such a formulation, the union utility function is more heavily weighted against *employment* than implied by (4).

One important feature of the union utility function used above is that the union care about the utility level of workers not employed in the firm. The number of union members employed outside the firm has no effect on the outcome, but there must be some union members employed outside the firm in order for the union to care about employment as long as employment is not shrinking. Layard et al. (1991) make the assumption that insiders do not care about the well-being of workers outside the firm, but assume instead that they care about the probability of being laid off. Because the probability of reemployment depends on expected change in employment, the workers implicitly care about employment, but the union preferences is more heavily weighted against *wages* than implied by (4). The consequences of union utility more heavily weighted against wages than implied by our initial assumptions can be investigated by a simple reformulation of the union utility function.

We assumed above that workers employed by the firm are a random draw from the pool of workers with an alternative income below W . In practice, rules like ‘last in - first out’ (LIFO) may question this assumption. Consider instead a case where the firm has gradually expanded to the present size, along the supply curve, which means that seniority is a negative function of the alternative wage. With a LIFO rule, the worker with the highest alternative wage is firstly laid off if the firm decreases employment. In this case the union utility function is

$$U = \sum_{i=1}^L U_i = NW + (N^S - N) \frac{W + W^S}{2} + (L - N^S) \frac{A^H + W}{2} \quad (16)$$

W^S is the lowest wage necessary to employ N workers. On the labor supply curve, $W^S = W$, while on the labor demand curve, $W^S < W$. It is easy to show that indifference curves corresponding to (16) are flat just where they meet the supply curve. The reason is that on the supply curve, the next worker hired is paid his opportunity wage and the first worker laid off can get the same wage in alternative employment. The relevant measure in wage bargaining, however, is the net union utility.

$$\begin{aligned}
U^0 &= N \frac{W^S + A^L}{2} + (N^S - N) \frac{W + W^S}{2} + (L - N^S) \frac{A^H + W}{2}, \\
U - U^0 &= N \frac{2W - W^S - A^L}{2} = N \left(W - A^L - \frac{N}{2\phi} \right).
\end{aligned} \tag{17}$$

By inserting (1) into (17), it is easily seen that on the supply curve the net union utility (17) is equal to (4). Thus, the bargaining outcome in the supply-constrained case is independent of whether a LIFO rule is taken into account in the formulation of the union preferences.

In the demand-constrained case, $N < N^S$, the wage outcome will be larger under a LIFO rule than in the random case because the net union utility function (17) is more heavily weighted against wages than (4). For given bargaining power, the wage in the demand-constrained case (REGIME 1) will be higher, which implies that $\hat{\gamma}$ will be smaller, i.e., the range of γ for which $W = W^*$ is lower.

Oswald (1993) introduces an extreme version of the union utility function under the LIFO principle. He argues that the median worker in terms of tenure is the decisive union member, and in most cases the probability of layoff for the median member is small and negligible. Assuming that the decisive member of the union has an alternative wage equal to $\delta W + (1 - \delta)A^L$, where $0 < \delta < 1$ describes the position of the decisive member in the distribution of the alternative wage, the revealed preferences of the union are

$$U - U^0 = (1 - \delta)(W - A^L) \tag{18}$$

When the union does not care about employment, the indifference curves are flat, and there is no discontinuity in the marginal union utility for $W = W^*$. Now the bargaining outcome will be continuous in γ .

Proposition 3

When the union utility function is given by (18)

$$\hat{\gamma} = \tilde{\gamma} = \hat{\gamma} = \frac{(1 - \kappa)W^*}{(1 - \kappa)W^* + \kappa(W^* - A^L)} \tag{19}$$

Proof: With the utility function (18), the wages under the demand and supply constrained cases are

$$W^D = A^L \left(1 + \frac{(1-\gamma)(1-\kappa)}{\gamma\kappa - (1-\gamma)(1-\kappa)} \right) \quad (20)$$

and

$$W^S = \frac{\gamma}{1+\gamma} A^L + \frac{R(N)(1-\gamma) + \gamma\kappa}{N(1+\gamma)}, \quad (21)$$

respectively. For $W = W^*$, implying $R'(N) = W^*$, manipulation of (20) and (21) yields (19). \square

In contrast to the case with a rent maximizing union considered in Proposition 1 and 2, there exist only one value of firm bargaining power, $\hat{\gamma}$, for which the bargaining outcome equals the competitive solution.⁸ Notice further that $\hat{\gamma}$ has an intermediate value compared to $\hat{\gamma}$ and $\tilde{\gamma}$. Compared to the rent maximizing union, the range of values of the bargaining power for which the outcome is supply constrained (REGIME 2) is larger because the union gain of a wage increase is lower (does not value higher employment), and the range of values of the bargaining power for which the outcome is demand constrained is larger because the union gain of a wage increase is higher (does not care about lower employment).

The assumption that the union does not care about the employment level must be considered as an extreme specification of union preferences. Appendix A proves that as long as the union to some extent care of the employment level, Propositions 1 and 2 holds and there will be some range of the bargaining power for which $W = W^*$.

4. Conclusion.

In this paper we have developed a simple model of wage bargaining between a union and a firm facing an upward sloping labor supply curve to analyze how changes in the relative bargaining power of the union and the firm alter the bargaining outcome. Starting from the monopoly union case with zero bargaining power of the firm, increased firm bargaining power reduces the wage and increases the employment along the labor demand curve until labor demand equals labor supply. A further increase in firm bargaining power does not affect the wage and employment at the margin. The ‘competitive’ solution applies for a range of

⁸ It follows from (20) and (21) that, evaluated for $W = W^*$, the marginal effect of γ is equal in the supply and demand constrained cases.

values of the relative bargaining power. Only when the firm bargaining power exceeds a certain critical value, increased firm bargaining power decreases the wage (and employment) along the labor supply curve, and in the limit the pure monopsony solution applies. The likelihood of the intermediate (quasi-competitive) case increases as the market powers of the firm in the product and labor markets decline, and if the union objectives get more weighted against employment relative to wages.

The model predicts a nonlinear relationship between relative bargaining power and employment. As the relative firm bargaining power increases from zero to unity, the employment firstly increases, then stays constant, and finally decreases. Thus, the model offers one explanation of the inconclusiveness regarding the union employment effects often found in empirical work. Our model suggests that when estimating the effect of unions on employment it is important to take into account whether the firm has some market power in the labor market.

The model shows that union influence may be efficient enhancing when firms have market power in the labor market because the wage then may be closer to the marginal revenue product of labor than when unions are absent. In fact, bargaining power in the hands of trade unions may secure efficiency because 'medium' powerful unions may secure an outcome where demand equals supply, where 'medium' powerful does not imply a certain level of the union bargaining power but a range of different bargaining powers. An important caveat, however, is that this conclusion is based on a partial analysis, in future work this should be more closely analyzed within a general equilibrium model.

Appendix A. Flexible union utility function

The union potentially cares about the wage and employment levels. The functional form of the utility function is in general unknown, and in this appendix we simply assume that the net union utility is given by

$$U - U^0 = u(W, N). \quad (\text{A.1})$$

Based on (A.1) and (8), the bargaining outcome in the demand and supply constrained cases, respectively, can be written

$$\Psi_{W^D} = \frac{\gamma\kappa\varepsilon - (1-\gamma)(1-\kappa)\Psi_N}{(1-\gamma)(1-\varepsilon\kappa)\varepsilon} \quad (\text{A.2})$$

$$W^S = \frac{\gamma A^L + (\gamma\kappa + (1-\gamma)\Omega)R(N)/N}{2\gamma + (1-\gamma)\Omega} \quad (\text{A.3})$$

where

$$\Psi_W = \frac{\partial u(W, N)}{\partial W} \frac{W}{u(W, N)}, \quad \Psi_N = \frac{\partial u(W, N)}{\partial N} \frac{N}{u(W, N)}, \quad \text{and} \quad \Omega = \Psi_W \frac{W - A^L}{W} + \Psi_N \quad (\text{A.4})$$

(A.2) and (A.3) yields

$$\hat{\gamma} = \frac{(1-\kappa)W^*\Omega}{(1-\kappa)W^*\Omega + \kappa(W^* - A^L)}, \quad (\text{A.5})$$

$$\tilde{\gamma} = \frac{(1-\kappa)(\varepsilon\Psi_W + \Psi_N)}{(1-\kappa)(\varepsilon\Psi_W + \Psi_N) + \kappa\varepsilon} \quad (\text{A.6})$$

For $\Psi_W = W/(W - A^L)$ and $\Psi_N = 1$, as for the rent maximizing union utility function (4), these expressions are equal to the expressions in Proposition 1. It follows that $\hat{\gamma} \geq \tilde{\gamma}$ if

$$\Psi_N((1-\varepsilon)W^* - A^L) \geq 0, \quad (\text{A.7})$$

which holds with strict inequality if Ψ_N is strictly positive, while for $\Psi_N = 0$, the expression holds with equality. Thus, as long as the union care about employment, there will be some range of γ for which $W = W^*$.

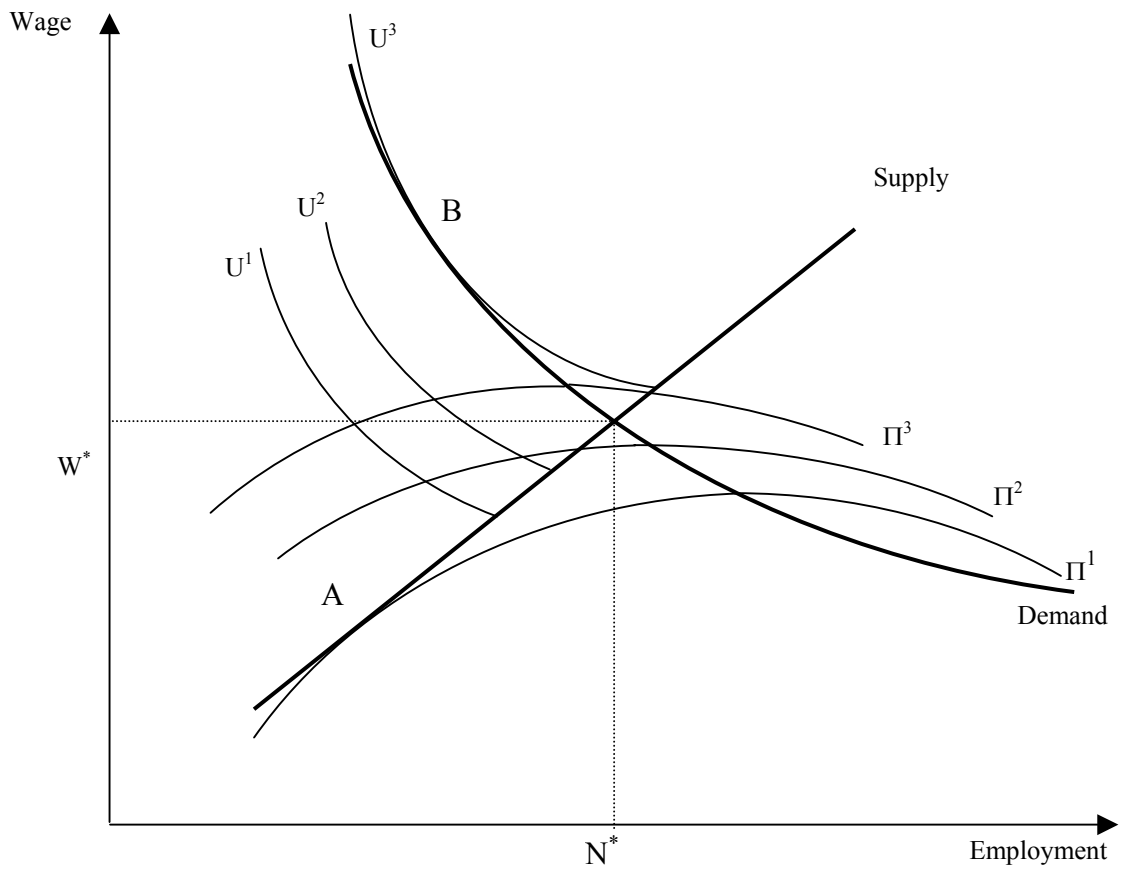


Figure 1. Isoprofit and indifference curves

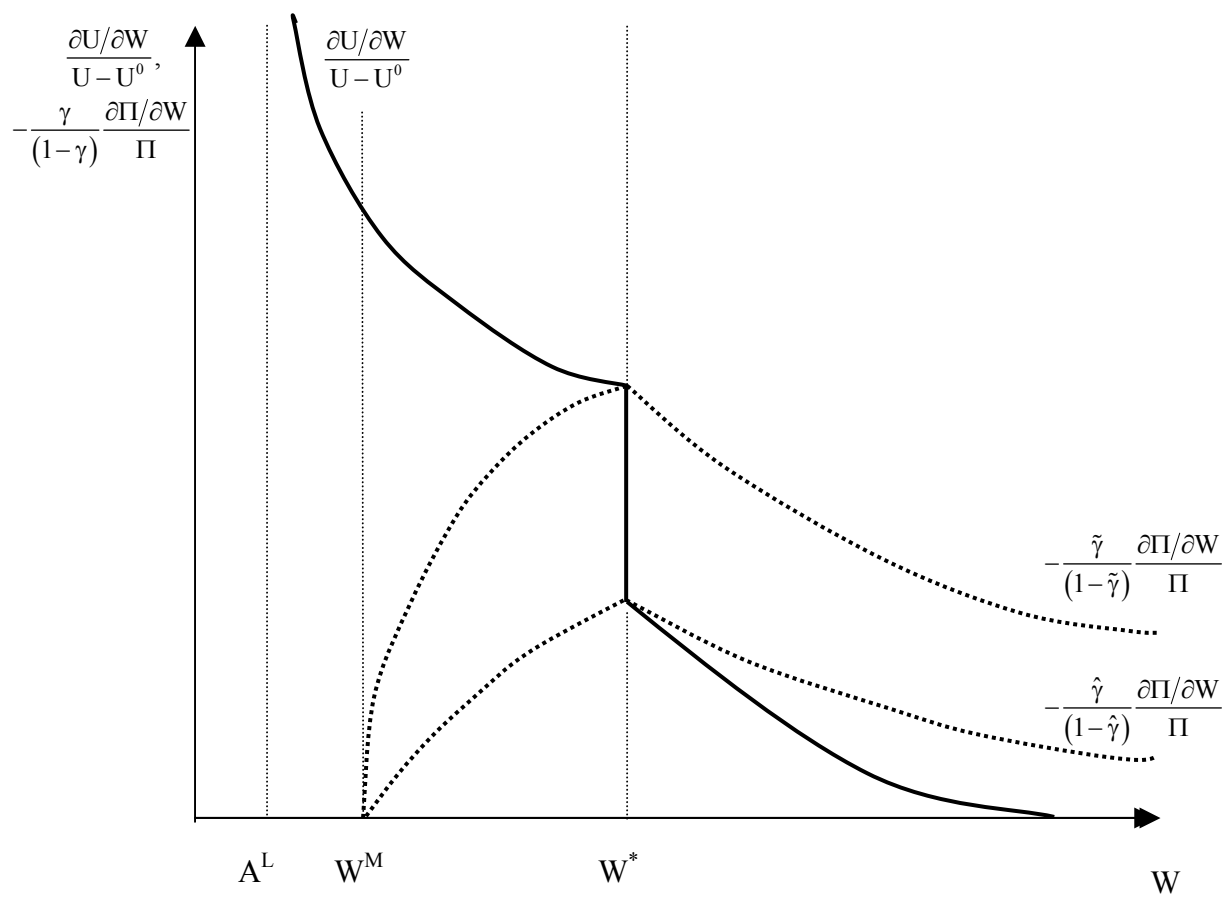


Figure 2. The bargaining solution.

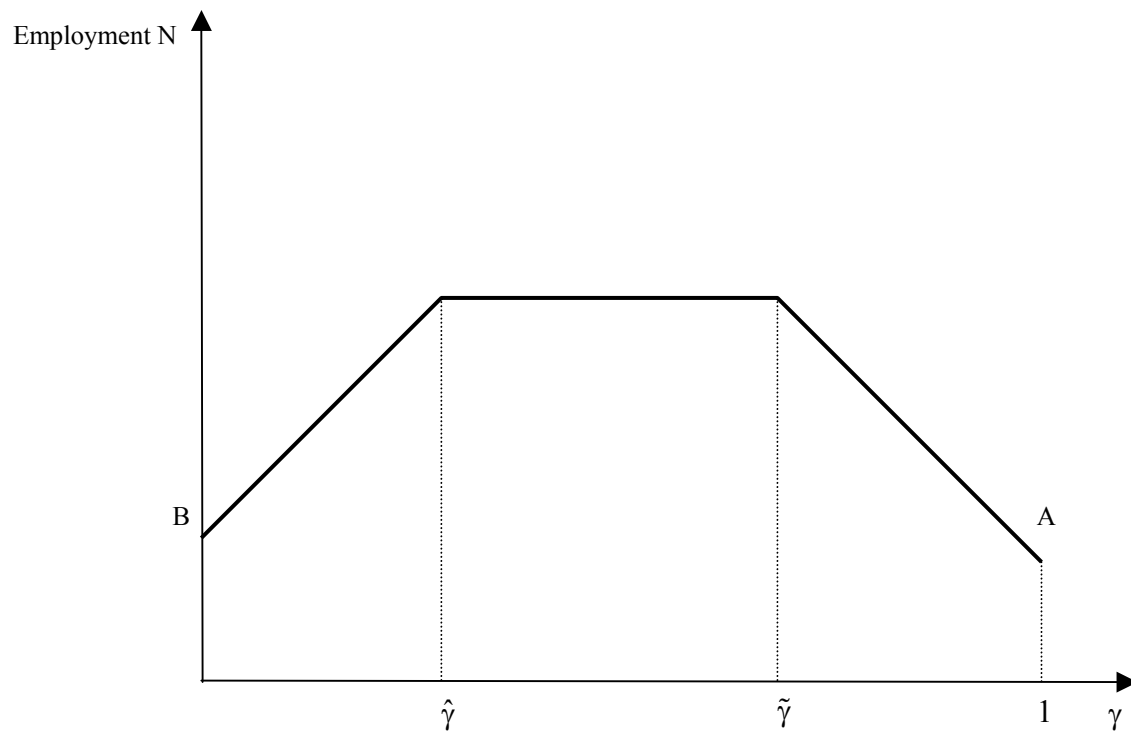


Figure 3: Employment and the bargaining power of the firm

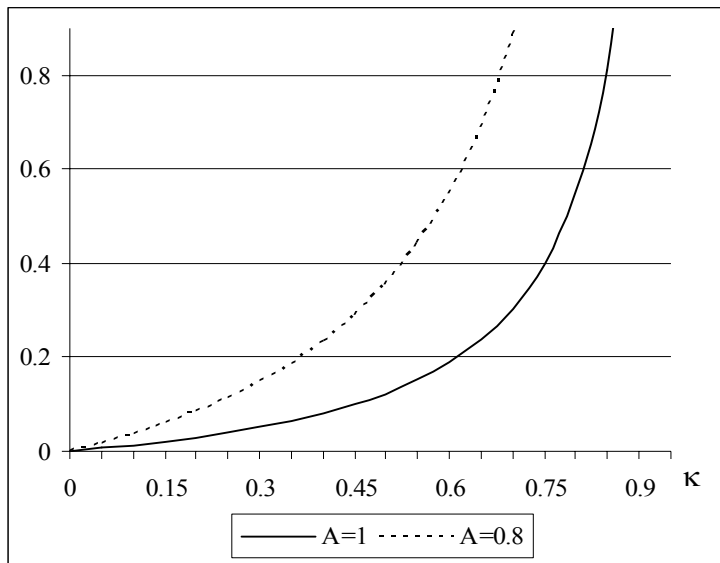


Figure 4. The relationship between $\hat{\gamma} - \tilde{\gamma}$ and κ . $W^* = 1.2$, and $A^L = 1$ or $A^L = 0.8$.

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**Erratum to Torberg Falch and Bjarne Strøm, "Wage bargaining and monopsony",
Working paper series 8/2004, Norwegian University of Science and Technology.**

In Proposition 1 of the Working Paper, the definitions of the critical bargaining powers of the firm, $\hat{\gamma}$ and $\tilde{\gamma}$, have been interchanged. The correct definitions read

$$\hat{\gamma} = \frac{(1-\kappa)(A^L - (1+\varepsilon)W^*)}{(1-\kappa)(A^L - (1+\varepsilon)W^*) - \kappa\varepsilon(W^* - A^L)}$$

and

$$\tilde{\gamma} = \frac{(1-\kappa)W^*}{(1-\kappa)W^* + \frac{1}{2}\kappa(W^* - A^L)}.$$

The rest of Proposition 1 is correct.

The misprint regarding $\hat{\gamma}$ and $\tilde{\gamma}$ has turned Proposition 2 around. The correct Proposition 2 reads

Proposition 2:

(i) $\hat{\gamma} < \tilde{\gamma}$

(ii) For $\hat{\gamma} \leq \gamma \leq \tilde{\gamma}$, $\frac{\partial W}{\partial \gamma} = \frac{\partial N}{\partial \gamma} = 0$.

For the Cobb Douglas specification of product demand, equation (15) reads

$$\tilde{\gamma} - \hat{\gamma} = \frac{\kappa(W^* - A^L)}{(1-\kappa)A^L} \frac{(1-\frac{1}{2}\kappa)W^* - \frac{1}{2}A^L}{(1-\frac{1}{2}\kappa)W^* - \frac{1}{2}\kappa A^L}$$

The numerical example in Figure 4 is correct, except that the figure presents the relationship between $\tilde{\gamma} - \hat{\gamma}$ and κ instead of $\hat{\gamma} - \tilde{\gamma}$ and κ .

Detailed derivation of the results is available at

<http://www.sv.ntnu.no/iso/torberg.falch/nettsider/Paper/Lagrangian.pdf>