The University of Nottingham

research paper series

Globalisation and Labour Markets

Research Paper 2006/15

Open Shop Unions and Product Market Competition

by

Paulo Bastos, Udo Kreickemeier and Peter Wright

The Centre acknowledges financial support from The Leverhulme Trust under Programme Grant F114/BF

GEP

Leverhulme Centre for Research on Globalisation and Economic Policy

The Authors

Paulo Bastos is a Postgraduate Research Student in the Leverhulme Centre for Research on Globalisation and Economic Policy (GEP), University of Nottingham; Udo Kreickemeier is a Lecturer in the School of Economics, University of Nottingham, and an Internal Fellow in GEP; Peter Wright is an Associate Professor and Reader in the School of Economics, University of Nottingham, and an Internal Fellow in GEP.

Acknowledgements

Financial support from the Leverhulme Trust (Programme Grant F114/BF) is gratefully acknowledged. Paulo Bastos thanks Fundação para a Ciência e a Tecnologia (SFRH/BD/17274/2004) for financial support.

Open Shop Unions and Product Market Competition

by

Paulo Bastos, Udo Kreickemeier and Peter Wright

Abstract

In this paper we analyse the impact of changes in product market competition on wage outcomes in the presence of an open shop union. With less than full union membership, product market competition is shown to affect not only a unionised firm's profits but also its payoff in the event of a dispute. In contrast to the prediction of the standard model, increases in product market competition may now increase wage levels. The model is therefore able to accommodate the mixed empirical findings regarding the impact of product market competition on union wages.

JEL classification: J51; J52; L13

Keywords: Bargaining, open shop trade unions, product market competition.

Outline

1. *Introduction*
2. *The Model*
3. *Robustness Checks*
4. *Concluding Comments*

Non-Technical Summary

The standard model of union bargaining in a Cournot oligopoly gives clear and intuitively plausible predictions on the effect that product market competition has on wages. In a widely cited paper, Dowrick (1989) finds that, under decentralised bargaining, an increase in the number of firms competing in an industry induces a reduction in the bargained wage. Naylor (2002a) shows that because of the wage moderation effect that results from product market competition, an increase in the number of firms competing in the product market may actually lead to an increase in industry profits.

In contrast to the clear theoretical prediction, the evidence on the effect of product market competition on bargained wages is mixed. For the U.S. and U.K. economies, where bargaining occurs primarily at the firm level, a number of studies examining the impact of market structure on union wage outcomes obtain the result that higher market power is frequently associated with lower union wages.

Our aim in this paper is to develop a model that can accommodate these mixed empirical results. We show that the established theoretical prediction of a positive relationship between bargained wages and industry concentration crucially depends on the assumption that the union is a closed shop with 100% level of membership, implying that unionised firms stop producing in the event of a strike. This assumption, however, is seldom realistic. In most developed countries, open shop arrangements, where the union is recognised for bargaining purposes but membership is not compulsory, are the dominant form of union organisation. In addition, empirical evidence indicates that firms normally do not stop operating during a strike. In the present paper, we analyse the impact of product market competition on the outcome of union-firm bargaining when workers are organised in open shop unions that represent only part of the workforce of a firm. In this case, unionised establishments continue to operate in the event of a strike with their non-unionised workers, and so the wage outcome is affected by the level of union density. Additionally, the bargain is now affected by the extent to which the firm's competitors expand their own production in the event of a strike.

As our main result, we show that for sufficiently low (but strictly positive) levels of union density increased product market competition leads to higher wages, thereby reversing the prediction of the standard model, while the standard result prevails for sufficiently high levels of union density. The intuition as to why the standard result can be overturned in the case of open shop unions is straightforward: Product market competition impacts not only on unionised firm's profits but also their payoff in the event of a dispute. If a union strikes at one firm, competitors will optimally expand their production. As a consequence, the firm's disagreement payoff falls, helping the union in the bargain. Hence the union captures a larger share of a smaller pie, and the net effect on the wage rate is indeterminate. Due to the robustness of this mechanism, our main result holds for a broad class of specifications used in the literature with respect to the union objective function and to the scope of bargaining.

1 Introduction

The standard model of union bargaining in a Cournot oligopoly gives clear and intuitively plausible predictions on the effect that product market competition has on wages. In a widely cited paper, Dowrick (1989) finds that, under decentralised bargaining, an increase in the number of firms competing in an industry has the unambiguous effect of reducing the bargained wage.[1] In two recent papers, Naylor (2002a,b) explores the implications of this result for profits, both at the industry and firm level. Naylor (2002a) shows that because of the wage moderation effect that results from product market competition, an increase in the number of firms competing in the product market may actually lead to an increase in industry profits. Naylor (2002b) demonstrates that, for similar reasons, it is actually possible for every firm's profit to increase with the number of firms in the industry.

In contrast to the clear theoretical prediction, the evidence on the effect of product market competition on bargained wages is mixed. For the U.S. and U.K. economies, where bargaining occurs primarily at the firm level, a number of studies examining the impact of market structure on union wage outcomes obtain the result that higher market power is frequently associated with lower union wages. Using individual level data for the U.S., Block and Kuskin (1978), Freeman and Medoff (1981) and MacPherson and Stewart (1990) find that union wages are negatively associated with the degree of industry concentration. Hendricks (1975) uses information on union contracts, and finds that an increase in the

[1] Under the standard assumption of zero disagreement payoffs, this result holds whether bargaining is restricted to wages or covers both employment and wages.

degree of sales concentration raises wages only in highly unionised industries. In industries characterised by low and medium unionisation, wages are significantly negatively associated with industry concentration. Abowd and Tracy (1989) find that the impact of industry sales concentration on union wages is positive at low levels of concentration and negative at high levels of concentration. Bratsberg and Ragan (2002) analyse the effect of deregulation on the union wage premium over the period 1972-99 and show that the results vary considerable across industries. For the U.K., Stewart (1983) finds that the level of concentration in the industry has no significant effect on the earnings of union members, while Van Reenen (1996) obtains a negative and (weakly) significant effect of concentration on wages.

Our aim in this paper is to develop a model that can accommodate these mixed empirical results. We show that the established theoretical prediction of a positive relationship between bargained wages and industry concentration crucially depends on the assumption that the union is a closed shop with 100% level of membership, implying that unionised firms stop producing in the event of a strike. This assumption, however, is seldom realistic. In most developed countries, open shop arrangements, where the union is recognised for bargaining purposes but membership is not compulsory, are the dominant form of union organisation (see, for example, Boeri et al (2001), Visser (2003) and Booth and Bryan (2004)).[2] In addition, empirical evidence indicates that firms normally do not stop op-

[2]The theoretical literature on open shop unions considers that in the event of disagreement the firm continues production with the fraction of its workers who are not members of the union (see Naylor and Cripps (1993), Naylor and Rauum (1993), Corneo (1993, 1995)). In these models, by affecting the payoff of the firm in event of a dispute, the level of union density impacts on the outcome of collective bargaining.

erating during a strike. In the present paper, we analyse the impact of product market competition on the outcome of union-firm bargaining when workers are organised in open shop unions that represent only part of the workforce of a firm, implying that unionised firms can produce with their non-unionised workers in the event of a strike.[3]

As our main result, we show that for sufficiently low (but strictly positive) levels of union density increased product market competition leads to higher wages, thereby reversing the prediction of the standard model, while the standard result prevails for sufficiently high levels of union density. The intuition as to why the standard result can be overturned in the case of open shop unions is straightforward: Product market competition impacts not only on unionised firm's profits but also their payoff in the event of a dispute.

However, this literature does not include explicit models of the product market and firm's oligopolistic behaviour so they are unable to explain the interactions between product markets structure and union-firm bargaining.

[3]Gramm (1991) and Gramm and Schnell (1994) examine firms' operating capacity at struck facilities during a strike. They use a sample of 35 large strikes (involving 1,000 or more workers) in single firm bargaining units in the US during 1984-1988, and 21 small strikes (involving 6 or more workers in 1984-85 and 20 or more workers in 1986-88) in New York. In the US sample they find an average operating capacity of 57% when no replacements are hired, 77% when temporary replacements are hired, and 90% when permanent replacements are used. In the New York sample the average operating capacity was 60% regardless of the use of replacements. Cramton and Tracy (1998) analyse strikes involving bargaining units of at least 1,000 workers in the period 1980-89. They find that the firm's average operating capacity during the strike is 43% when no replacements are hired, 67% with temporary replacements, and 56% with permanent replacements. In addition, they find that the fraction of strikes involving replacements is relatively small (14.1%), which is in accordance with previous evidence provided by Olson (1991) and Gramm (1991).

If a union strikes at one firm, competitors will optimally expand their production. As a consequence, the firm's disagreement payoff falls, helping the union in the bargain. Hence the union captures a larger share of a smaller pie, and the net effect on the wage rate is indeterminate. Due to the robustness of this mechanism, our main result holds for a broad class of specifications used in the literature with respect to the union objective function and to the scope of bargaining.

The remainder of the paper is organised as follows. In section 2, we introduce the basic model and derive the outcome of collective bargaining. We start by analysing the case in which a monopolist bargains over wages with an open shop union. We then examine how the outcome of collective bargaining changes when the same firm competes with a second firm, which may or may not be unionised. Section 3 briefly discusses the robustness of the results. Section 4 concludes.

2 The model

Consider the market for a homogeneous commodity with inverse linear demand

$$p = a - by \tag{1}$$

where p denotes product price and y total output. Changes in the degree of product market competition are captured in the simplest way possible by comparing a monopoly firm 1 (in which case $y = y_1$) and a Cournot duopoly with firms 1 and 2 (in which case $y = y_1 + y_2$). Assume that this market is small relative to the rest of the economy, so that we can abstract from income effects. Firm 1 is assumed to be unionised, while firm 2 may

or may not be unionised.

Each firm is assumed to produce under constant returns-to-scale, with labour l_i ($i = 1, 2$) as the only input. The marginal product of labour is set to unity as a numeraire. Therefore, one can denote output and employment interchangeably ($y_i = l_i$) and a firm's profit equals

$$\pi_i = (p - w_i)y_i = (a - by - w_i)y_i. \tag{2}$$

We assume that the objective of the union in firm 1 can be represented by the Stone-Geary utility function

$$\Omega_1 = (w_1 - w^c)^\theta l_1^{1-\theta} \tag{3}$$

where w^c denotes the reservation wage and parameter $\theta \in (0, 1]$ the relative strength of the union's preference for wages over employment. This functional form encompasses the common assumptions of rent maximisation ($\theta = \frac{1}{2}$) and wage maximisation ($\theta = 1$) as special cases. The reservation wage is assumed to be exogenous and, without further loss of generality, is set equal to zero ($w^c = 0$). If a second unionised firm is present in the market, the utility of the union in this firm is represented by a function analogous to (3).

We assume that the union is an open shop, and the fraction of workers who are union members is denoted by $\mu \in (0, 1]$. The firm pays all its workers, whether they are union members or not, the same bargained wage, w_1.[4] Union density is exogenously given when

[4]This amounts to assuming that the union wage effect is a pure public good. For empirical evidence supporting this assumption see Barth et al. (2000) and Booth and Bryan (2004). Using matched employer-employee data for Norway and the UK, these papers provide evidence that, when controlling for the level of union density in the establishment, the individual membership status ceases to have any significant effect on the wage.

collective bargaining takes place, and hence the individual decision to become a union member is taken to be independent of wage formation. This assumption is consistent with the literature on open shop unions, according to which membership may be motivated by private goods provided by the union and therefore independent of the collective wage.[5]

Following Naylor and Cripps (1993) and Naylor and Raaum (1993), we consider a sequence of contract periods. In each contract period, the model can be described as a two-stage game. In stage one, firm(s) and union(s) bargain over wages, for a given level of union density. In stage 2, firms decide on their level of production, and hence employment, taking as given the wage of the other firm (in the case of a duopoly) and taking into consideration their labour demand schedule.[6] In order to solve the model analytically, we proceed by backwards induction.

[5]Naylor and Cripps (1993) and Booth and Chatterji (1995) argue that membership is increasing in the collective wage. This result, however, hinges on the crucial assumption that the marginal utility of income of each worker is decreasing with income, which guarantees that the utility loss by paying the membership fee is decreasing in the wage. Under this assumption, a higher wage ensures that even workers that place a relatively low valuation on the union excludable good rationally decide to become union members. However, this (restrictive) assumption is not common to all papers on open shop unions. Naylor and Raaum (1993) and Corneo (1993, 1995, 1997) assume that the marginal utility of income of each member is constant, which implies that the individual decision to become a union member is independent of the collective wage.

[6]The alternative of efficient bargaining, where firms and unions bargain over wages and employment, is considered in Section 3.

2.1 Solving for production

Under the right-to-manage assumption, firms will choose the level of output (employment) in order to maximise profits given the bargained wage. Consider first that firm 1 is a monopolist. Solving the first order condition for profit maximisation yields

$$y_1^* = \frac{a - w_1}{2b}. \tag{4}$$

Alternatively, with a duopoly in the product market, best reply functions are given by the standard expressions

$$y_i = \frac{a - w_i}{2b} - \frac{1}{2}y_j \qquad i, j = 1, 2, i \neq j \tag{5}$$

and equilibrium outputs follow as

$$y_i^* = \frac{a - 2w_i + w_j}{3b} \qquad i, j = 1, 2, i \neq j. \tag{6}$$

2.2 Solving the wage bargain

The wage paid by firm 1 in each contract period is the outcome of a Nash bargain with the union

$$\arg\max_{w_1} \left\{ (\Omega_1 - \Omega_1^s)^\beta (\pi_1 - \pi_1^s)^{1-\beta} \right\}. \tag{7}$$

Here, Ω_1^s and π_1^s represent, respectively, the disagreement payoff of the union and the firm, while $\beta \in (0, 1)$ represents the relative bargaining power of the union, and reflects possible asymmetries in the underlying bargaining procedure.[7] If a second unionised firm

[7] This formalisation is consistent with the non-cooperative interpretation of the Nash solution offered by Binmore et al. (1986). In this context, the union's relative power should not depend on union density provided that the influence of this variable is captured on the firm's disagreement payoff. Nevertheless, all qualitative results of the model would go through if β was assumed to be an increasing function of μ.

is in the market, bargaining within this firm is represented by a function analogous to (7). We assume that, in the event of a disagreement, union workers strike and receive their reservation wage.[8] Therefore, Ω_1^s is equal to zero independent of the market structure. By contrast, π_1, π_1^s and Ω_1^s depend on the market structure. We now proceed to derive their values for three cases: unionised monopoly; an asymmetric duopoly when one firm is unionised and the other is not; a symmetric unionised duopoly when both firms are unionised.

2.2.1 Unionised monopoly

From (3) and (4), union utility under monopoly is given by:

$$\Omega_1 = {w_1}^{\theta} \left(\frac{a - w_1}{2b} \right)^{1-\theta} \tag{8}$$

where, using (2) and (4), the monopolist's profit is given by:

$$\pi_1 = \frac{(a - w_1)^2}{4b}. \tag{9}$$

We assume that the firm and the union behave rationally and possess complete information. These assumptions exclude the possibility of a strike in equilibrium. However, by affecting the disagreement payoff of the firm, the threat of a strike is crucial in the

[8] Income of union members during a strike may consist of strike pay financed by union resources and/or income from temporary jobs that union members obtain during the dispute (see Layard et al. (1991)). Notice that if workers merely receive strike pay and this is less than w^c the reservation wage, there will be a minimum level of union density that the union must achieve in order to raise the wage above w^c (see Naylor and Cripps (1993) and Naylor and Raaum (1993)).

bargaining process.[9]

We follow Naylor and Cripps (1993) and Naylor and Raaum (1993) in assuming that, in the event of a strike, the firm continues production with its non-union members under the terms of the contract negotiated in the previous period. Hence, the monopolist's total sales under a strike are equal to the output that the firm is able to produce with its non-union workers, at the wage rate negotiated in the previous contract period ($\overline{w}_1$). Therefore, the output of firm 1 under a strike is given by:

$$y_1^s = (1-\mu)\overline{y}_1^* \tag{10}$$

where, $\overline{y}_1^*$ is the employment of the domestic firm in the previous contract period (that is, the firm's profit maximising level of employment at the wage rate $\overline{w}_1$). Output losses inflicted upon the firm in the event of a strike are therefore an increasing function of union density. As in Naylor and Cripps (1993) and Naylor and Raaum (1993) we assume that the firm is myopic in the sense that it neglects the impact of its current employment decisions on future wage negotiations. Hence we have $\overline{y}_1^* = \frac{1}{2b}(a - \overline{w}_1)$. From (2) and (10) the conflict payoff of the monopolist is given by:

$$\pi_1^s = \left(1-\mu^2\right)\frac{(a-\overline{w}_1)^2}{4b}. \tag{11}$$

To proceed, we follow in Naylor and Cripps (1993) and Naylor and Raaum (1993) and solve for the steady-state Nash bargained wage. This involves two steps. First, using (8),

[9] As noted by Binmore et al. (1986), the Nash bargaining solution can be interpreted by looking at an underlying dynamic game of the type proposed by Rubinstein (1982). Therefore, the disagreement payoffs should correspond to the streams of income that accrue to the parties when they are in a state of disagreement.

(9) and (11), we maximise the Nash product in (7) taking as given the wage of the previous contract period ($\overline{w}_1$). This leads to the first order condition for the current period Nash bargaining problem. The steady-state bargained wage follows by imposing the condition $w_1 = \overline{w}_1$. This gives:

$$w_1^{um} = \frac{\beta\theta\mu^2}{2-\beta(2-\mu^2)}a. \tag{12}$$

It is straightforward to check that the steady-state bargained wage is increasing in μ, β, and θ. The bargained wage also tends to zero whenever any of these parameters tends to zero.

2.2.2 Mixed duopoly

Consider now the entry of a second firm which, in this section, is assumed to be non-unionised. In the absence of a union, it pays its workers the reservation wage $w_2 = w^c = 0$. Under these circumstances, union utility in firm one is obtained from (6) and (3) as

$$\Omega_1 = w_1^{\theta}\left(\frac{a-2w_1}{3b}\right)^{1-\theta}, \tag{13}$$

and standard computations give the profit of firm 1 as

$$\pi_1 = \frac{(a-2w_1)^2}{9b}. \tag{14}$$

Following the previous discussion, the output of the unionised firm in the event of a strike equals $y_1^s = (1-\mu)\overline{y}_1^*$, where from (6) $\overline{y}_1^* = \frac{1}{3b}(a-2\overline{w}_1)$.

In order to find the disagreement payoff for the unionised firm, one needs to know the supply response of its non-unionised competitor in case of a strike. This is found by

substituting y_1^s into the best-reply function of the non-unionised firm, yielding

$$y_2^s = \frac{(2+\mu)a + 2(1-\mu)\overline{w}_1}{6b}. \tag{15}$$

It is easily checked by comparing (15) to (6), that firm 2 would expand its output in case of a strike, as would be expected.[10] Given this response, the disagreement payoff (profit) for firm 1 follows as:

$$\pi_1^s = \left[1 - \frac{\mu\,(1-\mu)}{2}\right] \frac{(a - 2\overline{w}_1)^2}{9b}. \tag{16}$$

Solving for the steady-state wage yields:

$$w_1^{md} = \frac{\beta\theta\mu(1+\mu)}{8 - \beta(8 - 2\mu(1+\mu))}a \tag{17}$$

As in the monopoly case, the steady-state bargained wage is increasing in the parameters μ, β, and θ.

The unionised monopoly-mixed duopoly wage differential

Comparison of (12) and (17) yields the unionised monopoly-mixed duopoly union wage differential, D:

$$D = w_1^{um} - w_1^{md} = A\frac{\beta\theta\mu}{2}a \tag{18}$$

where

$$A \equiv \frac{2\mu}{2 - \beta\,(2-\mu^2)} - \frac{1+\mu}{4 - \beta(4 - \mu(1+\mu))}. \tag{19}$$

From (18) it is clear that market entry of a non-unionised firm increases the wage paid by the unionised firm if and only if $A < 0$. In the case of symmetric Nash bargaining ($\beta = \frac{1}{2}$),

[10] Note that $a - 2\overline{w}_1 > 0$ has to hold for the output of firm 1 to be strictly positive.

this is true for $\mu \in (0, 0.312)$.[11]

In order to gain some some intuition for this result, note that in the borderline case of zero union membership ($\mu = 0$), a strike would not have any effect, and the firm pays the competitive wage in both situations ($w_1^{um} = w_1^{md} = 0$). With strictly positive union membership on the other hand, the profit differential $\pi_1 - \pi_1^s$ and hence the bargained wage rate becomes regime specific. Under monopoly, a marginal increase of μ starting from 0 has only a second-order effect on the disagreement payoff. This is different under mixed duopoly: There is a now a negative first order effect on the disagreement payoff because of the increase in the competitor's output that occurs during a strike. Therefore, for sufficiently small union densities, the profit differential $\pi_1 - \pi_1^s$ (and therefore the wage) is smaller under a unionised monopoly than under mixed duopoly. At the opposite extreme, when $\mu = 1$, $\pi_1 - \pi_1^s$ is higher under monopoly than under mixed duopoly. This follows from the fact that, when union membership is 100%, the disagreement payoff is zero in either case, while the profit is higher in the monopoly case in the absence of a strike. By continuity, this implies that at some intermediate level of density, wage rates are equal in both situations.

As shown in Appendix A, increasing product market competition not only raises wages but also union utility for sufficiently low levels of union membership. The range of membership levels for which this is true, is however smaller than that for wages. This is due to the fact that product market competition causes a contraction in employment of the

[11] A critical level of union density below which increasing product market competition raises the bargained wage can be shown to exist for all relative bargaining strengths.

unionised firm which, ceteris paribus, lowers union utility. Therefore, union utility will only increase if this fall is compensated for by a sufficiently large increase in the negotiated wage.

2.2.3 Unionised duopoly

Consider now the case where firm 2 is unionised as well. Workers are organised in firm-specific unions and bargaining is decentralised, in the sense that each firm bargains independently with the corresponding union. In addition, assume that the negotiations take place simultaneously and that firm 1 and its union correctly anticipate that the wage will be agreed between firm 2 and its union, when negotiating their own wage.

To keep the model analytically tractable, we consider the perfectly symmetric case. In particular, we assume that union density is the same in both firms ($\mu_1 = \mu_2 = \mu$), and that unions have identical objective functions ($\Omega_1 = \Omega_2$) and bargaining power ($\beta_1 = \beta_2 = \beta$). Under these circumstances, union utility can be written as

$$\Omega_1 = w_1^{\theta} \left(\frac{a - 2w_1 + w_2}{3b} \right)^{1-\theta} \tag{20}$$

with an analogous equation determining Ω_2. The profit of firm 1 becomes

$$\pi_1 = \frac{(a - 2w_1 + w_2)^2}{9b} \tag{21}$$

As before, the output of firm 1 in the event of a strike is $y_1^s = (1-\mu)\overline{y}_1^*$, where this time $\overline{y}_1^* = \frac{1}{3b}(a - 2\overline{w}_1 + \overline{w}_2)$. Substituting into the best reply function of firm 2 gives

$$y_2^s = \frac{a(2+\mu) + (2\overline{w}_1 - \overline{w}_2)(1-\mu) - 3w_2}{6b}, \tag{22}$$

which is the level of production of firm 2 in the event of a strike in firm 1. We are now in a position to write the disagreement payoff of firm 1 as

$$\pi_1^s = \frac{(a-\overline{w}_1)(1-\mu)\left[(a-2\overline{w}_1)(2+\mu)-\overline{w}_2(1-\mu)+3w_2\right]}{18b}. \tag{23}$$

As in the previous section, the solution for steady-state Nash bargaining wage is obtained in two steps. First, we maximise the Nash maximand in (7), taking as given the wages negotiated in the previous contract period ($\overline{w}_1$,$\overline{w}_2$) and the wage of the other firm (w_2). This leads to the first order condition for the current period Nash bargaining problem. Second, using the first order condition, we solve for the steady-stage bargained wage by imposing that $w_1 = \overline{w}_1$ and $w_2 = \overline{w}_2$. This gives

$$w_1^{ud} = w_2^{ud} = \frac{\beta\theta\mu(1+\mu)}{8-\beta(8-(2-\theta)\mu(1+\mu))}a. \tag{24}$$

The unionised monopoly-unionised duopoly wage differentials

Comparing (12) and (24), one can see that firm 1 pays a higher wage in the steady-state equilibrium if firm 2 is unionised as well, rather than non-unionised. There is therefore now an even larger interval of union density values for which increasing product market competition increases wages. In Appendix A it is shown that the same is true for union utility.

3 Robustness checks

As a robustness check we consider whether changing the scope of bargaining qualitatively alters the results. Specifically, we look at the case of efficient bargaining, in which firms

and unions negotiate over both wages and employment. This section contains a description of the outcomes for the case of a rent maximising union, with the detailed calculations being delegated to Appendix B.

When comparing the wage outcome in a unionised monopoly and a mixed duopoly, the logic from the right-to-manage model carries through: The presence of a competitor serves to improve the position of the union in the bargain, as the firm faces a reduction in its fallback level of profits in the event of a strike because its competitor expands output. There is therefore a range of union density for which increased product market competition leads to higher wage levels.

The same however is not true if the competitor is unionised. This is because, under efficient bargaining, the hands of a non striking firm are tied in the event of a strike at the competitor. If short term employment re-contracting during the strike is ruled out,[12] the non striking firm cannot expand production in the event of a strike at the other firm. Indeed, we find that for levels of union density strictly between zero and one, the wage level is lower under unionised duopoly than it is under both monopoly and mixed duopoly.

4 Concluding comments

In this paper we have analysed the impact of changes in product market competition on the wage outcomes when workers are represented by open shop unions. In this case, unionised establishments continue to operate in the event of a strike with their non-unionised workers,

[12]The assumption that union contracts over wages and employment are binding is common in the unionised oligopoly literature (see, for example, Zhao (1995)).

and so the wage outcome is affected by the level of union density. Additionally, the bargain is now affected by the extent to which the firm's competitors expand their own production in the event of a strike. This introduces a previously unnoticed mechanism whereby product market competition impacts on the negotiated wage. The implications of this extension to the simple union-firm bargaining framework are profound. In contrast to the prediction of the standard model, increases in product market competition may now increase wage levels. The model presented in this paper can therefore accommodate the diverse empirical findings regarding the impact of product market competition on bargained wages.

Appendix

A The impact of increasing product market competition on union utility

We may straightforwardly show for a mixed duopoly model that for sufficiently low levels of union membership increasing product market competition increases union utility. For simplicity, we confine attention to the case of symmetric Nash bargaining ($\beta = \frac{1}{2}$) and a rent maximising union ($\theta = \frac{1}{2}$). Substitution of (12) into (8) yields an expression for union utility in the monopoly case:

$$\Omega_1^{um} = \frac{a}{2\sqrt{b}} \left(\frac{4+\mu^2}{2+\mu^2} \right)^{\frac{1}{2}} \left(\frac{\mu^2}{4+\mu^2} \right)^{\frac{1}{2}} \tag{A.1}$$

Substituting (17) into (13) yields the equivalent expression for union utility in the presence of a non-unionised competitor:

$$\Omega_1^{md} = \frac{a}{2\sqrt{b}} \left(\frac{\mu(1+\mu)}{4+\mu(1+\mu)} \right)^{\frac{1}{2}} \left(\frac{8+\mu(\mu+1)}{4+\mu(\mu+1)} \right)^{\frac{1}{2}} \tag{A.2}$$

One can show by comparison of (A.1) and (A.2), that union utility is higher under a mixed duopoly when $\mu \in (0, 0.187)$.

Unionised Duopoly

Again, we confine our attention to the case of symmetric Nash bargaining ($\beta = \frac{1}{2}$) and a rent maximising union ($\theta = \frac{1}{2}$). Substituting (24) into (20) yields the expression the

expression for union utility in the presence of competition from an equally unionised firm:

$$\Omega_1^{ud} = \frac{a}{2\sqrt{b}} \left(\frac{\mu(1+\mu)}{48+9\mu(1+\mu)} \right)^{\frac{1}{2}} \left(\frac{8+\mu(\mu+1)}{16+3\mu(\mu+1)} \right)^{\frac{1}{2}} \tag{A.3}$$

Comparison of (A.3) and (A.1) allows us to conclude that, if Nash bargaining is symmetric and the union maximises rents, the presence of product market competition from an equally unionised firm leads to higher union utility if $\mu \in (0, 0.193)$.

B Efficient bargaining

As a robustness check of our results, we repeat the analysis assuming efficient bargaining. As in the right-to-manage model, we consider a sequence of contract periods. In each contract period, bargaining is over both wages and employment. For simplicity we assume that the union maximises rents ($\theta = \frac{1}{2}$). This implies that output is independent of the bargained wage and equal to its competitive level

$$y_1^* = \frac{a}{2b} \tag{B.1}$$

Equilibrium is given as the generalised Nash solution of the cooperative game played by the firm and the union:

$$\arg\max_{w_1} \left\{ (\Omega_1 - \Omega_1^s)^\beta (\pi_1 - \pi_1^s)^{1-\beta} \right\} \quad s.t.\ y_1 = y_1^* \tag{B.2}$$

where as before the union disagreement payoff is normalised to zero ($\Omega_1^s = 0$). Using (2), (3) and (B.1) we get

$$\pi_1 = \frac{1}{b}\left(\frac{a}{2}\right)^2 - w_1\left(\frac{a}{2b}\right) \tag{B.3}$$

$$\Omega_1 = w_1^{\frac{1}{2}}\left(\frac{a}{2b}\right)^{\frac{1}{2}} \tag{B.4}$$

Using the same reasoning as in the right-to-manage model, the disagreement payoff of the firm is given by

$$\pi_1^s = \frac{a(1-\mu)(a(1+\mu) - 2\overline{w}_1)}{4b} \tag{B.5}$$

and the steady-state bargained wage under monopoly follows as:

$$w_1^{um} = \frac{\beta\mu^2}{4 - 2\beta(\mu - 2)}a \tag{B.6}$$

Introducing competition by a non-unionised firm 2 that pays all its workers the reservation wage ($w_2 = w^c = 0$) yields equilibrium outputs

$$y_1^* = y_2^* = \frac{a}{3b} \tag{B.7}$$

When evaluated at (B.7), firm 1's profit and union utility are given by:

$$\pi_1 = \frac{1}{b}\left(\frac{a}{3}\right)^2 - w_1\left(\frac{a}{3b}\right) \tag{B.8}$$

$$\Omega_1 = w_1^{\frac{1}{2}}\left(\frac{a}{3b}\right)^{\frac{1}{2}} \tag{B.9}$$

In the event of a strike, the unionised firm produces $y_1^s = (1-\mu)\overline{y}_1^*$, where $\overline{y}_1^* = \frac{a}{3b}$ is the level of employment in the previous period. From (5), this induces the non-unionised firm to produce $y_2^s = (1 + \frac{\mu}{2})\overline{y}_2^*$. The conflict payoff of the unionised firm can now be derived as

$$\pi_1^s = \frac{a(1-\mu)(a(2+\mu) - 6\overline{w}_1)}{18b} \tag{B.10}$$

Solving for the steady-state bargaining wage yields:

$$w_1^{md} = \frac{\beta\mu(1+\mu)}{6(2-\beta(\mu-2))}a \tag{B.11}$$

Comparing (B.6) and (B.11) shows that product market competition from a non-unionised leads to a higher bargained wage for $\mu \in (0, \frac{1}{2})$.

If firm 2 is unionised as well and union contracts over employment are binding, it cannot expand production in case of a strike. The disagreement payoff of firm 1 becomes

$$\pi_1^s = \frac{a(1-\mu)(a(1+\mu) - 3\overline{w}_1)}{9b}, \tag{B.12}$$

exceeding the disagreement payoff under mixed duopoly and under monopoly. As a consequence, the steady-state bargained wage is lower than under mixed duopoly and under monopoly. Specifically, we obtain

$$w^{ud} = \frac{\beta\mu^2}{6+3\beta(\mu-2)}a \tag{B.13}$$

References

[1] Abowd, J. and Tracy, J. (1989). 'Market structure, strike activity and union wage settlements.' *Industrial Relations*, vol. 28, pp. 227-50.

[2] Barth, E., Raaum, O. and Naylor, R. (2000). 'Union wage effects: does membership matter?', *Manchester School*, vol. 68, pp. 259-75.

[3] Binmore, K., Rubinstein, A. and Wolinsky, A. (1986). 'The Nash Bargaining solution in economic modelling.', *Rand Journal of Economics*, vol. 17, pp.176-188.

[4] Block, F. and Kuskin, M. (1978). 'Wage determination in union and non-union sectors.', *Industrial and Labour Relations Review*, vol. 31, pp. 183-92.

[5] Boeri, T., Brugavini, A. and Calmfors, L. (2001), *The Role of Unions in the Twenty-First Century*, London: Oxford University Press.

[6] Booth, A. and Bryan, M. (2004). 'The union membership wage-premium puzzle: Is there a free rider problem?', *Industrial and Labor Relations Review*, vol. 57, pp. 402-421.

[7] Booth, A. and Chatterji, M. (1995). 'Union membership and wage bargaining when membership is not compulsory.', *Economic Journal*, vol. 105, pp. 345-60.

[8] Bratsberg, B. and Ragan, J. (2002). 'Changes in the Union Wage Premium by Industry.', *Industrial and Labor Relations Review*, vol. 56, pp. 65-83.

[9] Corneo, G. (1993). 'Semi-unionised bargaining with endogenous membership and management opposition.', *Journal of Economics*, vol. 2, pp. 169-188.

[10] Corneo, G. (1995). 'Social custom, management opposition and trade union membership.', *European Economic Review*, vol. 39, pp. 275-292.

[11] Corneo, G. (1997). 'The Theory of the open shop trade union reconsidered', *Labour Economics*, vol. 4, pp. 71-84.

[12] Cramton, P. and Tracy, J. (1998). 'The use of replacement workers in union contract negotiations: The U.S. experience, 1980-1989', *Journal of Labor Economics*, vol. 16, pp. 667-701.

[13] Dowrick, S. (1989). 'Union-oligopoly bargaining.', *Economic Journal*, vol. 99, pp. 1123-1142.

[14] Freeman, R. and Medoff, J. (1981). 'The impact of the percent organized on union and non-union wages.' *Review of Economics and Statistics*, vol. 63, pp. 561-572.

[15] Gramm, C. (1991). 'Employers decisions to operate during strikes: consequences and policy implications' in W. Srings, *Employee rights in a changing economy: The issue of replacement workers*, Washington, D. C.: Economic Policy Institute.

[16] Gramm, C. and Schnell, J. (1994). 'Some empirical effects of using permanent striker replacements.', *Contemporary Economic Policy*, vol. 12, pp. 122-133.

[17] Hendricks, W. (1975), 'Labor market structure and union wage levels', *Economic Inquiry*, vol. 63, pp. 401-416.

[18] Layard, R., Nickell, S. and Jackman, R. (1991), Unemployment: Macroeconomic Performance and the labour market, Oxford: Oxford Economic Press.

[19] Macpherson, D. and Stewart, J. (1990), 'The effect of international competition on union and non-union Wages.', *Industrial and Labor Relations Review*, vol. 43, pp. 434-446.

[20] Naylor, R. (2002a). 'Industry profits and competition under bilateral oligopoly.', *Economics Letters*, vol. 77, pp. 169-175.

[21] Naylor, R. (2002b). 'The effects of entry in bilateral oligopoly', University of Warwick.

[22] Naylor, R. and Cripps, M. (1993). 'An economic theory of the open shop trade union.', *European Economic Review*, vol. 37, pp. 1599-1620.

[23] Naylor, R. and Raaum, O. (1993). 'The open shop union, wages, and management opposition.', *Oxford Economic Papers*, vol. 45, pp. 589-604.

[24] Olson, C. (1991). 'The use of strike replacements in labor disputes.' Working Paper, Princeton, NJ: Princeton University, Industrial Relations Section.

[25] Rubinstein, A. (1982) 'Perfect Equilibrium in a Bargaining Model.', *Econometrica*, vol. 50, pp. 97-110.

[26] Stewart, M. (1983). 'Relative Earnings and Individual Union Membership in the United Kingdom.', *Economica*, Vol. 50, pp. 111-125.

[27] Van Reenen, J. (1996). 'The Creation and Capture of Rents: Wages and Innovation in a Panel of U.K. Companies.', *Quarterly Journal of Economics*, vol. 111, pp. 195-226.

[28] Visser, J. (2003). 'Unions and Unionism around the World.' in Addison, J. and Schnabel, C. (eds.), *International Handbook of Trade Unions*, Edward Elgar.

[29] Zhao, L (1995). 'Cross-hauling direct foreign investment and unionized oligopoly.', *European Economic Review*, Vol. 39, pp. 1237-53.