Product market integration and endogenous bargaining structure

Michele Santoni
(DEPA, Università degli Studi di Milano)

This version: January 2003[*]

Abstract. This paper focuses on the effects of product market integration on wage-bargaining institutions in a one-way trade model of an international Cournot oligopoly. It shows that product market integration (i.e. a reduction in trade costs either from an arbitrary or from its optimal level) lowers the incentives to centralisation for home unions, given that firms always prefer decentralisation, making it more likely that a decentralised wage bargaining structure occurs in equilibrium.

JEL Classification: F1, J51, L13.

Keywords : Bargaining institutions, Unionised oligopolies, Trade integration.

Address for correspondence:
Michele Santoni
DEPA
Facoltà di Scienze Politiche
Università degli Studi
Via Conservatorio 7
20122 Milano (MI)
Email: Michele.Santoni@unimi.it

[*] An early version of this paper was presented at the IZA workshop on "European product market integration and labour markets" (Bonn, April 2002). I thank Torben M. Andersen, Huw D. Dixon, and Odd R. Straume for comments and suggestions. Mistakes are mine.

1. Introduction

The 2004 Enlargement programme of the European Economic Area is likely to increase further the process of product market integration started with the Single Market Programme in 1993, by further reducing trade barriers among member countries. Several papers have analysed the effects of increased integration on wage formation and employment outcomes in unionised labour markets (see e.g. Munch and Skaksen, 2002, and Andersen et al. 2000, pp. 110-12, for a survey). However, the relationship between product market integration and wage bargaining institutions, which should affect economic performance in the longer run, has received relatively less attention in the literature (see e.g. Flanagan, 1999, Nickell, 2001, Calmfors, 2001, Agell, 1999 and 2002). Moreover, the theoretical papers addressing this relationship do not provide formal models of endogenous determination of the degree of centralisation in wage bargaining (see e.g. Driffill and van der Ploeg, 1993, 1995, Danthine and Hunt, 1994, Gaston 2002).

This paper considers a simple partial equilibrium model of one-way-trade with strategic product markets in order to address the following issues: how and in which direction will an increase in product market integration, measured as a reduction in "trade" costs, either from an arbitrary level (as e.g. in Driffill and Van der Ploeg, 1993, and Naylor, 1999) or from its optimal level (as in Fisher and Wright, 1999), affect the degree of centralisation in wage setting within a given country? To what extent will these effects depend on the initial distribution of wage bargaining power between firms and unions and on the centralisation costs for both parties?

In particular, the paper considers a domestic, homogeneous good, Cournot triopoly industry, composed of two unionised domestic firms and one foreign firm. Following Horn and Wolinsky (1988),[1] there is a multi-stage sequential game: initially trade costs are determined, either exogenously or optimally by a benevolent social planner; then, the two unions decide whether to

[1] Horn and Wolinsky (1988) consider the incentives to merge for unions and firms in a duopoly (see also Davidson, 1988, and Grandner, 2001): however, they assume symmetric bargaining power for firms and unions and do not address trade issues.

form a coalition for wage bargaining, and similarly the two firms; then, given wage bargaining institutions, domestic firms and unions choose wages; finally, firms compete in the product market.

The paper shows that, depending on the combination of various parameters (i.e. union wage bargaining power, centralisation costs for unions, domestic unions' reservation wages, foreign firm's production costs including trade costs), two wage bargaining regimes may arise in equilibrium: fully decentralised bargaining (i.e. at the firm level) and union centralised bargaining (i.e. a central union bargaining with two uncoordinated firms). Product market integration makes the fully decentralised bargaining regime more likely to occur in equilibrium. The economic intuition for this result is simple: integration lowers the domestic firms' product market rents, which has a two-fold effect on the incentives to form wage coalitions in equilibrium. On the one hand, integration makes it less credible (namely, more costly in terms of lost employment) the central union's commitment to higher wages resulting from its internalisation of employment externalities in wage setting, thus lowering a union's incentives to form a wage coalition when facing uncoordinated firms.[2] On the other hand, integration does not reverse the home firms' incentives to decentralised bargaining, by allowing firms to keep wages down at the bargaining table with their union, which is of paramount importance when product market competition is characterised by strategic substitutability. These findings are confirmed when considering optimal trade policies.

The results of this paper are consistent with the view that increasing product market integration should lead to the emergence of more decentralised wage bargaining institutions in a given country, although through different mechanisms than those pointed out here.[3] More recently, Agell (1999, 2002) has challenged this view, by presenting cross-country evidence suggesting that

[2] This is consistent with Danthine and Hunt's (1994) finding, derived within a different non-strategic framework, that product market competition is a tougher discipline device for industry-level unions than for firm-level unions.

[3] Danthine and Hunt (1994, pp. 536-37) note that integration increases the number of unionised firms competing in a given industry; Flanagan (1999, p. 1170) and Nickell (2001, p. 176) argue that a firm's benefits from wage flexibility increase; Calmfors (2001, p. 17) argues that the degree of centralisation is negotiated between firms (favouring decentralisation) and unions, and that integration improves the employer's conflict payoffs. Driffill and van der Ploeg (1993), on the contrary, show that a reduction in trade costs increases wage competition between unions in different countries, thus giving them more incentives to go international to avoid this.

on average more open economies have more centralised wage setting, the argument being that centralised bargaining institutions are better at satisfying workers' demand for social insurance, which is the stronger the more open an economy is. By presenting a simple alternative test based on fixed effects panel estimation, this paper finds that on average higher openness significantly decreases the bargaining level instead: this suggests that product market incentives to decentralisation might well dominate social insurance incentives to centralisation.

2. The model

In a home country, which can be interpreted as the European Union, there is a typical Cournot industry composed of two unionised domestic firms and one foreign firm. Firms produce homogeneous goods under constant marginal costs and face linear demands for their products. Home unions maximise rents from employment in excess of an exogenously fixed reservation wage. Home wages are determined through Nash bargaining in four different bargaining regimes: full decentralisation (DD); full centralisation (CC); union centralisation (CD); firm centralisation (DC).[4] Unions and firms face exogenous costs of centralisation H and G, respectively. The foreign firm's marginal costs depend on an exogenous foreign wage w* (in terms of a domestic numéraire good, produced in a competitive sector) and on trade costs t (e.g. a tariff; transport, red-tape and other transaction costs), which are proportional to foreign output. Product market integration is interpreted as a reduction in trade costs t. In this and the next sections, trade costs are assumed to be exogenously set to the same arbitrary level in each regime. Section 5 will extend the analysis to regime specific optimal trade costs.

Given the degree of product market integration, in stage 1 firms and unions choose simultaneously and independently whether they want to form a wage coalition: as a result of this choice, the four possible bargaining regimes may occur, although CD and DD turn out to be the

[4] Based on Nickell and Layard's taxonomy (see Boeri et al, 2001, Tab. 5.1), DD may represent countries such as the UK, CC the Nordic Countries, CD Spain, DC Switzerland. The standard assumptions are fully decentralised and fully centralised bargaining, see e.g. Leahy and Montagna (2000).

candidate (unique) sub-game perfect Nash equilibria. In stage 2, given the bargaining structure, wage negotiations occur in the domestic labour market. In stage 3, there is product market interaction among firms. The solution is derived under backward induction.

2.1. Stage 3 Cournot competition

The representative domestic consumer has quasi-linear preferences over X, the Cournot good, and Y, the numéraire good produced in a competitive sector: $U(X, Y)= [aX-(X^2)/2]+Y$. This yields the linear inverse product demand curve: $P=a-X$, where $X=x_1+x_2+x^*$; X and xs are total industry output and the output supplied by the home firms 1 and 2 and the foreign firm *, respectively. Firms have symmetric linear-in-labour technologies, and the marginal product of labour is normalised to unity. The firms' profit functions are: $\Pi_i=(P-w_i)x_i$, with i=1, 2, and $\Pi^*=(P-w^*-t)x^*$; w_i are domestic wages, w* are exogenous foreign wages, t are "trade" costs. Firms maximise profits by choosing output and employment, and by taking outputs of the rival firms and predetermined wages as given. This process yields the standard best-reply functions: $x_i=-(½)(x_j+x^*)+(½)(a- w_i)$, with i, j=1, 2 and i≠j; $x^*=-(½)(x_1+ x_2)+(½)(a- w^*-t)$. Clearly, with linear demand curves, outputs are strategic substitutes. Labour demand curves, the industry price and indirect profits are then:

$$\hat{x}_i = \frac{1}{4}\left[a - 3w_i + w_j + w^* + t\right]; \quad \hat{x}^* = \frac{1}{4}\left[a - 3(w^* + t) + w_i + w_j\right] \tag{1}$$

$$\hat{p} = \frac{1}{4}\left[a + w_1 + w_2 + w^* + t\right] \tag{2}$$

$$\hat{\Pi}_i = \left[\hat{x}_i\right]^2; \ \hat{\Pi}^* = \left[\hat{x}^*\right]^2 \tag{3}$$

with i, j=1, 2 and i≠j: for given wages, the industry price and domestic firms' indirect profits (viz. total industry outputs) are an increasing (viz. decreasing) function of trade costs t, as expected.

2.2. Stage 2 wage setting

Domestic workers join the union at the firm level. The typical trade union maximises rents:

$U_i=(w_i- \bar{w})x_i$ (4)

where $\bar{w}$ can be interpreted as the reservation wage level (e.g. the wage rate in the competitive sector; an unemployment benefit; the disutility of labour), which is taken as given by unions. The wage is determined as a result of a Nash bargaining that occurs simultaneously in each firm, subject to the rules of the game that depend in turn on the predetermined bargaining regime, see below. The parametric union bargaining power over wages is denoted by $b \in [0, 1]$: b=0 corresponds to no union power, and b=1 to the monopoly union case.[5]

2.2.1. Fully decentralised wage bargaining (DD)

Each domestic firm and union bargain simultaneously and separately over the wage, anticipating the effects of the wage decision on their labour demand curve (1) and thus on the product market stage. The Nash solution to the wage problem is

$$NA^{DD}{}_i = \left[\hat{\Pi}_i\right]^{1-b}\left\{\left[w_i - \bar{w}\right]\hat{x}_i\right\}^b \quad (5)$$

i=1, 2, where the relevant equations (1), the domestic labour demand curve, and (3), the domestic indirect profits must be substituted in. The inside options for both the union and firm are set equal to zero in the absence of any utility flow during a dispute. Each firm-union bargaining pair maximises the Nash product (5) by choice of the wage, taking as given the two rival firms' marginal costs. The two first-order conditions for (5) are:

$$b\hat{\Pi}_i\left[\underbrace{\frac{1}{4}\left[a-3w_i+w_j+w^*+t\right]}_{x_i}\ \underbrace{-\left(\frac{3}{4}\right)}_{\partial x_i/\partial w_i}\left(w_i-\bar{w}\right)\right]+(1-b)\left[\left(w_i-\bar{w}\right)\hat{x}_i\right]\underbrace{2\hat{x}_i\left(-\left(\frac{3}{4}\right)\right)}_{\partial\Pi_i/\partial w_i}=0 \quad (6)$$

The left-hand side first term is the union's net marginal benefit of a wage increase, with the standard trade-off between wage increments and employment losses. The left-hand side second

[5] Union bargaining power is assumed to be the same across firms and bargaining regimes. This might be the case if b represents the "patience" of negotiators during a dispute (i.e. the higher is the discount factor of the union, and the lower is the discount factor of the firm, the higher b is), which may be independent of the regime.

term is the firm's net marginal cost of a wage increase: in a strategic product market model, this includes the cost of losing market shares when output competition is tough (i.e. when the outputs are strategic substitutes). Equation (6) defines implicitly the firm-union pairs' wage best-reply functions: as wages are strategic complements here, these would be linear and upwards sloping in wage space. From (6), yields symmetric equilibrium wages:

$$w_1^{DD} = w_2^{DD} = \bar{w} + \left[\frac{b}{6-b}\right] R$$
$$R = \left[a + w^* + t - 2\bar{w}\right] \qquad (7)$$

The domestic wage is a mark-up over the reservation wage $\bar{w}$. The mark-up is increasing in union bargaining power b and proportional to a measure of product market rents, denoted by R. In particular, R can be interpreted as a measure of market size for domestic producers.[6] Note that a reduction in trade costs t, by reducing R, induces wage moderation: the labour demand for the typical home firm is reduced at any given wage level and, because of linearity, the elasticity of labour demand rises at the initial optimal wage.[7] By substituting (7) back into (1)-(4), yields the equilibrium outputs and price, union's utility and profits. These are reported in Table 1.1. below.

[Table 1.1. in here]

2.2.2. Union centralised wage bargaining (CD)

A centralised union bargains simultaneously with each home firm. The union's objective function when bargaining in firm i is the sum of the union rents in both the firms. Following Horn and Wolinsky (1988, p. 452), we assume that, in the case of a dispute (namely, a temporary negotiation

[6] This follows Neary's (2001, p. 8) and Rowthorn's (1992) interpretation of the maximum level of domestic sales consistent with breaking even as a measure of market size. Here, the maximum level of domestic sales, given the output produced by the foreign firm, is $(x_1 + x_2)_{MAX} = \alpha - \overline{w} - \hat{x}^*$; where $\hat{x}^* = \max\left\{\overline{w} - (w^* + t);\ 0\right\}$ is the Cournot-Nash equilibrium output for the foreign firm when domestic firms play $(x_1 + x_2)_{MAX}$.

[7] This result is also a feature of the one-way trade framework of this paper: for example, in Naylor's (1999) "reciprocal dumping" model, cutting trade costs enlarges export opportunities for home firms, opening up the possibility of an increase in total labour demand and thus, with linearity, of home wages. Here, we are implicitly assuming that the export market is "small", so we can disregard such an effect.

breakdown) in firm i, the firm i earns zero profits, whereas the firm j operates at the anticipated equilibrium output of this regime, or $\hat{x}_2^{CD}(\hat{w_1}^{CD}, \hat{w_2}^{CD}; w^* + t)$: then, the centralised union's inside option, when negotiating with firm i, is the utility flow $V=[w_j^{CD}-\bar{w}]\hat{x}_j^{CD}(\hat{w_j}^{CD}, \hat{w_j}^{CD}; w^* + t)$, which can be interpreted as strike funds;[8] the firms' inside option is zero. The Nash programme becomes $NA^{CD_i} = \left[\hat{\Pi}_i\right]^{1-b}\left\{\left[w_i - \bar{w}\right]\hat{x}_i + \left[w_j - \bar{w}\right]\hat{x}_j - V\right\}^b$, where the relevant equations for the labour demands (1) and indirect profits (3) must be substituted in. V is taken as given by the parties during the negotiation. However, now the union internalises the employment externality in wage setting, as it recognises the effect of the wage in the firm i on the employment level in the firm j. The solution to the two first-order conditions for the wage is

$$b\hat{\Pi}_i\left[\underbrace{\frac{1}{4}\left[a - 3w_i + w_j + w^* + t\right]}_{x_i}\ \underbrace{-\left(\frac{3}{4}\right)}_{\frac{\partial x_i}{\partial w_i}}\left(w_i - \bar{w}\right)\ \underbrace{+\frac{1}{4}}_{\frac{\partial x_j}{\partial w_i}}\left(w_j - \bar{w}\right)\right] + (1-b)\left[\left(w_i - \bar{w}\right)\hat{x}_i\right]\underbrace{2\hat{x}_i\left(-\left(\frac{3}{4}\right)\right)}_{\partial\Pi_i / \partial w_i} = 0 \qquad (8)$$

Because the outputs are strategic substitutes, increasing the firm's i wages raises the firm's j labour demand, which implies that the union's net marginal benefit from a higher wage becomes larger than under decentralisation: centralisation, by internalising the employment externality of higher wages in a firm, allows the union to credibly precommit itself to a tougher stance at the bargaining table. Equilibrium wages are then: $w_1^{CD} = w_2^{CD} = \bar{w} + \left[\frac{b}{6-2b}\right]R$. By substituting this back into (1)-(4), yields equilibrium outputs, price, union's utility and profits, as reported in Table 1.1. above.

[8] Alternatively, one could assume that firm j operates at the anticipated duopoly equilibrium output resulting from its interaction with the foreign firm.

2.2.3. Firm centralised wage bargaining (DC)

A central employer organisation bargains simultaneously with the firm-specific union in each firm. Inside options are set equal to zero, implying that there are no lockout funds for firms.[9] The negotiators choose the wage rate to maximise: $NA^{DC}{}_i = \left[\hat{\Pi}_i + \hat{\Pi}_j\right]^{1-b}\left\{\left[w_i - \bar{w}\right]\hat{x}_i\right\}^b$, where equations (1) and (4) must be substituted in. The two first-order conditions become:

$$b(\hat{\Pi}_i + \hat{\Pi}_j)\left[\underbrace{\frac{1}{4}\left[a - 3w_i + w_j + w^* + t\right]}_{x_i}\ \underbrace{-\left(\frac{3}{4}\right)}_{\frac{\partial x_i}{\partial w_i}}\left(w_i - \bar{w}\right)\right] + (1-b)\left[\left(w_i - \bar{w}\right)\hat{x}_i\right]\left\{\underbrace{2\hat{x}_i\left(-\left(\frac{3}{4}\right)\right)}_{\partial\Pi_i/\partial w_i} + \underbrace{2\hat{x}_j\left(+\left(\frac{1}{4}\right)\right)}_{\partial\Pi_j/\partial w_i}\right\} = 0$$

The union's net marginal benefit of higher wages rises, while the firm's net marginal cost falls, relative to previous regimes: the latter result occurs because, with strategic substitutability, internalising the positive effect of wage increases in the firm i on the outputs and thus on the profits of the firm j makes the firm weaker at the bargaining table. The solution for wages, outputs, indirect profits and utility is reported in Table 1.2. below.

[Table 1.2. in here]

2.2.4. Fully centralised wage bargaining (CC)

A central employers' association and a centralised union bargain simultaneously in the two firms: this implies zero inside options for both bargainers. The parties choose the wage to maximise $NA^{CC}{}_j = \left[\hat{\Pi}_i + \hat{\Pi}_j\right]^{1-b}\left\{\left[w_i - \bar{w}\right]\hat{x}_i + \left[w_j - \bar{w}\right]\hat{x}_j\right\}^b$. The two first-order conditions are

[9] An alternative assumption is that, during a dispute in firm i, the central employer organisation derives an utility flow equal to the profits in firm j at the anticipated equilibrium output of this regime. This would not alter the analysis of section 3 below, although it would of course change the outcome of the bargaining process. In particular, it would lower equilibrium wages in the DC regime (see for Davidson, 1988, pp. 420-21 for a discussion).

$$b(\hat{\Pi}_i+\hat{\Pi}_j)\left[\underbrace{\frac{1}{4}\left[a-3w_i+w_j+w^*+t\right]}_{x_i}\underbrace{-\left(\frac{3}{4}\right)}_{\frac{\partial x_i}{\partial w_i}}\left(w_1-\bar{w}\right)+\underbrace{\left(\frac{1}{4}\right)}_{\frac{\partial x_j}{\partial w_i}}(w_j-\bar{w})\right]+$$

$$+(1-b)\left[\left(w_i-\bar{w}\right)\hat{x}_i\right](U_i+U_j)\left\{\underbrace{2\hat{x}_i\left(-\left(\frac{3}{4}\right)\right)}_{\partial\Pi_i/\partial w_i}+\underbrace{2\hat{x}_j\left(\frac{1}{4}\right)}_{\partial\Pi_j/\partial w_i}\right\}=0$$

The solution to this programme is presented in Table 1.2. above, together with the expressions for equilibrium prices, quantities, union's utility and profits. Note that the internalisation of employment externalities by both firms and unions leads to unions becoming stronger at the bargaining table, given that the goods are strategic substitutes. Finally, note the restriction $a > \bar{w} \geq w^* + t$ in Tables 1.1. and 1.2: this is needed for all the three firms to be active in equilibrium.

3. Stage 1: Endogenous bargaining regimes for given degree of product market integration

Following the literature on coalition formation in oligopolistic markets (see e.g. Bloch, 2002, for an introductory survey), assume that unions and firms can form a single coalition as regards wage determination (a wage coalition henceforth), namely a centralised union or a centralised employer association: each union announces simultaneously whether it wants to join the centralised union, given the firms' simultaneous decision of whether joining a centralised employer association. Inside a wage coalition, unions, say, take into account of the total union rents when bargaining over wages with firms, and similarly firms take into account of the total firm profits if they constitute an employer association: stage two equilibrium total union rents and profits are then equally divided inside each coalition.

Therefore, the payoffs reported in Tables 1.1. and 1.2. represent the payoffs for each individual union and firm in each possible bargaining regime. However, assume also that unions face exogenous symmetric costs $H \geq 0$ of forming a wage coalition: these may be interpreted as

transaction costs or as costs related to union recognition laws and employment protection legislation. Similarly, firms face symmetric costs $G \geq 0$ of forming a wage coalition, which can be interpreted as transaction costs, or as opportunity costs related to internal organisational reasons that would favour decentralisation over centralisation.

Note that a sub-game perfect Nash equilibrium bargaining regime is a strategy profile (the strategy set for each agent being joining or not the relevant wage coalition) such that no agent has an incentive to deviate unilaterally, given the strategy choice of the other agents. This of course implies that the decision by, say, a union to form a wage coalition will depend on whether or not firms decide to form a wage coalition in turn. Table 3 below describes the strategic form of stage one game for the typical union and firm.[10]

[Table 3 in here]

Consider first the strategy choice of the typical firm. Given that unions are decentralised, the firm's net gain from centralisation is:

$$\gamma(b, \mathrm{G}, \mathrm{R}) = \hat{\Pi}^{\mathrm{DC}} - \hat{\Pi}^{DD} - G =$$
$$= -b(1-b)\left(\frac{12+8b-5b^2}{(6-b)^2(2+3b)^2}\right)\underbrace{\left(\alpha + w^* + t - 2\bar{w}\right)^2}_{R^2} - G \qquad (9)$$

Provided the centralisation cost G is non-negative, the equation (9) always takes on negative values for 0<b<1: in other words, each firm has never an incentive to form a wage coalition in this case. The intuition for this result is that firm centralisation makes firms weaker both at the bargaining table with each union (as they internalise the positive profit externality in firm j of higher wages in firm i)[11] and, as a consequence, in their product market competition with the foreign firm, whose production costs are independent of domestic wages here.

[10] This can also be interpreted as follows. Assume that the two unions (firms) choose simultaneously whether to remain centralised or decentralised, given their expectations of what firms (unions) will do. If they have both common expectations on whether firms (unions) will form a wage coalition and veto power (e.g. one union alone cannot form a wage coalition), the payoff matrix is as in Table 3.

Similarly, when unions are centralised, firms have an incentive to decentralisation if $G \geq 0$, namely

$$\varepsilon(b,\ \mathrm{G},\ \mathrm{R}) = \hat{\Pi}^{CC} - \hat{\Pi}^{CD} - G = \\ = -\frac{b(1-b)}{64}\left[\frac{12-9b+b^2}{(3-b)^2}\right]\underbrace{\left(\alpha + w^* + t - 2\bar{w}\right)^2}_{R^2} - G \qquad (10)$$

always takes on negative values. Again, firms will never form a wage coalition in this case. In other words, under this paper's assumption, decentralisation is a dominant strategy for firms.

Turning to the typical union, the union's net gain from centralisation, given that firms are decentralised, is:

$$\Phi\left(b,\ \underset{-}{H},\ \underset{+}{R}(\underset{+}{\alpha},\ \underset{+}{w^*},\ \underset{+}{t},\ \underset{-}{\bar{w}})\right) = \hat{U}^{CD} - \hat{U}^{DD} - H = \\ = \left[\frac{b^2(18-21b+4b^2)}{8(3-b)^2(6-b)^2}\right]\underbrace{\left(\alpha + w^* + t - 2\bar{w}\right)^2}_{R} - H \qquad (11)$$

Each union will bargain over wages as a centralised institution if and only if $\Phi(b,\ H,\ R)$ is positive. In the absence of centralisation costs (i.e. H=0), each union always prefers centralisation to decentralisation, as its utility is higher under CD than DD, and so are its wages: this is Horn and Wolinsky's (1988, Proposition 1) result with strategic substitute products, extended to the case of $b \in (0,\ 1]$ here. However, when centralisation costs are positive (i.e. H>0), the union net gain from centralisation depends both on the market size for domestic producers R (see section 2.2.1 above), and on the union bargaining power b.

Figure 1 illustrates by plotting the $\Phi(b,\ H,\ R) = 0$ relationship in (H, b) space, for given R: below this relationship each union strictly prefers centralisation to decentralisation, given that firms are decentralised, and *vice versa* above it. Note that the $\Phi(b,\ H,\ R) = 0$ relationship is hump-shaped in union bargaining power b, implying that, *coeteris paribus*, "very strong" unions gain less than

[11] Recall that we have assumed no lock-out funds in section 2 above. However, if we were to allow for a stronger position of firms at the bargaining table due to such a possibility, although the profit differential in equation (9) would be smaller, it would still remain negative, coeteris paribus.

"strong" unions from centralisation: this is because "very strong" unions under CD set wages too high than under DD (compare equations 7 and 8 above for b=1, say), such that the employment cost (namely, the domestic firms' market share loss) is too large, thus reducing the gross gains from centralisation.

[Figure 1 in here]

Similarly, for given R, the union net gain from centralisation, when firms are in a wage coalition, is

$$\rho(b,\ \mathrm{H},\ \mathrm{R}) = \hat{U}^{CC} - \hat{U}^{DC} - H =$$
$$= \frac{b}{32}\left[\frac{(-4+3b^2)(2-3b)}{(2+3b)^2}\right]\underbrace{\left(\alpha + w^* + t - 2\bar{w}\right)^2}_{R^2} - H \qquad (12)$$

Provided the union centralisation costs H are non-negative, equation (12) always takes on a negative value for 0<b<2/3, whereas it could be positive for 2/3<b<1. The relationship $\rho(b,\ \mathrm{H},\ \mathrm{R})=0$ would lie in the first quadrant in Figure 1 above for b>2/3 (not shown): given that firms are centralised (which never occurs here in equilibrium), above this relationship unions would strictly prefer decentralisation to centralisation, and *vice versa* below it. As a result of these incentives, yields

Proposition 1. For a given common degree of product market integration t:

i) Domestic equilibrium wages are ranked as follows

$w^{DC} \geq w^{CC} > w^{CD} > w^{DD}$ for $0<b\leq 2/3$;

$w^{CC} > w^{DC} \geq w^{CD} > w^{DD}$ for $2/3<b\leq 4/5$;

$w^{CC} \geq w^{CD} > w^{DC} \geq w^{DD}$ for $4/5<b\leq 1$.

ii) The typical union's and firm's utility rankings (gross of centralisation costs) are

$U^{DC} \geq U^{CC} > U^{CD} > U^{DD}$ and $\Pi^{DD} > \Pi^{CD} > \Pi^{CC} \geq \Pi^{DC}$ for $0<b\leq 2/3$;

$U^{CC} > U^{DC} \geq U^{CD} > U^{DD}$ and $\Pi^{DD} > \Pi^{CD} \geq \Pi^{DC} > \Pi^{CC}$ for $2/3<b\leq 4/5$;

$U^{CC} \geq U^{CD} > U^{DC} \geq U^{DD}$ and $\Pi^{DD} \geq \Pi^{DC} \geq \Pi^{CD} > \Pi^{CC}$ for $4/5<b\leq 1$.

iii.) With non-negative centralisation costs H for unions and G for firms, decentralisation is a dominant strategy for firms. Depending on the parameter combination (H, b), either centralisation or decentralisation is a dominant strategy for unions. As a result, two possible (unique) sub-game perfect Nash equilibrium regimes may occur: either DD or CD. CC and DC are never equilibrium regimes of the game.

Proof. Proposition 1.i) and 1.ii) yields by comparing payoffs from Tables 1.1. and 1.2. Proposition 1.iii) follows from equations (9), (10) and (11) and the definition of a sub-game perfect Nash equilibrium bargaining regime.

Figure 1 above illustrates. The $\Phi(b, H, R)=0$ relationship divides the space up in two regions: above it, the fully decentralised regime occurs. Below it, the union centralised regime takes place. Note that, for given union's centralisation costs H, the DD regime is more likely to occur when the unions is either very weak or very strong at the bargaining table, whereas intermediate values of union bargaining power are consistent with the CD regime in this case, as long as the union's net gain from centralisation becomes larger. Clearly, the CD regime always makes firms worse off.

4. Product market integration makes fully decentralised bargaining more likely

From Tables 1.1. and 1.2., it is straightforward to see that product market integration, namely a lowering of trade costs t, reduces equilibrium wages, prices, domestically produced outputs, union's utility and firm's profits whatever the bargaining regime. The intuition is that, given the assumed one-way nature of international trade, product market integration reduces product market rents for domestic unions and firms: these rents are proportional to $R = a + w^* + t - 2\bar{w}$, which can be interpreted as a measure of market size for the domestic producers (see footnote 6 above). Wage moderation depends instead on the linearity of labour demand curve assumption: in any regime, the relevant demand for domestic labour shifts inwards with integration, and the unions perceive a higher elasticity of labour demand at the pre-integration wage, thus they claim a lower post-integration wage.

What happens to the equilibrium bargaining regimes? From equation (11), it is straightforward to see that integration shifts downwards the $\Phi(b, H, R)=0$ relationship. In other words, it makes less attractive for unions to join in a wage coalition when firms play their dominant strategy of decentralisation. As a result, yields

Proposition 2. Product market integration raises the incentives towards decentralisation for unions by enlarging the parameter space (H, b) thereby DD, the fully decentralised wage bargaining regime, is the unique dominant strategy sub-game perfect Nash equilibrium regime.

Proof. Note that equation (11) is proportional to R and that R is increasing in the value of the trade cost t: product market integration, i.e. a cut of t, reduces the union's net gain from centralisation, coeteris paribus. Moreover, although integration lowers the firm's incentives to decentralisation (see equations 9 and 10), decentralisation remains the firms' dominant strategy.

Figure 2 illustrates for different values of R, thus of t: note that, as expected, the parameter space supporting the other equilibrium regime (CD) shrinks with integration.

[Figure 2 in here]

Proposition 2 has been derived by assuming that G and H remain invariant after product market integration. However, one may argue that integration may be associated with "exogenous" pressures increasing the costs of centralisation for both unions and firms (e.g. new union recognition laws making coordination more costly; reorganization of working activities, with flattening of hierarchies and multi-tasking, increasing the benefit of flexibility for firms, see e.g. Boeri *et al*, 2001, p.118): in this case, other things given, decentralisation is more likely to become a dominant strategy for both unions and firms.

Conversely, if, as Agell (1999, 2002) argues, integration, by increasing external risks, raises the unions' incentives to choose centralised bargaining as a social insurance device, this may be interpreted as a lowering of centralisation costs H. As a result, despite integration, CD may remain the equilibrium regime, with no measurable effect on the degree of centralisation.

5. Product market integration and optimal tariffs

Following Fisher and Wright (1999), this section models product market integration as the reduction of trade costs from their optimal value to zero. For simplicity, trade costs are interpreted as an external tariff and the foreign wage is set equal to the domestic reservation wage.[12] In the context of European labour markets, one can interpret this situation as one in which a new country (e.g. Lithuania) joins the European Economic Area, such that its non-unionised firm can now compete on a level playing field with the unionised EU firms.[13] To achieve sharper results, this section focuses on symmetric wage bargaining power (b=1/2).

The sequence of events is as follows. In stage 1, an utilitarian social planner (say, the European Commission) sets the optimal external tariff, anticipating the bargaining regime selected by firms and unions. In stage 2, unions and firms choose the bargaining regime, by anticipating its effect on wage negotiations and output choices at stages 3 and 4, respectively.

Solving the model by backward induction, the equilibrium levels of wages and outputs at stages 3 and 4 are the same as above, with the trade costs t being regime specific now. Turning to stage 2, given trade costs unions and firms choose the bargaining regime. In stage 1, before product market integration occurs, the "EU commission" chooses the optimal tariff in order to maximise social welfare in the typical industry, namely the sum of consumer surplus, producers' rents (i.e. the sum of profits and union rents) and tariff revenue, which reduces to:

$$SW^K = U(X_1^K + X_2^K + X^{*K}) - \bar{w}(X_1^K + X_2^K) - (p^k - t^k)X^{*k} \qquad (13)$$
$$k = \text{DD, CC, CD, DC.}$$

where U(.) is the indirect utility from consumption and the Xs and p are the optimal Cournot-Nash outputs and prices, respectively. As long as $dU/d(X_1+ X_2+X^*)=p$ by Roy's identity, yields:

[12] Although Fisher and Wright (1999) allow for richer forms of trade liberalisation (including bilateral free trade agreements), their assumption of firm-level monopoly unions is more specific than this paper's.

[13] In Lithuania, union density is less than 10% against a weighted by population average of 30.4% for the EU in 2000.

$$\frac{dSW^k}{dt^k} = \underbrace{-\frac{dp^k}{dt^k}X^{*k}}_{\text{consumer's surplus effect}} + \underbrace{(p^k - \bar{w})\left[\frac{dX_1^{\,k}}{dt^k} + \frac{dX_2^{\,k}}{dt^k}\right]}_{\text{rent shifting strategic effect}} + \underbrace{\left[t^k \frac{dX^{*k}}{dt^K} + X^{*k}\right]}_{\text{tariff revenue direct effect}} = 0 \qquad (14)$$

The marginal effect of a tariff increase on social welfare depends on three well known effects (see e.g. Fisher and Wright, 1999, p. 803): firstly, as the goods price increases, there is a reduction in the consumer's surplus; second, product market rents are shifted towards unionised firms, as the tariff provision makes both firms more aggressive in the output game (as the outputs are strategic substitutes here); finally, rents are directly extracted from the foreign firm, which raises tariff revenue. In any regime, the optimal tariff is positive, as the sum of the negative consumer's surplus effect exactly balances the positive rent shifting and tariff revenue effects, from which follows

Lemma 1. With the foreign wage equal to the union reservation wage ($w^* = \bar{w}$), the optimal tariffs are as follows:

i) $t^{DC} = \left[\frac{(2+5b)(10+9b)}{76+188b+123b^2}\right](a-\bar{w})$; $t^{CC} = \left[\frac{20+4b-3b^2}{76-20b+3b^2}\right](a-\bar{w})$;

$t^{CD} = \left[\frac{45-24b}{171-144b+32b^2}\right](a-\bar{w})$; $t^{DD} = \left[\frac{(6+b)(30-11b)}{684-348b+51b^2}\right](a-\bar{w})$

ii) The optimal tariffs are increasing in union bargaining power b. The tariff is the lowest in a non-unionised economy (b=0) with $t^* = 0.2631578\,(a-\bar{w})$, and the highest when the union has got monopoly power (b=1) with $t^C = 0.3559322\,(a-\bar{w}) > t^D = 0.3436692\,(a-\bar{w})$.

iii) The optimal tariffs are ranked as follows:

$t^{DC} \geq t^{CC} > t^{CD} > t^{DD}$ for $0 < b \leq 2/3$;

$t^{CC} > t^{DC} \geq t^{CD} > t^{DD}$ for $2/3 < b \leq 4/5$;

$t^{CC} \geq t^{CD} > t^{DC} \geq t^{DD}$ for $4/5 < b \leq 1$.

Note that the optimal tariff regime ranking is the same as the wage ranking of Proposition 1i): the intuition is that the optimal tariff must offset the additional reduction in domestic output and employment caused by unionisation under the assumptions of linear demand functions (see e.g. Fisher and Wright, 1999): these activity losses are the larger, the larger is the equilibrium wage in

each regime. By using Lemma 1 under the special case of symmetric wage bargaining power between firms and unions (b=1/2), yields the following:

Proposition 3 With symmetric bargaining power (b=1/2), and foreign wage equal to the union reservation wage (w*= $\bar{w}$):

i) The optimal tariffs are

$$t^{DC} = 0.325(a-\bar{w}) > t^{CC} = 0.3183(a-\bar{w}) > t^{CD} = 0.3084(a-\bar{w}) > t^{DD} = 0.3046(a-\bar{w})$$

ii) The typical union's and firm's utility rankings are

$$U^{DC} = 0.0447884(a-\bar{w})^2 > U^{CC} = 0.0407355(a-\bar{w})^2 > U^{CD} = 0.0342387(a-\bar{w})^2 > U^{DD} = 0.0316502(a-\bar{w})^2$$

$$\Pi^{DD} = 0.071213(a-\bar{w})^2 > \Pi^{CD} = 0.0684775(a-\bar{w})^2 > \Pi^{CC} = 0.0611033(a-\bar{w})^2 > \Pi^{DC} = 0.0559854(a-\bar{w})^2$$

iii) For given centralisation costs, product market integration makes it more likely that full decentralisation DD is the dominant strategy Nash equilibrium regime.

iv) The value of the social welfare function (13) in the two candidate equilibrium bargaining regimes DD and CD is as follows :

$$SW^{DD}\Big|_t{}^{DD} = 0.4191984(a-\bar{w})^2 > SW^{CD}\Big|_t{}^{CD} = 0.4158934(a-\bar{w})^2 > SW^{DD}\big|_{t=0} = 0.3690594(a-\bar{w})^2 > SW^{CD}\big|_{t=0} = 0.365(a-\bar{w})^2$$

Proof. Parts i) and ii), iv) yields from direct computation: note that the utility rankings are the same as for Proposition 1.ii) (for $0<b\leq 2/3$) above. As regards Part iii), by comparing the relevant payoffs, it follows that, before integration, D is a dominant strategy for the typical union if $H>0.0025885\,(a-\bar{w})^2$; after integration (namely, when the external tariff is reduced to zero), D is a dominant strategy for the union if $H>0.001405\,(a-\bar{w})^2$. D is always a dominant strategy for firms, irrespective of the value of the external tariff t.

Proposition 3 states that the optimal tariff is the smallest under full decentralisation and the largest under firm centralised negotiations and that, however, the utility ranking is unaffected relative to the case of arbitrary tariffs (see Proposition 1ii) above for $0<b\leq 2/3$). Moreover, Proposition 3 states that integration lowers the cut-off values of the centralisation costs above which not joining a wage coalition is a dominant strategy for unions, given that firms play their dominant strategy of

decentralisation. Similarly to the analysis of section 4 above, integration lowers market size for domestic producers, thus reducing the unilateral incentives to centralisation for the union, given that the firms are better off in choosing to remain decentralised.

Proposition 3iv) confirms, under symmetric wage bargaining power, Fisher and Wrights' (1999, p. 813) finding, for the case of monopoly unions and firm-level bargaining, that a unionised country is always worse off by liberalising trade with a country with a competitive labour market. However, such a welfare loss is lower when bargaining is decentralised after liberalisation: if the social planner can somehow manipulate H, trade liberalisation with a non-unionised country might be coupled with higher union's centralisation costs, so to induce, if necessary, a regime switch.

6. Testing the model's predictions

Agell (1999, 2002), by using cross-country OLS estimates for a sample of 20 OECD countries, finds a positive correlation between the Calmfors and Driffill (1988) centralisation rank index and average 1980-1984 log openness.[14] This section presents an alternative test using the bargaining level index (BL) computed by Golden, Wallerstein and Lange (2002) for 16 OECD countries over the 1950-1997 period:[15] this allows us to exploit both the time series and the cross sectional variation in the data. The dependent variable is the log index of the bargaining level, ranging from 1 (plant-level wage setting) to 5 (sectoral wage-setting with sanctions). The explanatory variable is the log degree of openness (OPE), measured as the sum of exports and imports as a share of GDP, and computed from the Penn World Tables, mark 5.6.[16] Table 4 below presents the panel regressions, which are run using the fixed effects estimator in order to remove time invariant

[14] Agell (2002) finds that this result is robust to alternative measures of centralisation (i.e. union and firm coordination indexes), and of the degree of openness, after controlling for country GDP per capita, country size and cultural homogeneity.

[15] These data are available on line at: http://www.shelley.polisci.ucla.edu/data. The countries included in the sample are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, Norway, Sweden, Switzerland, the UK, and the US. Relative to Agell (2002), there are no data available for Ireland, New Zealand Portugal, and Spain.

[16] The data set is available on line at: http://www.bized.ac.uk/dataserv/penndata/penn.htm. Nicoletti et al. (2001, p. 181) develop a legal index of product market regulation as a proxy for integration, but their index is computed for 1997 only.

country specific effects and to account for unobserved heterogeneity. Given the fairly long time span 1950-1997, the first lag of the dependent variable BL is included as an additional explanatory variable for correcting dynamic misspecification.

[Table 4 in here]

In contrast with Agell's results, Table 4 shows that on average higher openness significantly lowers the bargaining level. In particular, a 4% increase in the degree of openness leads to a 1% decrease in the bargaining level at mean values. These results seem to suggest that the product market incentives to decentralisation, pointed out by Danthine and Hunt (1994) and Calmfors (2001) among others may well dominate Agell's (1999, 2002) social insurance incentives to centralisation. The model presented in this paper has highlighted some basic mechanisms through which such product market incentives might operate.

7. Conclusions

This paper has considered the effects of product market integration on wage bargaining institutions in a simple partial equilibrium model of an international Cournot oligopoly under linear demand curves and homogeneous products. The paper has shown that more product market integration, namely a reduction in trade costs for foreign competitors in domestic markets, increases the unilateral incentives for domestic unions to choose decentralised (i.e. firm-level) over centralised (i.e. industry-level) wage bargaining institutions, without reversing the firms' incentive to decentralised bargaining, such that full decentralisation (i.e. each firm bargaining with its union) is more likely to occur in Nash equilibrium. The basic mechanism for this result works through the impact of product market integration on rents: product market integration lowers rents for domestic firms and unions, thus reducing the unilateral incentives to centralisation, especially for intermediate values of union bargaining power.

References

Andersen, T.M., Haldrup, N., Sørensen J.R. (2000).“EU labour markets: effects of greater product market integration”. *Economic Policy*, 18, 107-129.

Agell, J. (1999). “On the benefits from rigid labour markets: Norms, market failures, and social insurance”. *Economic Journal*, 109, F143-64.

Agell, J. (2002). “On the determinants of labour market institutions: Rent seeking vs. social insurance”. *German Economic Review,* 3, 107-35.

Bloch, F. (2002). “Coalitions and networks in industrial organization”. *Manchester School*, 70, 36-55.

Boeri, T., Brugiavini, A. and Calmfors, L. (2001). *The role of unions in the Twenty-First century*, Oxford: Oxford University Press.

Calmfors, L. (2001). “Wages and wage-bargaining institutions in the EMU: a survey of the issues”, *CESIFO Working Paper* n. 520.

Calmfors, L. and Driffill, J. (1988). “Bargaining structure, corporatism and macroeconomic performance”. *Economic Policy*, 6, pp. 14-61.

Danthine, J.P. and Hunt, J. (1994). “Wage bargaining structure, employment and economic integration”. *Economic Journal*, 104, 528-41.

Davidson, C. (1988). “Multiunit bargaining in oligopolistic industries”. *Journal of Labor Economics*, 6, pp. 397-422.

Driffill, J.E. and van der Ploeg, F. (1993). “Monopoly unions and the liberalisation of international trade”. *Economic Journal*, 103, 379-85.

Driffill, J.E. and van der Ploeg, F. (1995). “Trade liberalisation with imperfect competition in goods and labour markets”. *Scandinavian Journal of Economics*, 97, 223-245.

Flanagan, R.J. (1999). “Macroeconomic performance and collective bargaining: an international perspective”. *Journal of Economic Literature*, 37, 1150-75.

Fisher, T.C.G. and Wright, D.J. (1999). “Unionized oligopoly and trade liberalization”. *Canadian Journal of Economics*, 32, 799-816.

Gaston, N. (2002). “The effects of globalisation on unions and the nature of collective bargaining”, *Journal of Economic Integration*, 17, 377-396.

Golden, M., Lange, P. and Wallerstein M. (2002). “Union centralization among advanced industrial societies: An empirical study”. Dataset available at http://www.shelley.polisci.ucla.edu/data. Version dated September 19, 2002.

Grandner, T. (2001). “Unions in oligopolistic, vertically connected industries”. *European Economic Review*, 45, 1723-1740.

Horn, H. and Wolinsky, A. (1988). "Bilateral monopolies and incentives to merge", *Rand Journal of Economics*, 19, 408-19.

Leahy, D. and Montagna, C. (2000). "Unionisation and foreign direct investment: challenging conventional wisdom?", *Economic Journal*, 110, C80-C92.

Munch, J.R. and Skaksen, J.R. (2002). "Product market integration and wages in unionised countries", *Scandinavian Journal of Economics*, 104, 289-299.

Naylor, R. (1999). "Union wage strategies in international trade", *Economic Journal*, 109, 102-125.

Neary, P.J. (2001). "Foreign direct investment and the single market". CEPR Working Paper n. 01/24.

Nicoletti, G., Haffner, R.C.G., Nickell, S., Scarpetta, S. and Zoega, G. (2001). "European integration, liberalization and labour-market performance" in Bertola, G., Boeri, T. and Nicoletti, G. *Welfare and unemployment in a United Europe*, Cambridge: MIT Press.

Rowthorn, R.E. (1992). "Intra-industry trade and investment under oligopoly: The role of market size", *Economic Journal*, 102, 402-414.

TABLES

Table 1.1. Fully decentralised and union centralised bargaining regimes.

FULLY DECENTRALISED DD REGIME	UNION CENTRALISED CD REGIME
$w_1^{DD} = w_2^{DD} = \bar{w} + \left[\frac{b}{6-b}\right]R$	$w_1^{CD} = w_2^{CD} = \bar{w} + \left[\frac{b}{6-2b}\right]R$
$\hat{x}_1^{DD} = \hat{x}_2^{DD} = \frac{3}{4}\left[\frac{2-b}{6-b}\right]R$	$\hat{x}_1^{CD} = \hat{x}_2^{CD} = \frac{1}{2}\left[\frac{3-2b}{6-2b}\right]R$
$\hat{x}^{*DD} = \frac{1}{4(6-b)}\left[(6+b)a - (18-5b)(w^*+t) + (2-b)6\bar{w}\right]$	$\hat{x}^{*CD} = \frac{1}{2(6-2b)}\left[3a - (9-4b)(w*+t) + (3-2b)2\bar{w}\right]$
$\hat{p}^{DD} = \frac{1}{4(6-b)}\left[(6+b)(a+w*+t) + (2-b)6\bar{w}\right]$	$\hat{p}^{CD} = \frac{1}{4(3-b)}\left[3(a+w*+t) + (3-2b)2\bar{w}\right]$
$\hat{U}_1^{DD} = \hat{U}_2^{DD} = \left[\frac{3}{4}\right]\frac{b(2-b)}{(6-b)^2}R^2$	$\hat{U}_1^{CD} = \hat{U}_2^{CD} = \left[\frac{1}{8}\right]\frac{b(3-2b)}{(3-b)^2}R^2$
$\hat{\Pi}_1^{DD} = \hat{\Pi}_2^{DD} = \frac{9}{16}\left[\frac{2-b}{6-b}\right]^2 R^2$	$\hat{\Pi}_1^{CD} = \hat{\Pi}_2^{CD} = \frac{1}{16}\left[\frac{3-2b}{3-b}\right]^2 R^2$
$R = a + w*+t - 2\bar{w}$	$a > \bar{w} \geq w*+t$

Table 1.2. Firm centralised and fully centralised bargaining regimes.

FIRM CENTRALISED DC REGIME	FULLY CENTRALISED CC REGIME
$w_1^{DC} = w_2^{DC} = \bar{w} + \left[\frac{b}{2+3b}\right]R$	$w_1^{CC} = w_2^{CC} = \bar{w} + \left[\frac{b}{4}\right]R$
$\hat{x}_1^{DC} = \hat{x}_2^{DC} = \frac{1}{4}\left[\frac{2+b}{2+3b}\right]R$	$\hat{x}_1^{CC} = \hat{x}_2^{CC} = \left[\frac{2-b}{8}\right]R$
$\hat{x}^{*DC} = \frac{1}{4}\left[\frac{(2+5b)a - (6+7b)(w*+t) + (2+b)2\bar{w}}{2+3b}\right]$	$\hat{x}^{*CC} = \frac{1}{8}\left[(2+b)a - (6-b)(w^*+t) + (2-b)2\bar{w}\right]$
$\hat{p}^{DC} = \frac{1}{4}\left[\frac{(2+5b)(a+w^*+t) + (2+b)2\bar{w}}{(2+3b)}\right]$	$\hat{p}^{CC} = \frac{1}{8}\left[(2+b)(a+w^*+t) + (2-b)2\bar{w}\right]$
$\hat{U}_1^{DC} = \hat{U}_2^{DC} = \left[\frac{1}{4}\right]\frac{b(2+b)}{(2+3b)^2}R^2$	$\hat{U}_1^{CC} = \hat{U}_2^{CC} = \frac{b(2-b)}{32}R^2$
$\hat{\Pi}_1^{DC} = \hat{\Pi}_2^{DC} = \frac{1}{16}\left[\frac{2+b}{2+3b}\right]^2 R^2$	$\hat{\Pi}_1^{CC} = \hat{\Pi}_2^{CC} = \frac{1}{64}\left[2-b\right]^2 R^2$
$R = a + w*+t - 2\bar{w}$	$a > \bar{w} \geq w*+t$

Table 3. : Choice of bargaining institutions for given t.

		Union's strategies	
		DECENTRALISATION	**CENTRALISATION**
Firm's strategies	**DECENTRALISATION**	$\hat{\Pi}_i^{DD}*,\ \hat{U}_i^{DD}*$	$\hat{\Pi}_i^{CD}*,\ \ (\hat{U}_i^{CD}-H)*$
	CENTRALISATION	$(\hat{\Pi}_i^{DC}-G),\ \hat{U}_i^{DC}$	$\hat{\Pi}_i^{CC}-G,\qquad \hat{U}_i^{CC}-H$

* denotes a candidate best reply. H and G are non-negative centralisation costs for unions and firms, respectively.

Table 4. Centralisation of wage bargaining and product market integration. Panel data estimates for 16 OECD countries: 1950-1997

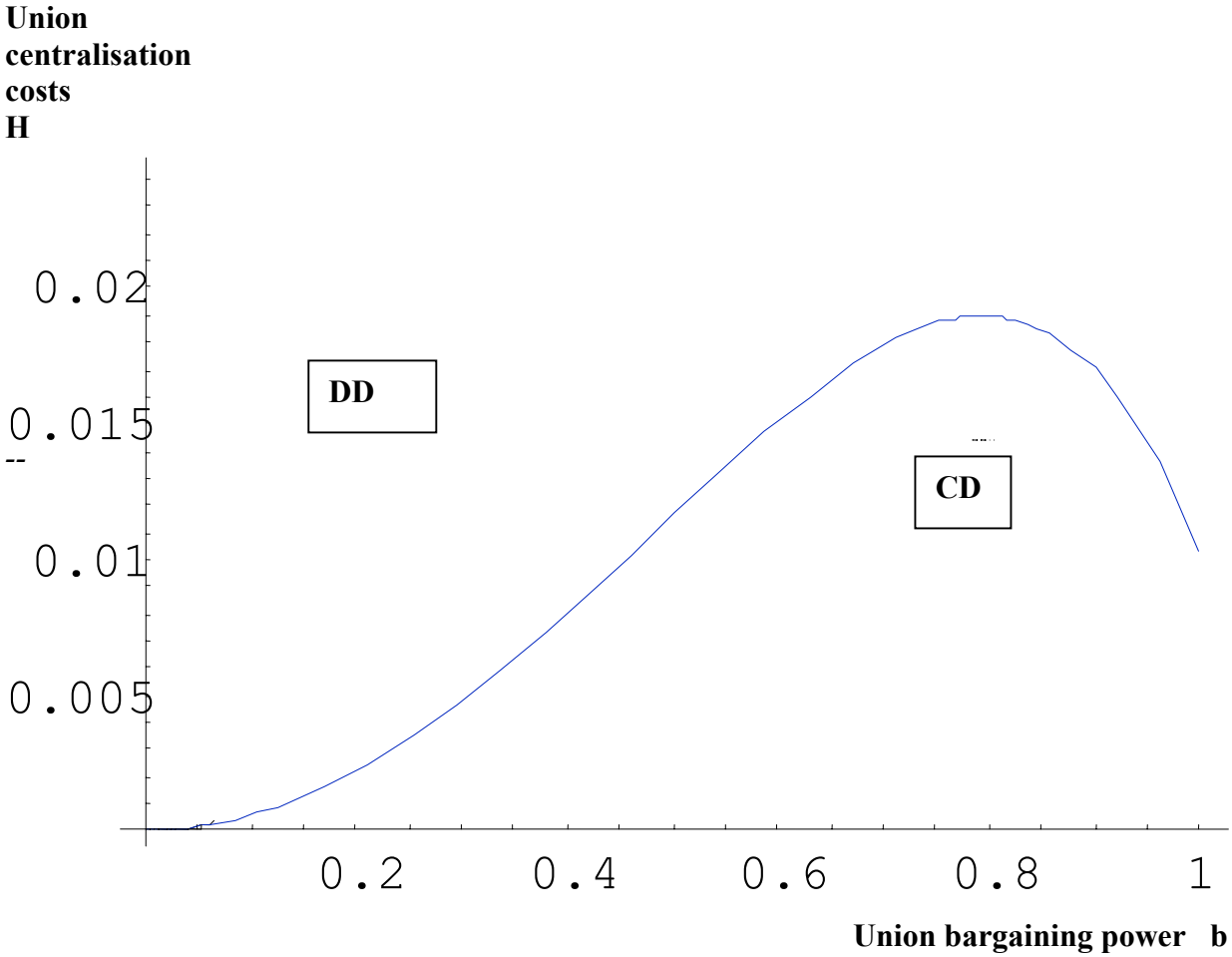
Dependent Variable: Log of Bargaining Level

	Fixed Effects
Ln(OPE)	-0.08**
	(0.03)
$Ln(BL)_{t-1}$	0.68**
	(0.07)
η	-0.25
R^2	0.46
Nobs	768
Tests Wald (joint): $Chi^2(2) = 139.3$ [0.000] ** AR(1) test: N(0,1) = -0.8602 [0.390] AR(2) test: N(0,1) = 0.8041 [0.421]	

Notes: Robust standard errors in brackets; R^2 adjusted for the degree of freedom;** significant at 1 percent level; η: Openness mean lag elasticity of the Bargaining Level.

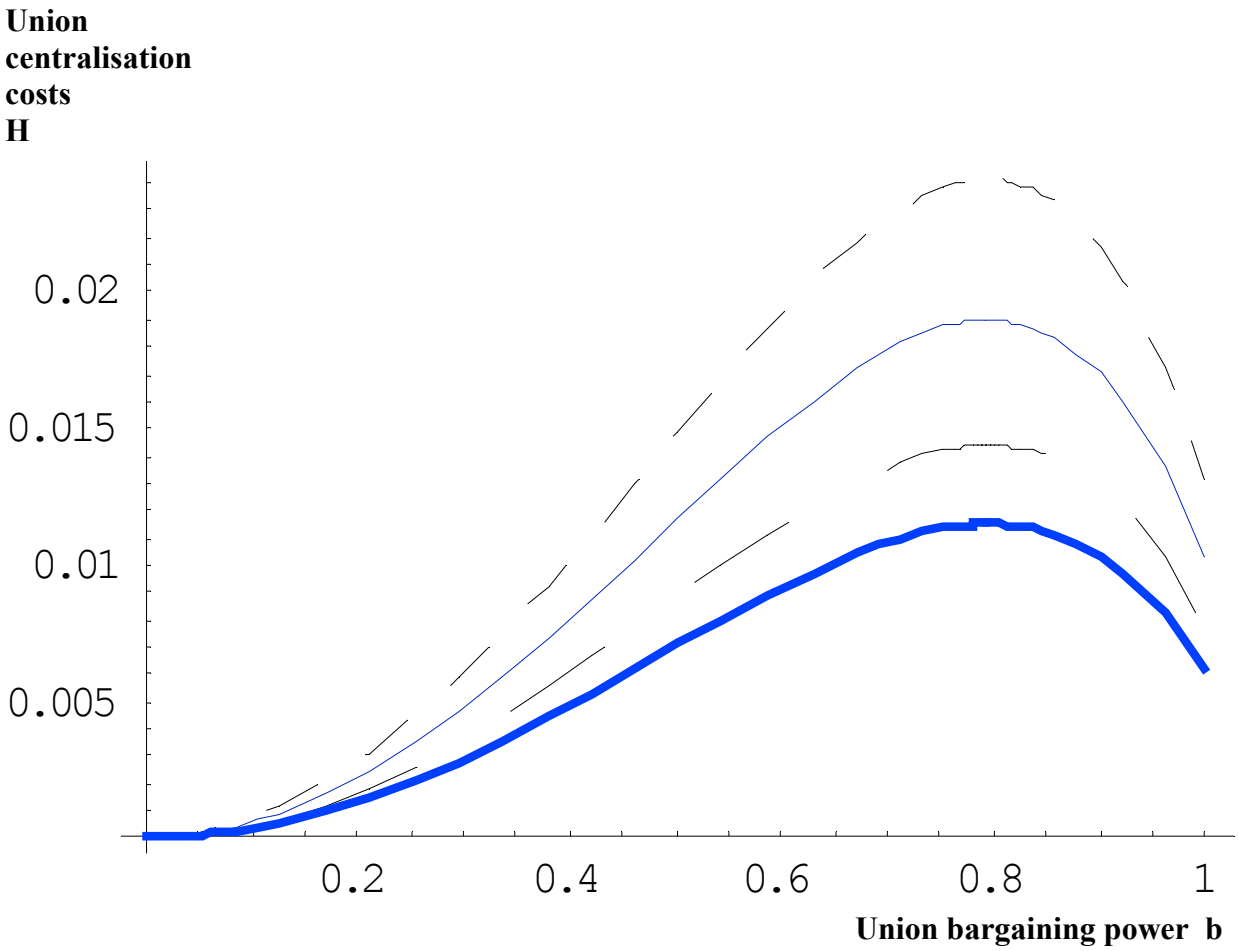
FIGURES

Figure 1. Equilibrium bargaining regimes for given degree of product market integration t



Note. Blue line, $\phi(., t_0) = 0$ is the union indifference regime relationship: above this schedule unions prefer decentralisation below it centralisation, given that firms are decentralised. Because firms' dominant strategy is decentralisation, this determines also the two equilibrium regimes DD and CD.

Figure 2. Product market integration makes a decentralised bargaining regime more likely



Note. An increase in product market integration enlarges the parameter space (i.e. the area above each schedule) thereby DD is the unique Nash equilibrium regime. Each schedule is derived under the following assumption: 1) R^2 =10.5 (upper dotted black line); 2) R^2 =8.25 (solid thin blue line); 3) R^2 =6.25 (lower dotted black line); 4) R^2 =5 (solid thick blue line).