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Departamento de Economía
Universidad Carlos III de Madrid
Calle Madrid, 126
28903 Getafe (Spain)
Fax (341) 624-9875

ENDOGENOUS WAGE-BARGAINING INSTITUTIONS
IN OLIGOPOLISTIC INDUSTRIES

Emmanuel Petrakis and Minas Vlassis*

Abstract

This paper develops a framework of endogenous formation of wage-bargaining institutions regarding the level at which unions and firms negotiate in industries with market power. We show that economic factors, such as asymmetries in productive efficiency and bargaining power, are responsible for the emergence of various degrees of bargaining centralization. An all union-efficient firms majority coalition typically establishes an extra stage of wage negotiations at the sectorial level. If, for given bargaining powers, the productivity differences are sufficiently high, wage negotiations are also conducted at firm-level. Otherwise, the (minimum) wage bargain struck at the sectorial level is simply confirmed by both, firms and unions. This is a case of complete bargaining centralization. If, however, technological and bargaining power asymmetries cancel out, wage negotiations are conducted only at the firm level (decentralized bargaining).

Key Words

Bargaining Institutions, Oligopoly, Minimum Wage, Majority Coalition.

*Petrakis, Departamento de Economía, Universidad Carlos III de Madrid; Vlassis, Department of Economics, Athens University of Economics and Business, Greece. We wish to express our appreciation to T. Kollinzas and J. Padilla for their helpful comments. We have also benefitted from suggestions during the presentations of earlier versions of this paper in EARIE 1994 Conference in Chania, Crete, in X Jornadas de Economía Industrial 1994, Madrid, as well as in the Economics Seminars in CEMFI, Madrid, Athens University of Economics and Business, Universidad de Zaragoza, and Universidad Carlos III. Financial support from DGICYT grant PB92-0245 is gratefully acknowledged.

1. Introduction

Real-life institutions of wage and employment determination through bargaining display substantial variability regarding the timing, scope, and level of union-firm negotiations. While, for instance, in EU countries wage negotiations are typically sequentially conducted, in Japan wages are negotiated simultaneously. In most cases bargaining takes place about wages alone, while there is some evidence that negotiations may involve other variables as well (e.g. employment). A striking variability is, in particular, observed regarding the level at which negotiations are conducted. In USA, Canada and Japan bargaining occurs at firm-level alone. In Europe negotiations take place at all three, national, sectorial and firm level in Belgium and Greece; mainly at both, national and sectorial level in Germany and Scandinavia; typically at both, sectorial and firm level in Italy, the Netherlands and Spain; at the sectorial level alone in France and Portugal; mainly at firm level in the UK and Ireland. (Layard *et al.* (1991)). A natural question, therefore, arises: Why does such a variety of bargaining institutions exist across countries? How these institutions emerge? So far, economic theory has hardly addressed such type of questions.

Our aim is to develop a theory of endogenous formation of bargaining institutions. We propose that economic factors, such as asymmetries in productive efficiency and bargaining power, are responsible for the evolution of different institutions across countries, or industries within a country. In this paper we restrict attention to the level at which wage-negotiations are conducted¹. Recently, the literature has recognized the

¹Some recent papers have paid attention on how the scope of bargaining (i.e. the arguments about which firms and unions negotiate) may be endogenously determined (see Espinoza & Rhee (1989), Eberwein & Kollintzas (1995) and Petrakis & Vlassis (1995)).

crucial role that the level of negotiations (the degree of bargaining centralization) plays for the determination of wage-employment-output equilibria (Hoel (1989 & (1990), Dorwick (1989), Corneo (1993), Padilla et al. (1994)). If, for instance, wage negotiations take place independently and simultaneously at the firm level (decentralized bargaining), wages are lower, and thus employment is higher, than under centralized bargaining, at the sectorial level². This literature, however, treats the level of negotiation as an exogenous institution. Moreover, only the cases of complete centralization, or complete decentralization are explicitly considered. There is no attempt soever to explain under which circumstances each of these polar cases emerges. Further, there is no explanation why bargaining may in fact be conducted at various (e.g. both sectorial and firm), levels as in many labour market systems.

Our approach builds on the fundamental postulate: Institutional arrangements are created if a "winning" coalition of agents, each acting for its own interest, finds their establishment beneficial. An agent in our context is either a firm or a firm's union. This is the only natural assumption, especially in an asymmetric world where conflicts of interests among the different firms' unions are usually present. On these grounds, we develop a framework of endogenous determination of alternative level-of-wage bargaining setups, in industries with market power. In particular, we consider a homogeneous good industry where technologically asymmetric firms compete a la Cournot in the product market. In the labour market firms bargain with unions over wages, while employment decisions are left to the employers' discretion (right-to-manage). Unions may, on

² This holds when the scope of negotiations covers only wages (right-to-manage) and the product market is imperfectly competitive. It is evident, as long as agents inside each bargaining unit (a firm and its union) do not internalize the industry-wide effects of their decisions. Therefore, competitive wage-cutting incentives drive wage bargains downwards.

principle, possess different bargaining powers³. Negotiations are conducted at both firm-level and industry (sectorial)-level only if such an institution has been collectively decided by a simple majority, during an initial institution selection stage⁴. In this case, the pivotal voter's most-preferred wage is first established as the (minimum) sectorial wage. Following which, a firm and its own union may, or may not, decide to enter a firm-level bargaining session to increase the firm-specific wage beyond the minimum sectorial one. On the other hand, if this institution has not been chosen, firms bargain with their own unions, in parallel sessions, over firm-specific wages alone. Finally, employment and production decisions are taken by the firms.

Our central result is that technological and relative bargaining power asymmetries are those that generate incentives for bargaining arrangements beyond the natural firm-level negotiations. In the latter, completely decentralized, bargaining regime, technologically superior firms pay much higher wages than their inefficient rivals, if unions' bargaining powers do not differ substantially. As a result, an efficient firm partially loses its potential cost advantage due to its relatively higher cost of labour. Our analysis highlights the strategic role that a minimum sectorial wage may play in the rivalry among, efficient and inefficient, firms. Once established, the technologically inferior firms are obliged to pay at least this wage to their employees. Therefore, efficient firms will opt for establishing a minimum sectorial wage in order to reduce wage differentials,

³Technological and bargaining power asymmetries are also considered in Padilla et al. (1994). The authors analyze the ensuing vertical spillovers between labour and product markets, however under a given institutional setup (decentralized bargaining).

⁴ In the institution selection stage, a union (a firm) will do search for potential partners to form a winning coalition as far as it expects benefits from the institution that such a coalition is able to establish. We implicitly assume here that this type of communication is costless.

and thus retain their relative cost advantage. On the other hand, unions have a primary incentive to settle some minimum wage, since a backup wage typically improves the bargaining position of a union during the negotiation with its own firm.

To introduce a minimum wage bargain, efficient firms will therefore search for potential partners among unions to form a "winning" coalition, i.e. a coalition which has the decisive power to establish this institution. If institutional decisions are taken by the majority rule, an all-union -- efficient firms coalition would then be able to settle an additional stage of wage negotiations at the sectorial level. In this way, an institution introducing an extra (sectorial) level of wage bargaining is endogenously formed by an adequate subset of agents, each acting for its own interest.

Our analysis entails two variations of the above bargaining setup (once established). Consider, for instance, an industry with two firms, one of them endowed with a superior technology. If the differences in productivity are small enough, firm level negotiations will never take place. The pivotal voter is the efficient firm, which opts for a sufficiently high industry-level minimum wage to steal market share from its competitor. This case is observationally equivalent to a completely centralized bargaining at the industry level. Nonetheless, the wage outcome (confirmed by both firms and their own unions) on principle differs from that of an ad-hoc centralized bargaining regime. On the other hand, if productivity differences are sufficiently high, the inefficient firm's union will resist a high minimum wage to avoid marginalization of its own firm and thus guarantee some employment for its own members. Wage negotiations are realized at firm level also, but only between the efficient firm and its own union. The inefficient firm and its union simply confirm the wage bargain struck at the sectorial level of negotiations. This provides a case of a partially decentralized bargaining regime which is in fact observed in some

real-life labour market systems.

If, however, technological and relative bargaining power asymmetries "cancel out", thus leading to equal wages for both efficient and inefficient firms, there are no strategic incentives for bargaining arrangements beyond the (natural) decentralized regime. In fact, efficient firms enjoy their full cost advantage under decentralized bargaining, and therefore have no interest to introduce industry level negotiations. Note, that bargaining at the firm level alone also takes place always if there are no asymmetries in both, productive efficiency and bargaining power.

The rest of the paper is organized as follows. In Section 2 our model is developed and the decentralized bargaining case is analyzed. Section 3 analyzes wage negotiations conducted at both, sectorial and firm level. The strategic role of the minimum sectorial wage is particularly highlighted. Section 4 shows that there are often incentives for a majority of agents to establish an extra stage of wage bargaining at the sectorial level. Which in turn, effectively, determines if bargaining is centralized or partially decentralized. In section 5 the implications of the endogeneity of the degree of bargaining centralization for the wage structure, employment, production and social welfare are analyzed. Finally, Section 6 concludes.

2. The Model

We consider a homogeneous good industry where two firms, on principle endowed with different technologies, compete in the product market by choosing simultaneously their quantities. For simplicity, we assume that production technologies

exhibit constant returns to scale and require only labour input to produce the good⁵. Let firm 2 possess a superior technology than firm 1. We shall call firm 1 "inefficient" and firm 2 "efficient". In particular, firm 1's production function is $y_1 = AN_1$, and firm 2's is $y_2 = kAN_2$ with $k \geq 1$, where y_i denotes firm i 's output and N_i its employment level. $A > 0$ is the productivity of labour when combined with the inefficient technology, and k is a measure of relative efficiency of technologies. We further assume, for tractability reasons, that market demand is linear and is given by $P(Y) = a - Y$, where Y is the aggregate output ($Y = y_1 + y_2$).

The labour market is unionized. Workers are assumed to be organized into two separate, firm-specific unions. This is appealing, since different technologies may require workers of distinct specialization. Also, since firms' technological asymmetries often create conflicts of interests between firms' unions. Let union i be the firm i 's union. Abusing slightly the terminology, we shall refer to the (in)efficient firm's union as (in)efficient union. Assume that unions are of the utilitarian type with risk-neutral members (Oswald (1982)). Then union's i objective is to maximize

$$U_i(w_i, N_i) = (w_i - w_0)N_i \quad (1)$$

where w_i is the negotiated wage and w_0 is the backup option. That is, w_0 is an unemployed union member's expected income. It can be thought as a weighted average of the competitive wage and the unemployment benefits with weights the probability of being employed, or not, in the competitive sector. Unions are, on principle, endowed with different bargaining powers during the negotiations with their own firms. Union 1's bargaining power is β , and union 2's is γ , with β greater, equal, or smaller than γ .

⁵For instance, a firm, endowed with a two-factor Leontief technology, produces with such a linear one-factor (labour) technology in the short-run, if its amount of capital is not too small.

Negotiations take place over wages alone, leaving employment to the firms' discretion (Right-to-Manage)⁶. Wage negotiations are conducted at firm-level alone, or at both, sectorial and firm, level according to the established institution. If the prevailing institution is decentralized bargaining, then firm/union pairs bargain in parallel sessions, each about its firm-specific wage. If the established (by the interested parties) institution is two-level wage bargaining, then the sectorial wage is first collectively negotiated by all firms and unions⁷. Following which, firm/union pairs may enter into parallel firm-level negotiation sessions to increase the firm-specific wage beyond the (minimum) sectorial one. If, at this stage, neither a firm, nor its own union, find beneficial such an increase, they simply confirm the minimum wage as the firm-specific wage. During the all union-firm negotiations stage, the pivotal voter's most-preferred wage is established as the sectorial wage. Firm-specific wages are then determined with the use of the Generalized Nash Bargaining solution with the restriction that they can never be lower than the sectorial wage.

Decentralized firm-level bargaining is assumed to be the status quo institution. This is appealing, especially in an asymmetric world where different firms' unions often have conflicting interests. Wage-bargains are then conducted at the firm-level alone, except if a "winning" coalition of agents, each acting for its own interest, finds the establishment of collective industry wage-bargains beneficial. To model this we add an institution selection stage that precedes any wage-negotiations. Interested parties (firms and unions) vote in

⁶The scope of bargaining is about wages alone and it is exogenously given here. Petrakis & Vlassis (1995) characterize the labour and product market conditions under which Right-to-Manage emerges as an endogenously determined institution in a subgame perfect equilibrium.

⁷Assuming mandatory extension of collective industry bargains, the sectorial wage is in fact the minimum wage for all firms in the industry.

favour, or against, the introduction of an additional wage-bargaining stage at the sectorial level. Each party is assumed to have one vote. If collective industry wage bargains obtain a simple majority of votes, two (sectorial and firm)-level wage negotiations emerge as the new institution⁸. Otherwise, the status quo, one (firm)-level institution prevails.

To summarize, the timing of the game is as follows. In the first stage, firms and unions vote for the bargaining institution according to which wage negotiations will be conducted. In case that two-level wage bargains are chosen as the prevailing institution, all firms and unions negotiate to settle a minimum wage for the sector in the second stage. In the third stage, firm/union pairs negotiate in parallel sessions, each about its firm-specific wage (given that the established sectorial wage acts as a wage floor). If, on the other hand, decentralized bargaining prevails, the game proceeds to the third stage (where, however, a wage floor is absent). Firms make simultaneously their employment decisions in the fourth stage. Finally, firms compete à la Cournot in the product market. We assume that all parties, while voting for an institution or negotiating about wages, take into account the implications of their decisions on the subsequent stages of the game. That is, we shall restrict attention to subgame perfect equilibria.

Let us first consider the employment and product market stages of the game. Note, that given our one-factor (labour) linear technologies, a firm's decision on employment also determines its output. Thus, employment and production stages can be reduced to a single stage where firms compete in the market by simultaneously choosing employment (or, outputs). Let output be the strategic variable. Each firm then chooses its output to

⁸In fact, the procedure by which a new bargaining institution is established is along these lines in a number of countries. In Spain, for example, a group of firms and unions, representing a majority of shareholders and workers, have the power to establish a new labour market institution (Jimeno (1992)).

maximize profits, taking as given the quantity produced by its rival, and the wages resulted from the firm-level negotiations. Firm 1's profits are $\pi_1 = (a - y_1 - y_2)y_1 - w_1 y_1 / A$ and firm 2's $\pi_2 = (a - y_1 - y_2)y_2 - w_2 y_2 / kA$. Note, that one-factor (labour) linear technology implies that w_1 / A (w_2 / kA) is the inefficient (efficient) firm's marginal cost of production. The outcome of this Cournot game with asymmetric unit costs of production is standard and is summarized in (2).

$$y_1^*(w_1, w_2) = (a - 2w_1 / A + w_2 / kA) / 3 \quad y_2^*(w_1, w_2) = (a - 2w_2 / kA + w_1 / A) / 3 \quad (2)$$

and $\pi_i(w_1, w_2) = (y_i^*)^2$, $i = 1, 2$. Then $N_1^*(w_1, w_2) = y_1^* / A$ and $N_2^*(w_1, w_2) = y_2^* / kA$. Note that $\partial^2 \pi_i / \partial w_i \partial w_j < 0$ for all $i, j = 1, 2$, i.e. wages are strategic substitutes from the firms' point of view. That is, an increase in the rival's wage raises a firm's marginal profitability of a wage cut. On the other hand, substituting N_i^* into union i 's objective (given in (1)), it can be checked that $\partial^2 U_i / \partial w_i \partial w_j > 0$, i.e. wages are strategic complements from the unions' point of view. An increase in the rival's wage (and thus in its marginal cost), improves a firm's competitiveness in the market. It becomes then more profitable for its union to press further for wage increases, since it does not lose as much in terms of employment.

Let assume, for the moment, that decentralized bargaining is the wage-bargaining institution in effect. Then firm/union units negotiate in parallel sessions about firm-specific wages. Firm i bargains with its own union over the firm-specific wage w_i taking as given the wage bargain, w_j , struck in the parallel firm/union j negotiation session. To obtain the negotiated wage we employ the generalized Nash Bargaining solution. Firm/ union unit 1's bargained wage then maximizes

$$[\pi_1^*(w_1, w_2)]^{1-\beta} [(w_1 - w_0) N_1^*(w_1, w_2)]^\beta \quad (3)$$

with $1-\beta$, and β firm 1's, and union 1's bargaining power, respectively. The first order

condition (foc) of (3) gives firm/union unit 1's reaction function,

$$w_1 = [\beta Aa + 2(2-\beta)w_0 + \beta w_2/k] / 4 \quad (4)$$

A similar analysis applied to the firm/union 2 bargaining session provides the firm/union unit 2's reaction function

$$w_2 = [\gamma Aak + 2(2-\gamma)w_0 + \gamma w_1/k] / 4 \quad (5)$$

with $1-\gamma$, and γ firm 2's, and union 2's bargaining power, respectively. Note, that w_i increases with w_j , $i, j=1, 2$, that is, wages are strategic complements from the viewpoint of firm/union bargaining units. An increase in firm/union j negotiated wage relieves the competitive pressure on firm i , thus facilitating firm i 's wage concessions to its union.

Solving (4) and (5) we get the negotiated wages under the decentralized bargaining regime

$$w_1^d = [aA\beta(4+\gamma) + 2\{4(2-\beta) + \beta(2-\gamma)/k\}w_0] / (16-\beta\gamma) \quad (6a)$$

$$w_2^d = k[aA\gamma(4+\beta) + 2\{4(2-\gamma)/k + \gamma(2-\beta)\}w_0] / (16-\beta\gamma) \quad (6b)$$

As expected, w_i^d is increasing in the backup wage w_0 . Note, that if unions possess the same bargaining power ($\beta=\gamma$), the efficient firm's wage is much higher than its inefficient rival's wage. As a result, a great part of the efficient firm's initial technological advantage is dissipated due to wage negotiations being conducted in a decentralized way⁹. If, in addition, $w_0=0$, then $w_2^d = kw_1^d$ and both, the efficient and inefficient, firms face the same marginal cost of production. If, however, $w_0>0$, firm 2 retains part of its technological superiority (since $w_2^d < kw_1^d$ for $\beta=\gamma$).

The efficient firm enjoys its full technological advantage whenever $w_1^d = w_2^d$. This holds, if $k = \beta(4+\gamma)/\gamma(4+\beta) \equiv \phi(\beta, \gamma)$ provided that $w_0=0$; further, if $w_0>0$, then the higher the w_0 is, the lower the γ has to be for given β (see figure 1). An inefficient

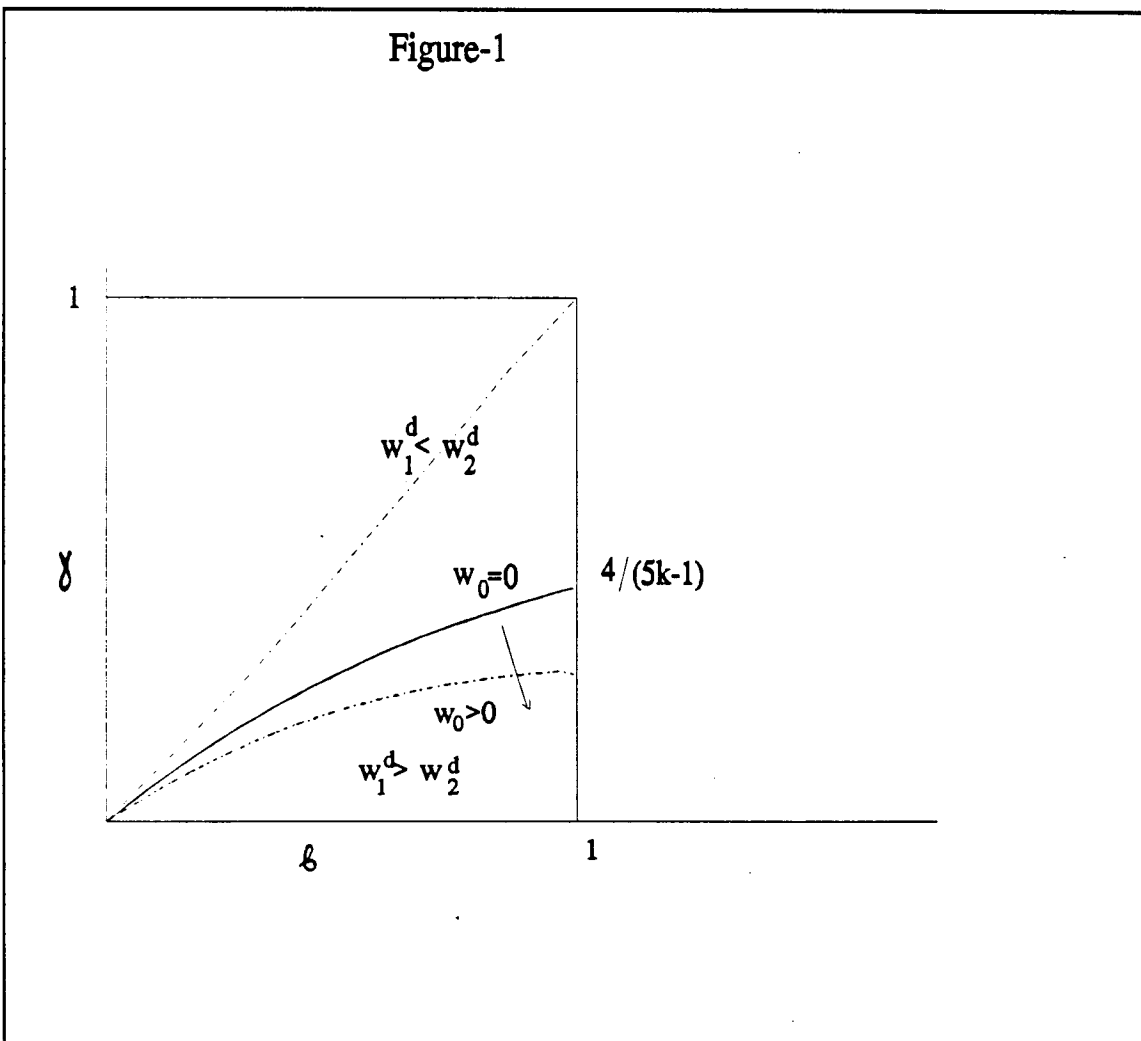
⁹ On the contrary, if wage negotiations are centralized, the efficient firm enjoys its full initial technological advantage. This is due to centralized bargaining determining a single wage to be payed by all firms in the industry.

union, with sufficiently higher bargaining power than its efficient counterpart's, is often able to achieve an equally high wage, despite the technological inferiority of its firm (except if w_0 is sufficiently high, where $w_2^d > w_1^d$ always). As the backup wage increases, a union cares relatively less about wage increases comparing to employment cuts. To see this, from (1) we get that $-dw_i/dN_i = (w_i - w_0)/N_i$, which is decreasing in w_0 . Then the inefficient union, with the guarantee of a high backup wage, will push less for wage increases in order to avoid the marginalization of its firm and the accompanying employment cuts. The efficient union, on the other hand, can still push for a higher wage without fearing drastic employment reductions. If, on the contrary, the backup wage is relatively small, $w_2^d > w_1^d$ as long as $\gamma \geq \beta$, or at least, if the efficient union is not much weaker than the inefficient union in the bargaining table. The above are summarized in the following proposition (see also figure 1).

Proposition 1: *Under decentralized bargaining, the negotiated wage in the efficient firm/union session is always higher than that of the inefficient firm/union's one whenever the backup wage is sufficiently high. For smaller backup wages, it is higher if the efficient union is relatively stronger ($\gamma > \beta$) or, if the technological superiority of the efficient firm compensates for the relative weakness of its own union.*

Proof: Note first that, $w_2^d - w_1^d = \{AaC(k) + 2D(k)w_0\} / (16 - \beta\gamma)$ where $C(k) = \gamma(4 + \beta)k - \beta(4 + \gamma)$ and $D(k) = \gamma(2 - \beta)k - 4(\gamma - \beta) - \beta(2 - \gamma)/k$, with $C'(k) > 0$ and $D'(k) > 0$. Further, $C(1) = 4(\gamma - \beta)$ and $D(1) = -2(\gamma - \beta)$. As $w_0/A < a$ is a necessary condition for the market to exist at all, if $\gamma > \beta$, we have $w_2^d > w_1^d$ for $k=1$, and thus for all k . If, on the other hand, $\gamma < \beta$, then $D(k) > 0$ for all k . Further, $C(k) \geq 0$ iff $k \geq \phi(\beta, \gamma)$; hence, $w_2^d > w_1^d$ under these parameter values, too. On the contrary, if $k < \phi(\beta, \gamma)$ and $w_0 = 0$, then $w_2^d < w_1^d$. But for w_0 sufficiently high, the inequality is reversed. This is so, because $w_2^d - w_1^d$ is increasing in w_0 ,

Figure-1



and is strictly positive for $w_0 = Aa$. (In fact, $w_2^d > w_1^d$ for all $w_0 > w_0^{\#}$, where

$$w_0^{\#} = AaC(k)/2D(k).$$

Q.E.D.

Note, that if $w_0 = 0$, $w_2^d > w_1^d$ requires k to be larger than $\phi(\beta, \gamma)$. However, as w_0 increases, this holds even for lower k , given the bargaining powers.

Finally, the outputs, aggregate employment, firms profits and unions welfare under decentralized bargaining can be obtained by substituting (6) into (2).

$$y_1^d = 2(2-\beta)[aAk(4+\gamma) - \{(8-\gamma)k - 2(2-\gamma)\}w_0]/3Ak(16-\beta\gamma) \quad (7a)$$

$$y_2^d = 2(2-\gamma)[aAk(4+\beta) - \{(8-\beta) - 2(2-\beta)k\}w_0]/3Ak(16-\beta\gamma) \quad (7b)$$

Further, $N^d = N_1^d + N_2^d = y_1^d/A + y_2^d/kA$ and $\pi_i^d = (y_i^d)^2$. Also, from the foc of (3) we get

$U_1^d = 3\beta(y_1^d)^2/2(2-\beta)$ and $U_2^d = 3\gamma(y_2^d)^2/2(2-\gamma)$. Note that as w_0 increases, both outputs and aggregate employment, as well as firms' profits and unions' rents decrease.^{10,11}

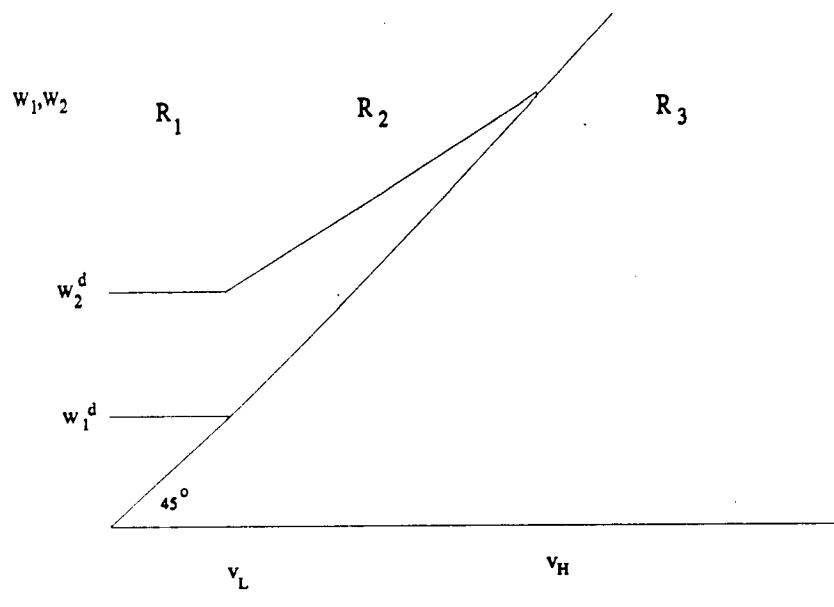
3. Sectorial-level Wage Negotiations: The Strategic Role of Minimum Wage

Suppose next that the established institution enables wage negotiations at both, sectorial and firm, levels. Let, for the moment, w_m be the (minimum) wage bargain struck at the sectorial level. Mandatory extension of sectorial wage bargains requires then that the firm-level wage be at least as high as w_m . Hence, if w_m turns out to be higher than the wage bargain would be struck at the firm level, no such firm-level negotiation would in

¹⁰This is true for values of k which are not too high. A sufficient condition is k to be less than 2. If the technological asymmetries are strong, a corner solution may arise where only the efficient firm remains active in the market. To avoid this case, we shall restrict our analysis to $k < 2$ in the next section.

¹¹However, a union's total welfare (most probably) increases with w_0 , since all union's members enjoy now a higher alternative income.

Figure-2



reaches a maximum at some $w_m \geq v_H$, while U_I^* is maximized at $w_m = \max[v_H, m_H]$ where $m_H \equiv w_0/2 + aAk/2(2k-1)$.

Summarizing, as the binding value of the sectorial wage increases (regions R2 and R3), the efficient firm's profits initially increase, in R2, and then decrease in R3, while the inefficient firm's profits decrease throughout. As far as it concerns unions' rents, the efficient union's rents initially increase, reach a maximum inside R3, and then decrease. The inefficient union's rents initially increase, reach a maximum (either inside any of R2 or R3, or at their border), and subsequently decrease. It is now clear that three out of the four groups of agents, each acting for its own interest, would opt for a sufficiently high w_m so that the sectorial wage to become binding for some, or all, participants during the firm-level negotiations. Whilst it is not surprising that both unions are happier with the guarantee of a minimum wage, it is the strategic pursuit of the efficient firm that enables the establishment of a sectorial wage floor. It is thus straightforward that, three out of four, would prefer bargaining at both, sectorial and firm, levels over the status-quo decentralized bargaining.

Let now proceed to the derivation of w_m . We assume that decisions are taken by simple majority rule. Our postulate is that the pivotal voter's most-preferred value of w_m will be selected as the minimum sectorial wage. This is reasonable as long as it is the pivot who delivers the coalition's decisive power¹². Then, the optimal sectorial wage

¹²This is one of a few possible working assumptions. Alternatively, it can be assumed that the minimum wage selected is the most-preferred one of the median voter. However, under an even number of voters (four in our case), the minimum wage chosen would be the average of the second and third's most-preferred one. It is not clear, though, that such a choice would give to the second voter a welfare higher than if he had stayed out of the coalition. This, in turn, could drive to an alternative postulate, where the minimum wage would be selected so as to simply compensate the pivot for her participation. Nevertheless, most such alternative assumptions do not change the flavour of our results, though they typically lead to a higher sectorial wage.

settlement is summarized in the following proposition:

Proposition 2: *If $w_1^d < w_2^d$, then at the sectorial-level negotiations the two unions and the efficient firm form a coalition which settles the minimum wage $w_m = m_L$ if $m_L < v_H$, and $w_m = v_H$ otherwise.*

Proof: From our discussion above, we know that the two unions and the efficient firm have incentive to form a coalition in order to impose a binding w_m . If $m_L < v_H$, the pivot is the inefficient union and the selected w_m will be its most-preferred sectorial wage, m_L . Otherwise, the pivot is the efficient firm. Its most-preferred sectorial wage, v_H , is then selected. Q.E.D.

The intuition is as follows: In case that $m_L < v_H$, the inefficient firm's union would resist a further wage increase, to avoid the marginalization of its own firm and the resulting low employment for its members. This happens if, for instance, there exist significant differences in productivity between the two firms (large enough k).

Consequently, firm-level negotiations will take place only between the efficient firm and its own union to increase the wage above the minimum. The inefficient firm and its union will meet just to confirm w_m as the firm's wage. Otherwise, both unions opt for a high minimum wage, but the efficient firm will only agree for a moderate value of w_m . In this case, no negotiation will in fact take place at the firm-level, since both firm/union pairs will simply confirm the minimum wage as the prevailing one in the industry. This usually happens when the productivity differences are not too large. Note that, in any case, the selected w_m is increasing in the outside wage, w_0 .

Let us now turn to case (ii) where $w_1^d = w_2^d$. Recall that firm-level wage bargains are equal if technological and bargaining power asymmetries cancel out or, they are absent

at first place. The efficient firm, enjoying now its full technological advantage, has no incentive to opt for a sectorial wage floor. Note, that region 2 in figure 2 now collapses. Given then that both firms' profits decrease, while both unions' rents increase, in region 3, there is no possibility for a majority coalition to be formed. At this point, the minimum sectorial wage cannot be determined by simply evoking our postulate. But, will be, in fact, any need to be determined? As it is shown in the following section, a sectorial wage bargaining stage will never be introduced by the interested parties.

Finally, we turn to case (iii) where $w_1^d > w_2^d$. If the inefficient union is sufficiently more powerful than the efficient one, such as to compensate for the technological deficiency of its own firm, the wage paid by the inefficient firm, under the decentralized regime, is higher. This adds to the inefficient firm's technological disadvantage, and thus aggravates its competitiveness. It is now the inefficient firm that has incentive to use the sectorial wage strategically, to restore part of its competitiveness by reducing the wage wedge. The analysis here is analogous to case (i) above, so we shall be brief in what follows.

Define $v_L' = w_2^d$ and $v_H' \equiv [aA\beta k + 2(2-\beta)kw_0]/(4k-\beta)$. It can be checked that $v_L' < v_H'$. Again, if $w_m \leq v_L'$, $w_i^* = w_i^d$, and if $w_m \geq v_H'$, then $w_i^* = w_m$, $i=1,2$. Finally, if $v_L' < w_m < v_H'$, then

$$w_2^* = w_m \quad w_1^* = [Aa\beta + 2(2-\beta)w_0 + \beta w_m/k]/4 \quad (14)$$

In a similar way, regions R1', R2', R3' are defined. Note that the expressions for outputs, profits and union rents are the same as in case (i), except for region R2' where we get,

$$y_1'^* = (2-\beta)(aAk - 2kw_0 + w_m)/6Ak \quad (15)$$

$$y_2'^* = [aAk(4+\beta) + 2(2-\beta)kw_0 - (8-\beta)w_m]/12Ak \quad (16)$$

Now, firm 1's output and profits increase, while firm 2's decrease, as the minimum sectorial wage increases. Note also, that in contrast to case (i), both unions' rents increase in this region (i.e. $\partial U_i^*/\partial w_m > 0$, $i=1,2$)¹³. As in case (i), three out of four, would opt for a sufficiently high w_m . As nonetheless, the following proposition demonstrates, the sectorial wage becomes now binding for all participants during the firm-level negotiations.

Proposition 3: *If $w_1^d > w_2^d$, then at the sectorial-level negotiations the two unions and the inefficient firm form a coalition which settles the minimum wage $w_m = v_H'$ always.*

Proof: Given that the two unions' rents and the inefficient firm's profits are increasing in $R2'$, they have incentive to form a coalition in order to impose a binding w_m . The pivot here is the inefficient firm. Therefore, its most-preferred sectorial wage, v_H' , will be selected. Q.E.D.

The intuition is straightforward. While both unions opt for a high minimum wage, the inefficient firm would only accept a moderate value of w_m . No firm-level negotiation would ever take place. Both firm/union pairs simply confirm the minimum wage as the prevailing one in the industry. Note, again, that the selected minimum wage is increasing in the backup wage.

4. Institution Selection Stage

We next proceed to the institution selection stage. This, in fact, can be considered as a *constitutional stage*, since now interested parties vote in favour, or against, the establishment of an additional, sectorial, level of wage bargaining beyond the status-quo

¹³ It is obvious that $\partial U_1^*/\partial w_m > 0$. To check $\partial U_2^*/\partial w_m > 0$, note that U_2^* is concave in w_m . Further, $\partial U_2^*/\partial w_m$ evaluated at v_H' , is increasing in k , and it is positive for the smallest k ($k=1$).

firm-level negotiations. We assume that each firm, and each union, has one vote, and that decisions are taken by the simple majority rule. In the previous section we have shown that, once a two-level bargaining procedure has been established, three out of four agents will impose a minimum sectorial wage which is binding for all (cases (i) and (iii)). This is so, because they thus attain a higher utility level than under the status quo, decentralized bargaining setup. Therefore, these agents will vote in favour of the establishment of minimum sectorial wage bargains. The endogenously chosen institution is, hence, wage bargaining at both, sectorial and firm, levels.

On the contrary, in case (ii) we have seen that two out of four agents (the two firms) always prefer wage bargains at the firm level alone. As a consequence, they will vote against the establishment of minimum sectorial wage bargains. The status quo, decentralized bargaining will therefore endogenously chosen. These results are summarized by the following proposition:

Proposition 4: *Whenever, due to technological and bargaining power asymmetries, decentralized wage bargains turn out to be unequal ($w_1^d \neq w_2^d$), a two (sectorial and firm)-level wage bargaining institution will be endogenously selected. The two unions and, either the efficient, or the inefficient, firm will vote for the establishment of minimum sectorial wage bargains. If technological and bargaining power asymmetries cancel out ($w_1^d = w_2^d$), decentralized bargaining is however endogenously selected.*

5. Employment and Welfare Effects

Our analysis entails various interesting implications regarding the structure of wages, employment, production pattern and social welfare. If the level of wage bargains is endogenously chosen, wage differentials between efficient and inefficient firms should be

typically expected to substantially decrease, or even be eliminated. Wages would be higher than under decentralized bargaining. As a result, aggregate production will be lower, the product price higher, and hence consumers' welfare lower. Second, unions' rents are always higher than if bargains were conducted at firm level alone. The (in)efficient firm's profits increase, whilst its rival's profits decrease, depending on whether the (in)efficient firm has the initiative to establish the extra level of wage bargains.

Third, the endogeneity of the level of wage bargains-institution induces a production shift towards the "right direction" (i.e. the efficient firm produces more), whenever the status quo wage differential favours the inefficient firm. If, on the contrary, it favours the efficient firm, we should expect a production shift towards the "wrong direction". Finally, turning to sectorial employment, we have clear negative effects only when production shifts to the "right direction". Recall that this occurs whenever the efficient firm pays higher status quo wage, due its technological superiority which is not offset by any bargaining power relative advantage. Then the higher wages implied by the emerging complete, or partial, bargaining centralization at the sectorial level, accompanied by the forementioned (labour saving) production shift, will naturally decrease aggregate employment. If nonetheless, production shifts to the "wrong direction" (labour augmenting), whilst the wage increase effect is not strong enough, aggregate employment may in fact increase.

6. Conclusions

In this paper we produce a framework of endogenous determination of the degree of centralization of firm-union wage bargains in oligopolistic industries. We show that economic factors, such as technological and bargaining power asymmetries, generate

various degrees of centralization. For instance, an all union-efficient firms majority coalition has the incentive to establish industry-level wage negotiations. In this case, if, for given bargaining powers, productivity differences are sufficiently high, firm-level wage negotiations are further conducted (partially decentralized bargaining). If, however, productivity differences are small, complete bargaining centralization emerges. Finally, if technological and bargaining power asymmetries cancel out (or being absent at first place), wage negotiations are conducted only at the firm level (decentralized bargaining).

Productivity asymmetries have been also shown to determine the extent of centralization of negotiations in a rather different context. Jun (1989) analyzes union formation decisions when a firm employs two groups of workers, a high- and a low-productivity group. Before entering in wage negotiations with the firm, workers decide to form a joint union or two separate unions. If productivity differences are small enough, a joint union is established, which then bargains with the firm about wage(s). Otherwise, two separate unions are formed, and then bargain simultaneously with the firm, each over its own wage.

There has, recently, been rising interest in studying the macroeconomic implications of the degree of centralization of wage bargaining, amongst other dimensions of labour market institutions (see e.g. Calmfors & Driffil (1988), Jackman *et al* (1990), Jimeno (1992)). In particular, since the degree of bargaining centralization significantly affects long-run unemployment and inflation rates, it is important to understand and analyze the conditions under which a certain degree of centralization emerges in a particular environment. Then policy measures can be designed with the purpose of abolishing existing inefficient institutions, and/or promoting the establishment of new more efficient ones. Our findings suggest that it is sufficient for a government to direct its

policies towards a small number of interested parties, which in turn, acting for their own benefit, will promote the socially desired bargaining institution. If, for instance, centralized bargaining is targeted, the government could simply subsidize the adoption of superior technology by a small number of firms. The latter will then become pivots in the formation of a majority coalition (including all unions) which will subsequently promote the establishment of this institution.

Our framework further predicts that sufficiently high unemployment benefits will eventually lead towards decentralization in wage bargains, whenever decision-making is entirely left to the interested parties. Normally, higher unemployment benefits induce a higher backup wage. Let, initially, wage negotiations be centralized, at the sectorial level. A high backup wage will shift production to the "right" direction (towards the efficient firm). As a consequence, the inefficient firm's union, fearing the marginalization of its own firm, will now become the pivotal voter restraining sectorial wage increases. Firm-level wage negotiations will then be further conducted, however only between the efficient firm and its own union. A partially decentralized wage bargaining system will thus be observed. Our prediction seems to be in line with recent evidence from Europe, displaying high unemployment rates accompanied with increasing decentralization on wage bargains (Jimeno (1992), De la Croix (1992)). As our analysis suggests, increasing decentralization may then be due to higher unemployment benefits which have been persistently risen in Europe during the last decades, and might have thus led to increased backup options for the unionized workers. Decreasing aggregate employment, on the other hand, might be due to the increased unemployment in the competitive sector, since there are ambiguous employment effects in the unionized sectors, as our framework predicts.

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