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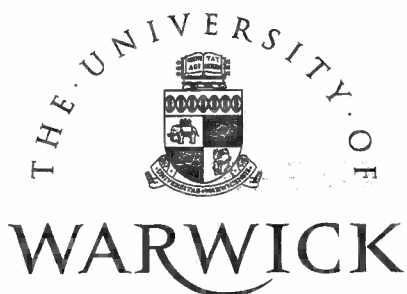
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ON CENTRALIZED BARGAINING IN A SYMMETRIC OLIGOPOLISTIC INDUSTRY

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On Centralized Bargaining in a Symmetric Oligopolistic Industry.

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Abstract

In this paper we study interactions between labor and product markets, in an imperfectly competitive industry with centralized wage bargaining. Firms jointly bargain with the union over wages and then compete in prices or quantities. We show that the bargained wage is independent of the number of firms, the degree of substitutability of firms' products, and the type of market competition, in a broad class of industry specifications, including the standard linear symmetric demand system - linear one factor technology one. These results are robust with respect to different specifications of union's objectives. Finally we propose, motivated by the above independence property, that the bargained wage in a Bertrand homogenous market be taken as the limit of the solution of the differentiated case as the degree of substitutability goes to one.

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1 Introduction:

> Unions are fundamentally organizations that seek to create or capture monopoly rents available in an industry. These rents could come from product market imperfections or from regulation of the industry.
>
> Ashenfelter,O. and Layard, R. (Handbook of Labor Economics, 1986)

Most of the existing literature on collective bargaining focuses on the impact of unionization of the labor market on different variables of economic performance e.g. profitability, employment, wage structure, productivity etc. An important issue they address is how different bargaining institutions affect these variables in different countries or industries within a country. In these studies the product market structure is typically assumed to be fixed. A complementary issue which arises in this context is the influence of product market parameters on the negotiated wage, employment and other variables of economic performance. Such market parameters are e.g. the industry concentration, the degree of product differentiation and the type of market competition. We develop here a theoretical model to analyze the effects of the product market specification on negotiated wages. We restrict attention to the case of industry-wide centralized bargaining.

In the empirical literature there is evidence of substantial wage differentials among industries that appear to be stable over time (Krueger and Summers (1988)). Layard *et al.* (1991) attribute this differential mainly to firm specific factors (like the size of firms in the industry, their productivity and profitability). This remains true when bargaining is centralized or product markets are competitive. Dickens & Katz (1987) detect some link between wages and industry concentration, which however is not robust to the inclusion of controls for labor quality. Rose (1987) reports that deregulation of the US trucking industry was accompanied by a significant reduction of wage differentials. On the other hand, deregulation of the airline industry in the US did not appear to be accompanied by significant wage reductions

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(Card (1989)). The evidence as it stands seems therefore to be rather inconclusive on the link between product market specification and wages. We intend, as a first step, to explore this link by means of a theoretical model.

In particular, this paper analyzes interactions between labor and product markets, in an n-firm oligopolistic industry with centralized wage bargaining. In the first stage firms jointly bargain with the union over wages, thereafter each firm chooses it's employment level (Right-to-Manage Model, Nickel 1982) and finally they compete in prices or in quantities in the product market. Firms are endowed with identical log-linear one factor (labor) technology. The union's welfare depends both on wages and aggregate employment and is assumed to be log-linear in employment. This subsumes a large class of union objectives used in the literature[1]. A specific type of differentiated industry is introduced to capture the effects of product substitutability on negotiated wage. We derive the negotiated wage as the solution of the Nash Bargaining problem where the maximand for the firms is the joint subgame perfect profits as a function of wage, and the maximand for unions is the utility as a function of wages, given the level of employment chosen by firms in a subgame perfect equilibrium.

There is a popular conception[2] of unions as entities that attempt to extract rents from firms. If this view were correct one would expect to see higher wages, cet.par, when markets are "more" imperfect in the sense of a smaller number of firms or with more differentiated products. Is this in fact true? We show that, contrary to this intuition, the bargained wage is independent of the number of firms, the degree of substitutability of firms' products, and the type of market competition, in a broad class of industry specifications, including the standard linear symmetric demand system - linear one factor technology one. These results are robust with respect to different specifications of union's objectives.

The use of the Nash solution poses a problem for the case of Bertrand competition with homogenous goods since then the Nash product is not well defined, profits for the firms being 0 in this case. Using the independence property discussed above, we propose that the bargained wage in a Bertrand homogenous market be taken as the limit of the solution of the differentiated

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[1] E.g. Total Excess Revenue, Oswald (1982), Median Member Welfare, Booth(1984).

[2] E.g. see quote at the beginning of the introduction. See also Layard, R., Nickell, S., and Jackman, R.(1991) page 189.

case as the degree of substitutability goes to one.

The organization of the paper is as follows: Section 2 presents the model and the main result, Section 3 provides two applications of the result to different market structures. Section 4 demonstrates the robustness of the result to different union objectives and provides an example to show the necessity of the assumptions. In section 5 we propose our solution for the Bertrand homogenous goods case, and provide an illustration of it. Finally we conclude in Section 6.

2 The Model:

There are n firms, all of which have identical log-linear one factor (labor) technologies:

$$x_i(l_i) = (A.l_i)^{\frac{1}{B}} \qquad i = 1, \dots, n \tag{1}$$

$$A > 0, \quad B \geq 1$$

where x_i is firm i's output and l_i is the labor used by firm i. The n firms and the union collectively bargain over the wage w, following which each firm chooses it's employment level (Right-to-Manage Model, Nickell (1982)) .

The union's welfare depends on wages and aggregate employment, L. and is assumed to be of the form:

$$U(w, L) = u(w).L^k \tag{2}$$

where $k \in \Re_+$ measures the relative importance given to employment. This kind of union objective subsumes a large variety of functions used in the literature (see Section 4).

We use , as in the literature on wage bargaining (see e.g. Nickell, 1982), an asymmetric version of the Nash Bargaining solution where a parameter b represents the exogenously specified bargaining power of the union. In the limit as $b \rightarrow 1$, the union will unilaterally set the wage and vice versa as $b \rightarrow 0$. The disagreement point is given by $(0, r)$ i.e. the firms make 0 profits and the union gets a reference level of revenue, r, where e.g. r could be interpreted as:

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$$r = [p.w^* + (1-p)d].L$$

Here p represents the probability of being employed, w^* represents the competitive wage, d represents the unemployment benefits. Thus, in this framework a symmetric Nash bargain solves:

$$Max._w \{U(w, L)\Pi^*(w)\}$$

where the level of employment is decided by firms, as in the Right-to-Manage model and $\Pi^*(w)$ represents aggregate "indirect profits". This is the Nash solution subject to the constraint that bargains are on the firms labour demand curves, and firms are interested in their "indirect profits" as a function of wages.

Proposition 1: The Independence Property:

Let there be n identical firms, with log-linear one factor technology, bargaining with a union. If each firm's "indirect profit" function and the (optimal) output function[3] are multiplicatively separable (m-separable) in wages and a list of parameters K, and if the union's objective function is m-separable in wages and in employment and is log-linear in employment, then the negotiated wage that emerges from the centralised Nash bargaining between firms and union is independent of the list of parameters K and the number of firms, n.

Proof:
Let the firms "indirect profits" be represented as:

$$\pi^*(w, K) = \Psi(w).\Phi(K) \tag{3}$$

and let the (optimal) output function be given by:

$$x^*(w, K) = \psi(w)\phi(K)$$

while the unions objective function is represented as:

$$U(w, L) = u(w).L^k \tag{4}$$

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[3] We make the standard assumptions to ensure that these functions are differentiable.

for any $k \in \Re_+$

The generalised Nash solution is then given by

$$Max._w(U(w, L(w, K)))^b(n.\pi^*(w, K))^{1-b} \qquad (5)$$

where $\pi^*(w)$ represents the maximised profits (induced by the equilibrium choice of output/prices) of the each firm under the given market structure, as a function of the wage rate announced in the first stage, and $L(w, K)$ represents the profit maximising choice of labour induced by the output/price choice of the firms as a function of wages and the parameters K. Since there are n identical firms we can write $L(w, K) = nl^*(w, K)$ where l^* represents the employment of a firm given the optimal continuation of the game.

The solution of equation (5) is equivalent to the solution of:

$$Max._w b \left[\ln u(w) + k \ln n + kB \ln x^*(w, K) - k \ln A\right] + (1-b) \ln n + (1-b) \ln \pi^*(w)$$

Substituting for $\pi^*(w, K)$ and $x^*(w, K)$, the First Order Conditions of this problem (assuming second order conditions are satisfied), are the following:

$$\frac{b}{u(w)}.u'(w) + \frac{b}{x^*}.k.\frac{\partial x^*}{\partial w} + (1-b).\frac{\Psi'(w)}{\Psi(w)} = 0 \qquad (6)$$

using here that:

$$l^*(w, K) = \frac{(x^*(w, K))^B}{A} = \frac{(\psi(w)\phi(K))^B}{A}$$

Substituting this in equation (6) above we have:

$$\frac{b}{U(w)}.U'(w) + \frac{Bb}{\psi(w)}.k\psi'(w). + (1-b).\frac{\Psi'(w)}{\Psi(w)} = 0 \qquad (7)$$

Clearly, therefore, the solution of this equation for w does not depend on K.

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The intuition behind this result is as follows: the Nash bargaining solution requires that the negotiated wage be such that the percentage decrease in firms' profits due to an increase in the wage, weighted by the firms' bargaining power, is equal to the percentage increase in union's welfare, weighted by

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it's bargaining power . Given the form of union's utility (4), the latter can be decomposed into the percentage increase of wage-related welfare, $u(w)$, and the percentage decrease of employment-related welfare, L^k . Clearly, the percentage increase of wage-related union welfare is independent of the number of firms and the parameters, K. On the other hand our separability assumption ensures that the percentage decrease in aggregate profits, $n\pi^*(w, K)$, and the percentage decrease of employment-related union's welfare, $(nl^*(w, K))^k = \left(\frac{n(x^*(w,K))^B}{B}\right)^k$, are again independent of n and K. This in turn implies that the negotiated wage does not depend on the number of firms or the list of parameters, K.

A natural question that arises here is what types of economies would satisfy the assumptions of our model and what are the parameters included in the list K. In the next section we show that linear demand-linear technology economies where firms compete in prices or in quantities in the product market, is an interesting class of economies that do satisfy our assumptions .

3   Linear Demand-Linear Technology Economies

In this section we illustrate the kinds of economies which satisfy the assumptions of our model. In addition we show that in these economies, the negotiated wage is independent of the *type of competition*. There are n identical firms in the market each endowed with a linear one factor technology which is given by (1) with $B = 1$. Firms face a symmetric linear demand system, which is a generalization of Dixit (1979) :

$$P_i(x_i, x_{-i}) = a - x_i - \gamma x_{-i} \qquad x_{-i} = \Sigma_{j \neq i} x_j \quad i = 1, ..., n \qquad (8)$$

In fact these are the demand functions of a representative consumer whose utility depends on consumption of goods $x = (x_1, x_2, ..., x_n)$ and the numeraire good m. It is given by $W(x) + m$[4] with:

$$W(x) = a\left(\sum_i x_i\right) - \frac{\left(\sum_i x_i^2 + 2\gamma \sum_{i \neq j} x_i x_j\right)}{2}$$

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[4]Note that this utility function subsumes a preference for variety. It is decreasing in γ and increasing in the number of product varieties.

where γ represents the degree of substitutability between any pair of goods i and j. The higher the γ the higher is this degree of substitutability between i and j. When γ tends to zero, each firm virtually becomes a monopolist; when γ tends to one, all goods are almost perfect substitutes.

The unions objective function is as before:

$$Max._w \quad u(w).(L)^k \tag{9}$$

As the following proposition shows, the negotiated wage in these economies satisfies the Independence property.

Proposition 2: *Let there be n identical firms, with linear one factor (labor) technology, bargaining with a union. If firms face linear (symmetric) demand functions as in (8), and if the union's objective function is m-separable in wages and in employment and is log-linear in employment, then the negotiated wage that emerges from the centralised Nash bargaining between firms and union is independent of the degree of product differentiation, γ, the number of firms, n and also of whether firms compete in prices or quantities*[5].

3.1   Cournot Competition:

We solve for the subgame perfect negotiated wage. In the last stage therefore, each firm solves the problem:

$$Max._{x_i}(a - x_i - \gamma x_{-i})x_i - \frac{w}{A}x_i \tag{10}$$

The First Order conditions then give:

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[5]Note that the type of market competition may be viewed as a market parameter, α, according to the Conjectural Variations approach (Bowley (1924)). In Cournot Competition a firm i perceives its rivals' outputs to be unaffected by changes in its own output. In Bertrand Competition, i conjectures that, in response to a change in its own output, its rivals will adjust their outputs in a compensatory way to leave their market prices unchanged. These two types of conjectures can be represented by a linear expectation function: $\Delta x_j^e = \alpha \Delta x_i, \quad j \neq i, \quad j = 1,...,n$. Then, for example, $\alpha = 0$, corresponds to Cournot Competition while $\alpha = \frac{-1}{n-1}$ corresponds to Bertrand Competition with homogenous goods. The differentiated Bertrand case, as well as the collusive (joint profit maximization) case can be accomodated by choosing appropriate values of α. In fact, it can be shown that our results hold for a wide spectrum of values of α.

$$a - 2x_i - \gamma x_{-i} = \frac{w}{A} \tag{11}$$

And the symmetric equilibrium :

$$x^*(w) = \frac{a - \frac{w}{A}}{2 + \gamma(n-1)} \tag{12}$$

$$l^*(w) = \frac{x^*(w)}{A} \tag{13}$$

and

$$\pi^*(w) = [x^*(w)]^2 = \frac{(a - \frac{w}{A})^2}{(2 + \gamma(n-1))^2} \tag{14}$$

Observe that both the optimal output and "indirect" profits are inversely related to the degree of differentiation, γ and to the number of firms, n[6]. Note too, that the optimal output and profits satisfy the assumptions of our model, i.e. they are m-separable in wages and the list of parameters (γ, n). The centralised wage bargaining, using the Nash solution. solves:

$$Max._w (n\pi^*(w))^{1-b}(u(w)(L(w, K))^k)^b \tag{15}$$

where b is the (exogenously given) index of bargaining power.
This maximisation is equivalent to:

$Max._w \quad 2(1-b)\ln x^*(w) + b\ln u(w) + bk\ln x^*(w) + bk\ln n - bk\ln A$

which gives the first order conditions:

$$\frac{2(1-b)}{x^*(w)} \cdot \frac{\partial x^*(w)}{\partial w} + \frac{b}{u(w)} \cdot u'(w) + \frac{bk}{x^*(w)} \cdot \frac{\partial x^*(w)}{\partial w} = 0 \tag{16}$$

or

$$-\frac{2(1-b) - bk}{aA - w} \cdot + \frac{b}{u(w)} \cdot u'(w) = 0$$

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[6]As γ decreases (or n increases), the size of all markets expands due to the representative consumer's preference for variety. Further, as γ decreases, the intensity of competition decreases. As a result the output and indirect profits per firm increase with γ. On the other hand, an increase in n implies a stronger competition and the latter effect dominates the market size effect, thus leading to lower per firm output and profits.

The solution of this implicit equation gives a wage that is independent of the number of firms and of the parameter of differentiation, γ. To illustrate, consider $u(w) = w - w_0$, where w_0 may be interpreted as the best alternative wage. This gives the first order conditions:

$$\frac{2 + b(k-2)}{aA - w} = \frac{b}{w - w_0} \tag{17}$$

or

$$w^* = \frac{aAb + (2 + b(k-2))w_0}{2 + b(k-1)} \tag{18}$$

That the wage coincides with the negotiated wage in the homogenous n-firm market is obvious. Hence it is independent of the parameter of differentiation, γ.

$\diamondsuit$

3.2 Bertrand Competition:

Given the system of equations(n equations):

$$P_i = a - x_i - \gamma\Sigma_{j\neq i}x_j \tag{19}$$

the inverse demand function under differentiated Bertrand competition is derived as:

$$x_i(P_i, \Sigma_{j\neq i}P_j) =$$

$$\frac{1}{(1 + \gamma(n-1))(1-\gamma)}\left\{a(1-\gamma) - (1 + \gamma(n-2))P_i + \gamma\Sigma_{j\neq i}P_j\right\} \tag{20}$$

for $i = 1, 2, ..., n$

Thus, given the wage rate, each firm solves:

$$Max._{P_i}(P_i - \frac{w}{A})x_i(P_i, \Sigma_{j\neq i}P_j)$$

which gives the following first order conditions:

$$a(1-\gamma) - (1 + \gamma(n-2))P_i + \gamma\Sigma_{j\neq i}P_j = (P_i - \frac{w}{A})(1 + \gamma(n-2)) \tag{21}$$

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Thus the symmetric equilibrium where $P_1^* = P_2^* = ... = P_n^* = P^*$ is given by:

$$P^* = \frac{a(1-\gamma) + (1+\gamma(n-2))\frac{w}{A}}{2+\gamma(n-3)} \quad (22)$$

And:

$$x^*(w) = \frac{(a-\frac{w}{A})(1+\gamma(n-2))}{(1+\gamma(n-1))(2+\gamma(n-3))} \quad (23)$$

and

$$\pi^*(w) = \frac{(a-\frac{w}{A})^2(1+\gamma(n-2))(1-\gamma)}{(2+\gamma(n-3))^2(1+\gamma(n-1))} \quad (24)$$

or

$$\pi^*(w) = \frac{(x^*(w))^2(1+\gamma(n-1))(1-\gamma)}{(1+\gamma(n-2))} \quad (25)$$

Again, note that both output and indirect profits are decreasing in γ and in n[7]. Note too that this function satisfies the separability properties specified in proposition 1. Using this profit function in the maximand given by (number of equation), we have :

$Max._w \quad 2(1-b)\ln x^*(w)+(1-b)\ln \frac{(1-\gamma)(1+\gamma(n-1))}{1+\gamma(n-2)} +b\ln u(w)+kb\ln x^*(w)-kb\ln A + kb\ln n$

The first order conditions give:

$$-\frac{2(1-b)}{aA-w} + \frac{b}{u(w)}.u'(w) - \frac{kb}{aA-w} = 0$$

or

$$\frac{2+b(k-2)}{aA-w} = \frac{b}{U(w)}.U'(w)$$

which is an implicit equation in w that is independent of the number of firms and the degree of differentiation γ. Again, if e.g. $u(w) = w - w_0$, then we have:

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[7]A similar argument holds as in the Cournot case. See previous footnote

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$$w^* = \frac{Aab + (2 + b(k-2))w_0}{2 + b(k-1)} \qquad (26)$$

The wage is independent of the number of firms and of the parameter of differentiation. Moreover, in the specific case of linear demand, the bargained wages under Cournot and Bertrand competition also coincide.

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3.3 Discussion of our Result.

If we were to use the logic of the quote at the beginning of the introduction of this paper, we would be lead to expect that the higher the surplus that an industry has, the higher should be the bargained wage. If firms' profits are directly related to the degree of product differentiation or the degree of industry concentration or the type of competition, why do we get this (independence) result? Using the reasoning developed in the previous section, we need to show why e.g. a monopolist would have the same percentage decreases in output and profits as a result of an increase in bargained wage compared with those of a single firm in an (almost) homogenous good (Cournot or Bertrand) industry.

Let us consider the Cournot case first. An increase in wage has two effects on the output of a firm. The resulting increase in the marginal cost leads each firm to decrease it's output. This is the negative direct effect on ouput. However, there is a compensating strategic effect, i.e. each firm will increase it's output in response to the other firms' decreasing their outputs. This compensating effect is bigger, hence the total effect is smaller, the higher is n and the higher is γ since competition becomes stronger. As we observed earlier these are also the cases where the per firm outputs are lower. Hence the percentage decrease in per firm output remains invariant to these parameters.

A similar property can be shown to hold for per firm indirect profits. Thus when γ is zero e.g. (the monopolist) the size of the strategic effect is small thus causing a large decrease in profits, while when γ is one, the size of this effect is large enough to offset the direct effect, so that there is a small change in profits. The same explanation goes through for n as well. viewing a large n as having a similar effect as a high γ. Comparing firms in the Bertrand game with those in the Cournot game, first observe that profits and market share

is larger under Cournot than Bertrand. We need to explain why we expect the impact of an increase in wages to be bigger in the Cournot case than in the Bertrand case, in order to show that both result in the same percentage decrease in profits. We distinguish, as before, between the "direct" effect of this increase in wages which is negative, and the "indirect" effect, which is positive. Thus an increase in the negotiated wage in the Bertrand case results in higher prices due to the direct effect, causing lower sales but the strategic effect results in firms being able to increase sales due to the increase in competitors' prices. Similarly, in the Cournot case, the direct effect of the wage increase results in lower output but the indirect or strategic effect results in increased profits. The crucial distinction between the two cases lies in the reaction functions characterizing the two types of competition. While (symmetric) firms in Bertrand competition react with a matching increase in prices, those under Cournot competition will react much less to the lowering of other firms' outputs. This means that the strategic effect is likely to be much smaller in the Cournot case than under the Bertrand case. The net change in profits is therefore small while in the Cournot case the strategic effect is smaller, hence the net effect is larger.

4 Different Union Objectives & the Necessity of the assumptions:

In this section we illustrate a variety of different objective functions of the union used in the literature which fit our specifications . These are considered below:

- The unions objective coincides with the welfare of its median member (Booth, 1984 and Grossman, 1983). Let $u(w)$ be the utility of the median member from w. Let $u(w_0)$ be the utility from some reference wage w_0 which can be interpreted as unemployment benefits or the wage from some inferior alternative employment. Let M be the number of members in the union. Then the median member expects to find a job with probability $\frac{nl^*}{M}$. Thus, his expected utility is:

$$U(w, nl^*) = \frac{nl^*}{M}u(w) + (1 - \frac{nl^*}{M})u(w_0) \qquad (27)$$

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or,

$$U(w, nl^*) = \frac{nl^*}{M}(u(w) - u(w_0)) + u(w_0)$$

This objective function is separable in the sense of equation (5). The only difference now is the addition of a constant term $u(w_0)$. Carrying out the Maximization exercise (6) yields the first order conditions:

$$\frac{2 - b}{aA - w} = \frac{bu'(w)}{u(w) - u(w_0)} \tag{28}$$

But the solution of equation (29) for w does not depend on the degree of differentiation, γ, the number of firms, n or the type of competition.

- Second, an obvious generalisation of the members total excess revenue is to assume that the union maximizes the members total excess utility. This is the utilitarian union objective function that has been used by Oswald (1982) with identical workers. In this case all members are assumed to be identical and have a utility of wage $u(w)$ and $u(w_0)$ for the best alternative wage, then the unions objective function is :

$$Max.U(l^*, w) = l^*(u(w) - u(w_0)) \tag{29}$$

it is easily checked that this specification gives us the same results, since in this case the assumptions of our Proposition 1 are still satisfied.

- Finally, consider another general form of the union objective function that has been used as the foundation for some empirical work (Dertouzos and Pencavel, (1981) and Pencavel (1984)), a modified version of a Stone Geary Utility function :

$$U(w, l) = \alpha(w - w_0)^m (nl^* - L_0)^\beta \tag{30}$$

Then, if alternative employment, L_0 is normalised to 0, not surprisingly, the independence properties of the negotiated wage still hold.

4.1 An Example to show the necessity of the assumptions:

Consider an objective function of the union which does not satisfy the assumptions of our model:

$$U(w, L(w, K)) = w.L(1 + \frac{L}{2})$$

Using this in the bargaining problem for the Bertrand differentiated goods case we have:

$$Max._w((x^*(w))^2 X(\gamma))^{1-b}(w.L(1 + \frac{L}{2}))^b$$

this is equivalent to maximizing:

$$(1-b)(2 \ln x^*(w) + \ln X(\gamma) + b(\ln w + \ln x^*(w) + \ln n - \ln A + \ln(1 + \frac{nx^*(w)}{A}))$$

where $X(\gamma) = \frac{1+\gamma(n-2)}{(1+\gamma(n-1))(2+\gamma(n-3))}$
This problem gives the first order conditions:

$$-\frac{(2-b)}{aA - w} + \frac{b}{w} = \frac{nbX}{2A^2 + nX(aA - w)} \tag{31}$$

Clearly, the solution of this equation depends on the parameters of the market specification.

5 A proposed Solution:

The Nash solution in the case of Bertrand competition with homogenous goods presents an obvious difficulty, since the profits of the firms are always 0, regardless of the wage rate, so that the Nash product is not well defined. We use the results of the previous section, to propose here, that it seems reasonable that the bargaining solution in the case of Bertrand competition, homogenous goods case, should be the limit of the solution with differentiated goods as the parameter of differentiation, γ, goes to 1. In the variety of combinations (of union objectives and market structures) we considered,

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and under our assumptions of linear technology and linear symmetric demand functions, we found that the negotiated wage was independent of the parameter of differentiation, so that the solution for differentiated and homogenous goods would coincide given our proposed solution concept. We illustrate now an our proposed solution with the example of Section 4 where the negotiated wage is not independent of the degree of differentiation: consider equation (31) for the case $n = 2$:

$$-\frac{(2-b)}{aA-w} + \frac{b}{w} = \frac{2b}{2A^2(1+\gamma)(2-\gamma)+2(aA-w)}$$

The solution of this function , $w(\gamma)$, is continuous in γ, hence we can use the limit of the solution as $\gamma \longrightarrow 1$, as the solution of the case of homogenous goods and Bertrand competition.

6 Conclusion:

In this paper we provide sufficient conditions under which the wage that emerges out of centralized bargaining between a union and the firms in an industry is independent of a number of market parameters. Indeed, we show that in an oligopolistic product market where identical firms face symmetric linear demand functions for their differentiated goods, and are endowed with linear one-factor (labor) technology, the negotiated wage is independent of the industry concentration, the degree of product differentiation and the intensity of market competition. Moreover, this property is robust to a broad class of union objectives.

It is well-known that the negotiated wage in a Bertrand homogenous goods market with identical firms and constant marginal costs is indeterminate, profits for the firms being 0 for any wage level. We propose in this paper that a reasonable way to solve this indeterminacy is that the negotiated wage of the homogenous market be the limit of the wage in the differentiated case as the degree of substitutability goes to one. The independence property discussed above then implies that the negotiated wage in the homogenous Bertrand market coincides with that of the differentiated market, if the firms, in addition, face linear symmetric demands.

The Dixit-Stiglitz (1977) monopolistic competition model has been used extensively in the literature (Macroeconomics, International Trade and Growth)

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to capture the effects of imperfectly competitive markets. While this model performs well when the number of firms in the industry is large (e.g. when entry costs are low and goods are poor substitutes), it does not capture the strategic effects in a concentrated industry. Indeed it ignores the price index effect of individual pricing decisions. The Yang and Heijdra (1993) variant solves this problem but loses much of the simplicity of the original. In contrast, the symmetric linear demands-one-factor (labor) technology oligopolistic product market model takes into account all strategic effects. Moreover if the wage bargaining is centralized this model retains the simplicity of the Dixit-Stiglitz (DS) model. We suggest therefore that it may be a reasonable alternative to the DS model.

We have provided in the paper sufficient conditions for the independence property to hold in the context of linear one-factor technology, and identical firms. What alternative specifications of demand systems give rise to multiplicatively-separable "indirect" profit functions? Does the negotiated wage remain independent of the market parameters if the technology is non-linear (e.g. Cobb-Douglas) or firms are not identical? These questions remain open for further research.

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