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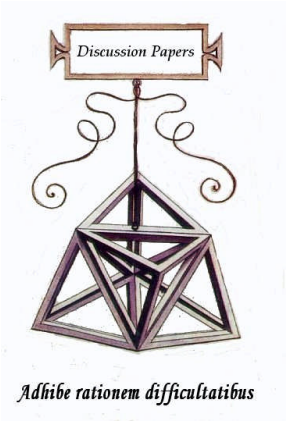

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When an efficient bargaining is more “efficient” than a competitive labour market

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When an efficient bargaining is more "efficient" than a competitive labour market

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Abstract We consider a unionised duopoly with efficient bargaining at the firm level (i.e. negotiations both on wage and employment). We show that if the target of unions is the total wage bill, then, as expected, consumer surplus and social welfare are the same of when the labour market is "competitive", that is the efficient bargaining institution preserves "efficiency". By contrast, if the trade union is wage (employment) oriented (or, according to an alternative interpretation, unionised workers are risk-averse (risk-neutral)) then both the consumers and social welfare are lower (higher) than those under competitive labour market. The interesting conclusion is that if unions are more employment-oriented (workers are risk-averse) then unionisation is preferred to a "competitive" labour market by consumers and by society as a whole.

Keywords: Efficient bargaining; Monopoly union; Right-to-manage; Cournot duopoly

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1. Introduction

In the recent decades many economic turbulences have also affected the preferences of workers and of their unions, in particular as regards the orientation towards the trade-off between wages and employment.[1] While the perception of such a trade-off is crucial in the recent literature on individual search models (e.g. Stigler, 1962), less attention has been paid to the role played by the trade-off in a unionised labour market on the goods market equilibrium and social welfare in a partial equilibrium context.

Assume that labourers form firm-specific unions, negotiating on wage and employment (efficient bargaining, EB). Is such a labour market institution effective to "restore" the social welfare obtained in the absence of unions? May consumers and society have larger welfare under the EB institution than under labour market competition? Building on the standard unionised Cournot duopoly approach, we compare the equilibrium outcomes when labour markets are unionised or not and we find that: 1) while when the target of unions is the total wage bill, then, as expected, the efficient bargaining institution preserves "efficiency" in the sense that consumer surplus and social welfare are the same of when the labour market is "competitive", 2) if the trade union is fairly wage- (employment-) oriented (or, according to an alternative interpretation, unionised workers are risk-averse (risk-neutral)) then the employment (i.e. output) is lower (higher) than that "efficient" and thus both the consumers and social welfare are lower (higher) than those under "competitive" labour markets.

Our paper contributes to the growing literature on unionised oligopoly (e.g., Horn and Wolinsky, 1988; Dowrick 1989; Bughin, 1995; Correa-López and Naylor, 2004; Fanti and Meccheri, 2011), showing a novel result as regards the positive relationship between unionisation, on the one side, and employment, consumer's welfare and total welfare of society, on the other side.

The economic intuition behind this result is as follows: when the employment is negotiated, if the unions have preferences even slightly oriented towards employment, then they are able to negotiate a level of employment (i.e. output) higher than that implied by the production chosen by firms competing in the output market in the absence of unions. This means that quantities (price) are higher (lower), thus improving the welfare of consumers with respect to the case with "competitive" labour market. Moreover, the orientation towards employment causes a reduction in wages such that also profits are higher, but also the employment is higher than in the "efficient" situation. Therefore, as regards welfare of unionised workers, we find that despite the wage reduction, there is an increase in employment which more than counterbalances the reduction in wages, thus implying a higher union's utility as well. As a consequence also the social welfare is higher than in the case of "competitive" labour markets.

The paper is organised as follows. The duopoly model with efficient bargaining is presented first. Then the implication both of the power and the preferences of unions on the product market and partial equilibrium social welfare are

[1] For instance, many works are converging in finding a rise in the employment risk in the recent decades, with the obvious effect on the workers' risk-aversion: e.g. Bernhardt et al. (1999), Farber (2001) and Valletta (1999) found a decline in employment stability (i.e. an increase in employment insecurity) from the 1960s and 1970s through the 1980s and 1990s, during the 1980s and 1990s, and between 1976 and 1992, respectively.

investigated, also discussing the results in comparison with the duopoly without unions. A final section concludes.

2. The model

We consider a normalised duopolistic Cournot market for a single homogenous product, with inverse demand given by

$$p = 1 - Q,^{2} \quad (1)$$

where p denotes price and Q is the sum of the output levels q_1 and q_2 of the two firms.

We assume that both firms produce through the following production function with constant (marginal) returns to labour:

$$q_i = L_i \quad (2)$$

where L_i represents the labour force employed by firm i.[3] The ith firm faces an average and marginal cost $w_i \geq 0$ for every unit of output produced, where w_i is the wage per unit of labour. Therefore, the firm i's cost function is linear and described by:

$$C_i(q_i) = w_i L_i = w_i q_i . \quad (3)$$

For each firm, the cost of producing one unit equals $w_i<1$. Π_i denotes the profits of the i-th firm, as it follows:

$$\Pi_i = (1 - w_i - Q)q_i \quad (4)$$

As is known, one typical model of the trade-union economics (Booth, 1995) is the efficient bargaining model (EB) (McDonald and Solow, 1981, Ashenfelter and Brown, 1986; Alogoskoufis and Manning, 1991) which prescribes that the union and the firm are bargaining over both wages and employment (or, more realistically, hours of work).[4] McDonald and Solow (1981), showing that the widespread model of monopoly union is not Pareto efficient, suggested the alternative EB model in which the firm and union negotiate to an outcome in which neither party could be made better off without making the other worse off. In such a model the allocation of labour will occur only when the iso-profit and union indifference curves are tangent to each other, so determining the Pareto efficiency of the allocation; in order to establish the point of equilibrium along with the curve defining the locus of all the Pareto-efficient wage-employment combinations, (i.e. the so-called contract curve) the literature has mainly popularised the asymmetric Nash bargaining solution (i.e. Pencavel 1991). The normative implication of the EB model is that it is socially efficient or at least less inefficient of the monopoly union model.[5]

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[2] Note that the standard inverse demand model $p' = a - dQ'$ can be transformed into this normalised model using $p = p'/a$ and $Q = (d/a)Q'$.

[3] As noted by Petrakis and Vlassis (2000, p. 265) this assumption "is equivalent to a two-factor Leontief technology in which the amount of capital is fixed in the short run and is large enough not to induce zero marginal product of labor."

[4] Although it may not be easy to specify the level of employment in realistic contracts, it is usually retained that "collective bargaining does often cover issues which may proxy for employment, such as crew size, manning rules, and seniority wage structures... McDonald and Solow (1981) suggest that, if it is not practical to specify the level of employment in a contract, manning agreements and featherbedding" may allow for an approximation of the efficient outcome. (Lawson, 2010, p.7).

[5] "If the Monopoly Union model is correct, employment in unionised firms will be inefficiently low and wages will be too high; in a simple efficiency analysis, unions would be socially inefficient

We assume that each decentralised union has preferences represented by the following utility function, which is an example of a Stone-Geary utility function very usual in the literature on trade-unions, i.e., Pencavel (1984, 1985), Dowrick and Spencer (1994), and Petrakis and Vlassis (2000):

$$V = \left(w - w^{\circ}\right)^{\theta} L \,, \tag{5}$$

where w° is the reservation or competitive wage. A value of $\theta = 1$ gives the rent-maximising case (i.e., the union seeks to maximise the total rent). Moreover, the unions aims to maximise the wage bill when $w^{\circ} = 0$. For simplicity, from now on we set $w^{\circ} = 0$. In particular, θ is a preference parameter that captures the union's relative intensity between the two targets (i.e. wages versus employment): values of θ smaller (higher) than 1 imply that the union is less (more) concerned about wages and more (less) concerned about jobs (see, e.g., Mezzetti and Dinopoulos, 1991; Zhao, 2001; Fanti and Gori, 2011).

From the empirical point of view various works suggest that unions' preferences are relatively employment-oriented.[6]

Moreover, following for instance Oswald (1982), Pencavel (1991), Booth (1995) and Petrakis and Vlassis (2000), there is an alternative interesting interpretation of the meaning of the parameter θ : it can be thought of as the representative unionised workers' relative rate of risk aversion, according to which if $\theta=1$ the worker is risk-neutral and if $0<\theta<1$ she is risk-averse.[7]

We assume that unions are identical and with same bargaining power during the negotiations with their firms. Under efficient-bargaining, firm's manager – union bargaining unit i selects w_i and L_i , or equivalently q_i , to maximise the following generalized Nash product,[8]

$$\max_{w.r.t.\ w_i, q_i} N_i = \left(\Pi_i\right)^{1-b} \left(V_i\right)^{b} = \left[(1 - w_i - Q)q_i\right]^{1-b} \left(w_i^{\theta} q_i\right)^{b} \tag{6},$$

where b represents the bargaining power of the labour unions.

From the system of first-order conditions of the efficient bargaining game between firms and unions, the reaction functions of firms 1 and 2 as well as of unions 1 and 2 are the following:

$$q_1\left(q_2, w_1\right) = \frac{1}{2-b}\left[1 - w_1 - q_2\right], \tag{7.1}$$

$$q_2\left(q_1, w_2\right) = \frac{1}{2-b}\left[1 - w_2 - q_1\right]. \tag{7.2}$$

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institutions and a weakening of union power would likely enhance social welfare (assuming that non-unionised labour markets are and would remain relatively competitive). If Efficient Bargaining is a better description of reality, these conclusions may not be true; if the contract curve is vertical, the employment level will be determined efficiently, and otherwise employment will either be too high or too low for social efficiency, but will likely be less socially inefficient than the Monopoly Union outcome." (Lawson, 2010, p. 8).

[6] As reported in Fanti and Gori (2011), for instance Dertouzos and Pencavel (1981) and Pencavel (1984) suggest an estimated value of θ included between zero and one. For the sake of precision it must be noted, however, that, for instance, recently Dumont et al. (2006) have produced estimates of the parameter that corresponds to θ in our model even higher than one. As discussed in the footnote 1 the recent increase in the employment insecurity has probably worked for increasing the risk-aversion of workers.

[7] By passing, we note that some anecdotic evidence suggests that workers are becoming more risk-averse because the recent deep economic crisis.

[8] For simplicity we let the reserve wage w°=0, without loss of generality.

$$w_1(q_1,q_2)=\frac{\left[-b\theta(q_1+q_2-1)\right]}{b(\theta-1)+1} \tag{7.3}$$

$$w_2(q_1,q_2)=\frac{\left[-b\theta(q_1+q_2-1)\right]}{b(\theta-1)+1} \tag{7.4}$$

From (7.1) and (7.2) we obtain output, respectively, by firm i, for given w_i , w_j (i, j=1,2):

$$q_i(w_i,w_j)=\frac{\left[(1-w_j)+(w_i-1)(2-b)\right]}{(c+2-b)(c+b-2)} \tag{8}$$

After substitution of eq. (8) in eqs. (7.3-7.4), we obtain

$$w_i(w_j)=\frac{b\theta\left[1+w_j-b\right]}{3+b^2(1-\theta)-2b(2-\theta)} \tag{9}$$

which defines the sub-game perfect best-reply function in wages of union–firm pair i . Solving the system composed by (9) and its counterpart for j, we obtain the sub-game perfect equilibrium wages, w_i and w_j :

$$w_i=w_j=w^*=\frac{b\theta}{3+b(\theta-1)} \tag{10}$$

By substituting (10) in (8) we obtain equilibrium output and price:

$$q_i=q_j=q^*=\frac{1}{3+b(\theta-1)} \tag{11}$$

$$p_1^*=p_2^*=p^*=\frac{b(\theta-1)+1}{3+b(\theta-1)} \tag{12}$$

Finally by substituting eqs. (11) and (12) in $\Pi_i=(1-w_i-Q)q_i$ we obtain equilibrium profits as follows:

$$\Pi_i=\Pi_j=\Pi^*=\frac{1-b}{\left[3+b(\theta-1)\right]^2} \tag{13}$$

Then, by using eqs. (10) and (11), the equilibrium union's utility is given by:

$$V_i=V_j=V^*=\frac{\left[2\left[3+b(\theta-1)\right]\right]\left[\frac{b\theta}{3+b(\theta-1)}\right]^{\theta}+4-2b}{\left[3+b(\theta-1)\right]^2} \tag{14}$$

Note that, while it is easy to see that, as expected, profits (union's utility) is always decreasing (increasing) when the union power, b, increases, the employment may be either increasing or decreasing with an increase in the strength of unions, depending on whether unions are more or less wage oriented, as shown by the following derivative:

$$\frac{\partial q^*}{\partial b}=\frac{1-\theta}{\left[3+b(\theta-1)\right]^2}\begin{matrix}>\\<\end{matrix}0 \Leftrightarrow \theta\begin{matrix}<\\>\end{matrix}1 \tag{15}$$

3. Welfare analysis

In this section we perform a welfare analysis of the present model with EB and compare the results with the "benchmark" model without unions.

3.1 Consumer's welfare

In equilibrium consumer's surplus ($CS^* = \frac{(q_1^* + q_2^*)^2}{2}$) is:

$$CS = \frac{(q_1^* + q_2^*)^2}{2} = \frac{2}{\left[3 + b(\theta - 1)\right]^2} \tag{16}$$

It follows that the consumer's surplus may be improved (worsened) by an increase of the union's power depending on whether unions are employment (wage) oriented.

3.2. Social welfare

Social welfare (SW) is defined as $SW^* = CS + 2\Pi^* + 2V^*$, and in equilibrium is given by:

$$SW^* = \frac{2\left[b(\theta - 1) + 3\left[\frac{b\theta}{3 + b(\theta - 1)}\right]^\theta + 4 - 2b\right.}{\left[3 + b(\theta - 1)\right]^2} \tag{17}$$

Knowing that the union power always increases union utility and reduce profits while it has an ambiguous effect on the consumer surplus, it is natural to ask which is the effect of union power on social welfare. Therefore the following result holds:

Result 1. *Social welfare is improved (worsened) by an increase in the union power depending on whether unions are employment (wage) oriented.*

Proof: the result straightforwardly follows from the following derivative:

$$\frac{\partial SW^*}{\partial b} = \frac{-2\left[b(\theta - 1) - 3\theta\right]\left[b(\theta - 1) + 3\left[\frac{b\theta}{3 + b(\theta - 1)}\right]^\theta - b\left[b(\theta - 1) + 1 - 4\theta\right]\right.}{b\left[3 + b(\theta - 1)\right]^3} \begin{matrix} > \\ < \end{matrix} 0 \Leftrightarrow \theta \begin{matrix} < \\ > \end{matrix} 1 \tag{18}$$

This result deserves a methodological comment. In the unionised oligopoly literature the addition of the unions' utilities to the definition of social welfare (e.g. Zhao, 2001; Correa-Lopez and Naylor, 2004) is usual. However, the quantitative weight of unions' utility in the social welfare function may depend on the specific form of the utility function to the extent that the same preferences might have a different weight depending on possible monotone transformations of the utility function (e.g. although $V = wL$ or $V = w^{0.5}L^{0.5}$ represent the same preferences relatively to wage and employment, their quantitative measure is different). Therefore in order to evaluate the robustness of our result, we have also considered in the definition of the social welfare the value of the total wage bill resulting from the choice of wages and employment under a utility function of

unions given by eq. (5) with $w^{\circ}=0$ (i.e. $V = w^{\theta} L$, which is, of course, different from the wage bill) rather than the value of the utility function (i.e. $V = w^{\theta} L$).[9]
To do so, we rewrite $SW^{*} = CS + 2\Pi^{*} + 2w^{*}q^{*}$, (i.e. $V^{*}=w^{*}q^{*}$), thus the social welfare becomes:

$$SW^{*} = \frac{2b(\theta - 1) + 4}{\left[3 + b(\theta - 1)\right]^{2}} \tag{19}$$

Hence it is easy to see, from the following derivative, that result 1 still holds:

$$\frac{\partial SW^{*}}{\partial b} = \frac{-2(\theta - 1)\left[b(\theta - 1) + 1\right]}{\left[3 + b(\theta - 1)\right]^{3}} \gtrless 0 \Leftrightarrow \theta \lessgtr 1 \tag{20}$$

Therefore we found that the result *1* holds irrespective of which definition of the welfare of the unionised workers is included in the social welfare.
Now are in position to answer to the following question: which effects on the efficient bargaining outcomes have the union's preferences?
Therefore, by comparing the equilibrium outcomes of the duopoly model in the various cases (i.e. the benchmark case with "competitive" labour market and the present model of efficient bargaining under different values of θ), displayed in the Table 1 below,[10] for three illustrative cases of the union's target, namely the total wage bill (θ=1) or a more employment (wage)-oriented target (i.e. θ=0.5 (θ=1.5)) under the usual assumption of an equal bargaining power between firms and unions (i.e. *b=0.5*), the following result is derived:

Result 2. *While the efficient bargaining institution in which the negotiating union has preference only on the total wage bill is socially "efficient" in the sense that output, price, consumer surplus and social welfare are those of the benchmark model with "competitive" labour market, when unions have preferences towards employment (wages) the consumer surplus and social welfare are higher (lower) than those of the benchmark model with "competitive" labour market. In this sense a unionised labour market with relatively employment-oriented unions is more "efficient" than a competitive labour market.*[11]

Moreover it is interesting to interpret this result at the light of the degree of risk-aversion of unionised workers: *i)* when workers are risk-neutral both unionisation with efficient bargaining and competitive labour market are "equally efficient"; *ii)*

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[9] In other words, in the alternative definition we have included in SW the wage bill wL, where w and L are given by eqs. (10) and (11) which are obtained under the utility function $V = w^{\theta} L$ rather than $V = wL$.

[10] Formally table 1 is obtained exploiting all the analytical outcomes of the paper, namely eqs. (10) -(20), which embody, as special cases, the case of duopoly without unions (letting *b=0*) and the case of wage bill maximising union's preferences (i.e. the case of risk-neutral labourers)(letting θ=*1*).

[11] This result is also interesting because the "efficiency" features of the efficient bargaining institutions are sometimes questioned, to the extent that for instance Petrakis and Vlassis (2000, p.262) argue that the bargain on wage and employment is improperly termed as "efficient" and this "can be misleading, since it does not always lead to Pareto superior outcomes even for the parties involved in the bargain. In particular, it is not always "efficient" (in that restricted sense) under decentralized firm-union bargaining in an oligopolistic industry. Of course, it is not efficient in a single industry, or in the macroeconomic context, when consumer surplus is also taken into account. Furthermore, even in terms of its unemployment implications, the role of efficient bargains is not clear."

when workers are risk-averse a unionised labour market with negotiations on both wage and employment brings upon a social welfare larger than if the labour market were competitive.

Therefore, the interesting implication is that the presence of unions negotiating on wage and employment (i.e. production) is welfare-preferred to the "efficient" labour market - where production (i.e. employment) is chosen by only firms - by consumers, workers and society, provided that unions have either preferences (even slightly) oriented towards employment or unionised labourers are (even slightly) risk-averse. We note that to the extent that either latter cases are empirically relevant, our findings may also have relevant policy implications (i.e. the formation of firm-specific unions as well as of a wage and employment bargaining agenda should be encouraged by policy).

Table 1. *A comparison of the equilibrium outcomes of the duopoly model for the illustrative case of b=0.5, for varying θ, and for the case without unions.*

Equilibrium outcomes	EB *(θ=1)*	EB *(θ=0.5)*	EB *(θ=1.5)*	Duopoly without unions
q^*	1/3	0.363636	0.307692	1/3
p^*	1/3	0.272727	0.384615	1/3
w^*	0.1666680	0.0909256	0.230769	0
Π^*	0.05555	0.0661157	0.0473372	0.1111
V^*	0.05555	0.10964	0.0341101	0
CS^*	0.2222	0.266462	0.189349	0.2222
SW^*	0.4444	0.615924	0.352243	0.4444

4. Concluding remarks

In this paper we considered a unionised duopoly with efficient bargaining (i.e. negotiations both on wage and employment), where the preference of unions may be less (more) concerned about wages and more (less) concerned about jobs (alternatively, workers may be either neutral or risk-averse).

We showed that if the target of unions is the maximal total wage bill, then, as expected, consumer surplus and social welfare are the same of when the labour market is "competitive", that is the efficient bargaining institution preserves "efficiency". By contrast, if unions are fairly employment (wage) oriented (or unionised workers are risk-averse (risk-neutral)) then both consumer's and social welfare are higher (lower) than those under "competitive" labour markets. The interesting conclusion is that if unions are more employment-oriented (workers are risk-averse) then both consumers and society benefit from (and thus policy should favour) unionisation rather than competition in labour markets.

Finally, we note that it remains to be seen whether our results are robust to changes in the model's assumptions: different, or more general, functional forms for costs and demand, firm and union heterogeneity, differentiated products and firm's behaviour different from the profit-maximising one (i.e. the managerial delegation model) seem to deserve future research.

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