Bargaining agenda in public and private monopoly.

Fanti, Luciano and Buccella, Domenico

University of Pisa, Kozminski University, Warsaw

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Luciano Fanti and Domenico Buccella[*]

Abstract: This paper analyses the choice of the bargaining agenda in a public/private unionised monopoly. Both the public and private monopolist always prefers the Right-To-Manage (RTM) to the Efficient Bargaining (EB) agenda. Private monopoly is socially preferred to the public one and conflict of interests on the preferred agenda arises between Government on one side and workers and consumers on the other side. In case of threat of market entry, the public (private) monopolist may strategically commit to RTM (EB) to deter entrance. If RTM is the ex-ante industry practice, a public incumbent company cannot use the EB agenda as a strategic tool to deter entry, while an incumbent private company can use it. An opposite result holds when EB is the established practice in the industry: the incumbent public company can use RTM to deter entry, while the incumbent private company cannot. The social welfare implications are analysed.

1. Introduction

The scope and the selection of the bargaining agenda take on a crucial role in labour-management relations and negotiations, both in the public and private sector of the economy. The course of actions defining the union-firm bargaining is essential both for the regulations in the labour market and the configuration of production activities in industries that can be characterized by the presence of private and public monopolies.

The paper aims to clarify some element of controversy in the labour-management relations and the negotiation process which are indispensable for the suitable working of labour and product markets, and the assessment of the consequences on social welfare. In particular, the paper concentrates on the following two aspects.

First, the present work investigates the effects of the adoption of different negotiation agendas (right-to-manage, RTM vs. efficient bargaining, EB) on firm profits, union

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[*] Luciano Fanti, Department of Economics and Management, University of Pisa, Via Cosimo Ridolfi, 10, I –56124 Pisa (PI), Italy. E-mail address: lfanti@ec.unipi.it; tel.: +39 050 22 16 369; fax: +39 050 22 16 384.

Domenico Buccella, Department of Economics, Kozminski University, Jagełłonska Street, 57/59 – 03301 – Warsaw, Poland. E-mail: buccella@kozminski.edu.pl; tel.: + 48 22 51 92 153

utility, consumer's surplus and overall social welfare, comparing private and public monopolies. Second, the work analyses the issue of entry in the public/private monopolised sector, with subsequent public/private provision of goods in the presence of unions, and the use of the bargaining agenda as a tool to prevent entry of a potential private/public competitor in the industry.

A previous literature focused on the investigation of whether the state-owned enterprises pay higher wages than identical privately-owned firms, and which are the long run effects of privatisation on wages and on the market equilibrium (De Fraja, 1993; Haskel and Szymanski, 1993; Bárcena-Ruiz and Garzón, 2009). More recently, Ishida and Matsushima (2009), Andaluz (2011) and Choi (2012) examined the effects of wage regulation for civil servants employed in the public sector and the issue of whether it is preferable Cournot o Bertrand competition in a mixed private-public duopoly when unions are present, respectively. However, none of these papers devotes the attention to the issue of the bargaining agenda in a public monopoly.

The reference framework of the present paper is a classic unionised monopoly. The issue of the bargaining agenda selection has been recently investigated by some works in a private oligopoly context, such as Bughin (1999), Buccella (2011) and Fanti (2014, 2015). Such papers focused on the strategic effects played by different bargaining arrangements on the oligopolistic competition by firms, and have shown mixed results. Very recently Fanti and Buccella (2015a,b) have investigated this issue in a context of a private monopolistic firm under the presence of managerial delegation and/or consumption externalities. These papers have shown that also in the private monopolistic context the choice of bargaining agenda is a relevant issue for the monopolist and the society.

Moreover, those authors concentrate also on the interconnections between entry and the bargaining agenda. Bughin (1999) investigates different market structures (duopoly vs. monopoly with threat of potential entry), and diverse entry modes and constraints on the negotiation agenda selection. That author suggests that, in a pure private unionized duopoly, the EB agenda is the industry equilibrium for each firm. Using a conjectural variation model, and in contrast to Bughin (1999), Buccella (2011) demonstrates that a conflict of interest among the negotiating parties arises as regards the agenda. In particular, when the duopoly is the given market structure, RTM is the firms' dominant strategy while EB is the unions' dominant strategy. Nevertheless, in a monopoly with threat of market entry, the parties in the incumbent company can agree on the EB agenda to deter entry. Fanti and Buccella (2015b,c) broadly reconsider the issue of entry in a unionized monopoly considering a large number of timing specification of the bargaining game, confirming the potential market deterrence effect of the EB agenda. Nonetheless, those contributions do not deal with the effects of different alternative labour market institutions on entry in the presence of a mixed duopoly, in which a public firm and a private firm compete à la Cournot.

While the above mentioned papers deal with private monopoly and oligopoly, we note that the public firms are real-life cases extremely relevant in several countries

and in several sectors (such as, e.g., telecommunication, utilities and transport systems). The early literature considering the comparison between public and private monopoly (and oligopoly) outcomes includes De Fraja and Delbono (1987, 1989, 1990) and, as regards wages comparisons, De Fraja (1993). The work of De Fraja (1993) is related to the present one. On the one hand, this paper extends the De Fraja's model which considers only the RTM case and, on the other hand, extends the aim of the De Fraja's work which mainly focused on the relationship between public and private wages and on the effects of privatisation on wages. In fact, the present paper aims to analyse 1) the choice of alternative bargaining agendas by public and private monopoly firms, and compares the corresponding equilibrium outcomes not only in terms of relative wages but also of the relative welfare of the various agents and social welfare as a whole, 2) the effects of the bargaining agenda in the long run through an entry game.

As regards the former point (i.e. the endogenous choice of the bargaining agenda in the usual short-run context), the principal results of the present paper are as follows. Under both private and public monopoly, the bargained wages are the same under the RTM and EB agenda; the profits are always higher under RTM[1]; conversely, the union's utility and consumer's surplus are always higher under EB.

More interestingly, the RTM agenda always emerges as the sub-perfect equilibrium with private as well as public monopoly. This result as regards the public monopoly is not a priori expected because workers and consumers prefer EB. However, the overall social welfare is always larger with RTM than EB negotiations, despite the latter arrangement benefits both workers and consumers relatively more than the RTM arrangement. The rationale for this result is that the negotiations under the EB institution have an extremely negative impact on profits that overcomes the positive effects on the union's and consumer's welfare, in comparison with the RTM agenda.

By contrast, in the private monopoly case, challenging the conventional wisdom, the overall social welfare may be higher (lower) under RTM than EB provided that the political weight of the union is adequately low (high) and the reservation wage and the union bargaining power sufficiently high (low).

These findings imply that there is a conflict of interests between union and firm also in the case of public firm, despite the latter takes care also of the union's welfare. Moreover there are always conflicting preferences also between the Government and consumers.

Another interesting finding emerges by the comparison between public and private monopoly outcomes: social welfare may be higher under private monopoly (provided that the political weight of the union, the reservation wage and the union bargaining power are sufficiently high), despite the fact that the latter takes care only of its own profit while the public monopoly takes care of the social welfare. The latter finding implies that, rather paradoxically, a Government very sensible to the union's welfare should prefer a private monopoly while the union and the consumers prefer a public

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[1] However, in the public company profits tend to be negative when the weight of the union in its objective function becomes sufficiently high both with the RTM and EB negotiations.

monopoly. The result that the social welfare in the private monopoly case may be higher than the welfare in the public monopoly case is due to the effects of the presence of unions and reverts the well-established results early shown by De Fraja and Delbono (1987, 1989) with monopolies without unions.[2]

As regard long run issues, De Fraja and Delbono (1989) study the long run optimal number of firms, but they "rule out the presence of potential entrants" (p. 303). Also De Fraja (1993, p. 468) observes that "the model lends itself naturally to the analysis of the long run effects of privatisation". However, in his model, the long run issues are only captured by a simple comparison between the equilibrium of the mixed duopoly and that of private duopoly. In the present paper, the long run issues are analysed through an entry game under private (public) incumbent and public (private) entrant, and under alternative bargaining schemes.

When considering the issue of market entry, it is found that the public (private) monopolist may strategically commit to the RTM (EB) agenda to deter the entrance of a potential private (public) competitor. If RTM is the practice in place within the industry, a public incumbent company cannot strategically shift toward the alternative EB agenda to deter the entry of a private competitor; however, an incumbent private company can use the EB agenda as a tool to deter market entrance of a public company, provided that the union bargaining power is below a threshold value. A diametrically opposed result applies if the EB agenda is the established bargaining practice in the industry. In fact, in this case, the incumbent private company cannot use the RTM agenda to deter the entry of a public competitor; however, an incumbent public company can shift toward the RTM negotiation to deter the entry of a private competitor, provided that the union bargaining power is above a threshold value. Therefore, the novel result of the present work is that, in striking contrast to the existing literature, also the RTM agenda can be an entry deterrence tool. The consequences of those findings from the point of view of the social welfare are striking. In fact, if the prevalent industry agenda is RTM, to introduce a private competitor in a publicly monopolised sector is more welfare beneficial than give the opportunity to form, *a priori*, a private monopoly. On the contrary, if the prevalent industry agenda is EB, to introduce a private competitor in a public monopoly can be welfare beneficial only if the unions are sufficiently weak.

To sum up, the paper contributes to the literature on the bargaining agenda in unionised industries and is the first, at the best of our knowledge, to analyse the effects of the choice of the agenda both in short and long run with a public firm.

The remainder of the article is organized as follows. Section 2 presents the basic ingredients of the model. While Section 3 analyzes the union-firm bargaining problem in the context of a private monopoly, Section 4 re-examines the subject in the presence of a public monopoly. Section 5 deals with a discussion of the comparative statics of the two scenarios. Section 6 investigates the issue of market entry in a mixed duopoly where the incumbent can be either a private or public

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[2] "As the intuition might suggest, W_M [i.e. the social welfare in the public monopoly case] is greater than the welfare in all other cases" (De Fraja and Delbono, 1989, p.305).

company, and briefly discusses the results and the impact on social welfare. Finally, Section 7 summarizes the key findings and implications and suggests directions for future research on the subject.

2. The model

Let us consider that there is only one firm in the market producing a good. The standard inverse demand function faced by the monopolist is given by

$$p = a - \beta q \qquad (1)$$

where p and q are the price and quantity of good, respectively.
The monopolist's profit function, by assuming, as usual (e.g. De Fraja, 1993), that $q = \sqrt{L}$, where L is the employment, is given by:

$$\pi = (a - \beta q)q - wq^2, \qquad (2)$$

where w is the per unit of output wage. We assume that the monopolistic firm is unionised.[3] We consider the two typical negotiation models of the trade-union economics (Booth, 1995): 1) the Right-to-Manage model (RTM) (e.g. Nickell and Andrews, 1983), in which wages are the outcome of negotiations between firms and unionized labour; however, once wages are set, the firms have the right to set the employment levels; and 2) the efficient bargaining model (EB) which prescribes that the union and the firm are bargaining over both wages and employment (or, more realistically, hours of work) (e.g. McDonald and Solow, 1981; Ashenfelter and Brown, 1986; Manning, 1987a,b).
The union has the following utility function:[4]

$$V = (w - w^\circ)L, \qquad (3)$$

where w° is the reserve or competitive wage.
We assume that unions are identical. Therefore, by recalling that $q = \sqrt{L}$, (3) becomes:

$$V = (w - w^\circ)q.^2$$

that is, the unions' objective function is to maximise the total rent.
The firm may be state-owned or private-owned. The social welfare is given by a weighted sum of consumers' surplus, *CS*, profit, and union's utility. It will be assumed here, following De Fraja (1993), that the analytical expression for the social welfare function is given by: $SW_{PUB} = CS + \pi + mV$.
The weight attached to the union's utility has been assumed to be an exogenously given parameter: $m \in (0,1]$, as better detailed in the next section.

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[3] We assume that the members of the union are large enough to meet the firm's labour demand.
[4] This is a specific case of the more general Stone-Geary utility function, i.e., Pencavel (1984, 1985), Dowrick and Spencer (1994):

$$V = (w - w^\circ)^\theta L,$$

A value of $\theta = 1$ gives the rent-maximising case (i.e. the union seeks to maximise the total rent); values of $\theta = <(>)1$ imply that the union is less (more) concerned about wages and more (less) concerned about jobs. Moreover, the union aims to maximise the wage bill when $w^\circ = 0$.

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Let us begin by illustrating the case of private monopoly firm[5] under the cases of RTM and EB[6].

3. Private Monopoly

3.1 RTM institution

At stage 2 solving the profit maximisation problem of monopolist firm, we get the following output function, for given wage

$$q(w) = \frac{a}{2(\beta + w)} \tag{4}$$

At first stage of the game, under Right-to Manage, monopolist - union bargaining unit selects $w,$ to maximize the following generalized Nash product,

$$\underbrace{\max}_{w.r.t.\ w} N = (\pi)^{1-b}(V)^b = \left[(a - \beta q)q - wq^2\right]^{1-b}\left((w - w^\circ)q^2\right)^b , \tag{5}$$

where b represents the bargaining union's power.
Maximising eq. (5) with respect to w, after substitution of eq. (3) in (4), we obtain the wage :

$$w_{PRI}^{RTM} = w^\circ(1+b) + b\beta \tag{6}$$

By using (6) we obtain the equilibrium output:

$$q_{PRI}{}^{RTM} = \frac{a}{2(w^\circ + \beta)(1+b)} \tag{7}$$

By using (6) and (7) the other equilibrium outcomes are obtained:

$$\pi_{PRI}{}^{RTM} = \frac{a^2}{4(w^\circ + \beta)(1+b)} \tag{8}$$

$$V_{PRI}{}^{RTM} = \frac{a^2 b}{4(w^\circ + \beta)(1+b)^2} \tag{9}$$

$$CS_{PRI}{}^{RTM} = \frac{a^2 \beta}{8\left[(w^\circ + \beta)(1+b)\right]^2} \tag{10}$$

$$SW_{PRI}{}^{RTM} = \frac{a^2\left[2b(w^\circ + \beta)(m+1) + 2w^\circ + 3\beta\right]}{8[(w^\circ + \beta)(1+b)]^2} \tag{11}$$

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[5] In the rest of the paper the subscript PRI (PUB) denotes the private monopoly (public monopoly, respectively).
[6] We note that the equilibrium outcomes of the Simultaneous Efficient Bargaining are the same of those of the Sequential EB for both private and public monopoly (the straightforward demonstration is omitted here for economy of space).

3.2. Efficient Bargaining institution.

Under efficient-bargaining the private monopolist-union bargaining unit maximizes the following generalised Nash product,

$$\underbrace{\max}_{w.r.t. \ w,q} N = (\pi)^{1-b}(V)^b = \left[(a-\beta q)q - wq^2\right]^{1-b}\left((w-w^\circ)q^2\right)^b , \tag{12}$$

Hence, the private monopolist- union bargaining unit selects at the first stage simultaneously w and q in the case of EB.

From the system of first-order conditions of the efficient bargaining game between private monopolist and union, the following system is obtained:

$$q(w) = \frac{a(1+b)}{2(\beta + w)}, \tag{13}$$

$$w(q) = \frac{qw^\circ(1-b) + b(q\beta - a)}{q} \tag{14}$$

$$q_{PRI}^{EB} = \frac{a}{2(w^\circ + \beta)} \tag{15}$$

$$w_{PRI}^{EB} = w_{PRI}^{RTM} \tag{16}$$

By using (15) and (16) the other equilibrium outcomes are obtained:

$$\pi_{PRI}^{EB} = \frac{a^2(1-b)}{4(w^\circ + \beta)} \tag{17}$$

$$V_{PRI}^{EB} = \frac{a^2 b}{4(w^\circ + \beta)} \tag{18}$$

$$CS_{PRI}^{EB} = \frac{a^2\beta}{8\left[(w^\circ + \beta)\right]^2} \tag{19}$$

$$SW_{PRI}^{EB} = \frac{a^2\left[2b(w^\circ + \beta)(m-1) + 2w^\circ + 3\beta\right]}{8(w^\circ + \beta)^2} \tag{20}$$

4. Public Monopoly.

Consider next a public monopoly firm. The Government instructs the public monopolist to maximise the social welfare, where, as seen in the previous section, the weight on the union's utility is less than one. There are two reasons why the weight on the union's utility is less than one, the first eminently algebraic and the second, namely, political.

As regards the former it is easy to see that the public firm's union could limitlessly raise its wage because the optimal output level of the public firm is independent of the wage,[7] while as regards the latter "there may be political reasons why an increase in union utility is not considered as positive an occurrence as an increase in the profit accruing to the Treasury or as a reduction in the price of the good (De Fraja, 1993, p. 460).

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[7] Alternatively, m can be fixed equal to one but then, in order to solve this problem, the bargaining choices have to face a budget constraint with respect to the level of profit of the public firm.

In what follows we investigate the cases of RTM and EB.

4.1 RTM institution

At stage 2 solving the social welfare maximisation problem of public monopoly firm, we get the following output function:

$$q(w) = \frac{a}{\beta + 2[(1-m)w + mw°]} \qquad (21)$$

At first stage of the game, under Right-to Manage, public monopoly- union bargaining unit selects w, to maximize the following generalized Nash product,

$$\max_{\underbrace{}_{w.r.t.\ w}} N_{PUB} = \left(SW_{PUB}\right)^{1-b}\left(V\right)^{b} = \left[\frac{\beta q(w)^2}{2} + (a - \beta q(w))q(w) - wq(w)^2 + m\left((w - w°)q(w)^2\right)\right]^{1-b}\left((w - w°)q(w)^2\right)^{b} \qquad (22)$$

where b represents the bargaining union's power.

Maximising eq. (22) with respect to w, after substitution of eq. (21) in (22), we obtain the wage:

$$w_{PUB}^{RTM} = \frac{2w°(1+b-m) + b\beta}{2(1-m)} \qquad (23)$$

By using (23) we obtain the equilibrium output:

$$q_{PUB}^{RTM} = \frac{a}{(2w° + \beta)(1+b)} \qquad (24)$$

By using (23) and (24) the other equilibrium outcomes are obtained:

$$\pi_{PUB}^{RTM} = \frac{a^2\left[2bm(2w° + \beta) - 2w°(1+b-m) - b\beta\right]}{2(1-m)(2w° + \beta)(1+b)^2} \qquad (25)$$

$$V_{PUB}^{RTM} = \frac{a^2 b}{2(1-m)(2w° + \beta)(1+b)^2} \qquad (26)$$

$$CS_{PUB}^{RTM} = \frac{a^2\beta}{2(2w° + \beta)^2(1+b)^2} \qquad (27)$$

$$SW_{PUB}^{RTM} = \frac{a^2}{2(2w° + \beta)(1+b)} \qquad (28)$$

4.2. Efficient Bargaining institution.

Under efficient-bargaining the public monopoly-union bargaining unit maximizes the following generalised Nash product,

$$\max_{\underbrace{}_{w.r.t.\ w,q}} N_{PUB} = \left(SW_{PUB}\right)^{1-b}\left(V\right)^{b} = \left[\frac{\beta q^2(w)}{2} + (a - \beta q)q - wq^2 + m\left((w - w°)q^2\right)\right]^{1-b}\left((w - w°)q^2\right)^{b} \qquad (29)$$

Hence, the public monopolist-union bargaining unit selects at the first stage simultaneously w and q in the case of EB.

From the system of first-order conditions of the efficient bargaining game between monopolist and union, the following system is obtained:

$$q(w) = \frac{a(1+b)}{2m(w^\circ - w) + (\beta + 2w)} \tag{30}$$

$$w(q) = \frac{2qw^\circ(b + m - 1) + b(\beta q - 2a)}{2q(m - 1)} \tag{31}$$

$$q_{PUB}{}^{EB} = \frac{a}{2(w^\circ + \beta)} \tag{32}$$

$$w_{PUB}{}^{EB} = w_{PUB}{}^{RTM} \tag{33}$$

By using (32) and (33) the other equilibrium outcomes are:

$$\pi_{PUB}{}^{EB} = \frac{a^2[2w^\circ(b + m - 1) + b\beta]}{2(2w^\circ + \beta)^2(1 - m)} \tag{34}$$

$$V_{PUB}{}^{EB} = \frac{a^2 b}{2(2w^\circ + \beta)(1 - m)} \tag{35}$$

$$CS_{PUB}{}^{EB} = \frac{a^2 \beta}{2(2w^\circ + \beta)^2} \tag{36}$$

$$SW_{PUB}{}^{EB} = \frac{a^2(1 - b)}{2(2w^\circ + \beta)} \tag{37}$$

5. Comparison of equilibrium results

In this section, armed with the equilibrium outcomes for both alternative bargaining agendas and types of firm's ownership, we may study which will be the choice of agenda and its corresponding effects on welfare. First, we show the choice of agenda and compare whether and how wages, quantities, profits, union's welfare and social welfare differ between the two bargaining agendas. Second, we compare private and public outcomes.

Let's define the following differentials (where x is a generic variable assuming the meaning of the subscript i) : $\Delta x_{i,j} = x_{i,j}{}^{RTM} - x_{i,j}{}^{EB}$, $i = \pi, V, q, SW$; $j = PRI, PUB$.

5. 1. Private Monopoly.

Result 1. *Wages are the same under RTM and EB,*[8] *the profit is always higher under RTM, while the union's utility and consumer' surplus are always higher under EB, and SW may be higher (lower) under RTM provided that m sufficiently low and w°, β, b sufficiently high. Proof:*

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[8] Given that under monopoly there is not a strategic interaction in the quantity (i.e. employment), bargaining over wages simultaneously or subsequently with respect to the choice of employment obtains the same wages and thus the analysis of De Fraja (1993, p. 461) on the wages paid by the public and private monopolist under RTM holds true under EB as well.

$$\Delta\pi_{PRI} > 0, \Delta V_{PRI} < 0, \Delta q_{PRI} < 0, \Delta SW_{PRI} \overset{\geq}{\underset{<}{=}} 0 \Leftarrow m \overset{<}{\underset{>}{-}} \frac{2b^2(w° + \beta) + (\beta + 2w°)b - 2\beta}{2b(w° + \beta)(2 + b)}$$

Corollary 1. Private monopoly always chooses the RTM arrangement.

While the finding as regards profits, union and consumer is expected, the fact that social welfare as a whole may be larger under RTM is less expected, but it is due to the fact that when the weight attached to union's utility in the social welfare is sufficiently low, the relative gain in profits under RTM is so large that it overweighs the relative loss for union and consumer in the evaluation of the overall social welfare.

5.2 Public Monopoly.

Result 2. *Wages are the same under RTM and EB; although the profit tends to be negative when m tend to be sufficiently high for both RTM and EB, the profit under RTM is always significantly higher than that under EB,[9] and this profit differential in favour of RTM is increasing with increasing union's power. As in the case of the private monopoly, the union's utility and consumer' surplus are always higher under EB. Proof:* $\Delta\pi_{PUB} > 0, \Delta V_{PUB} < 0, \Delta q_{PUB} < 0$

Therefore, Res. 2 states that, in line with the intuition, the public monopoly incurs large profit losses when it bargains also on employment, especially when both the union's utility is highly evaluated in the social welfare function and union's power is large.

Result 3. *SW is always higher under the RTM arrangement. Proof:* $\Delta SW_{PUB} > 0,$

Corollary 2. Public monopoly always chooses RTM like the private firm, although it is interested also to consumer's and union's welfares which are higher under EB.

The intuition behind Res. 2-3 and Corollary 2 is that the EB arrangement causes, in comparison with the RTM one, a so larger negative effect on profits which is more than counterbalancing the larger positive effect on the union's and consumer's welfare. As a consequence, we have the result that a public monopoly firm behaves as a private firm in the choice of the bargaining agenda, despite the fact that in its objective the utility of the union may have at the limit the same weight of the profit. Therefore, we may conclude that, both in the private and public monopoly, the bargaining agenda will be the RTM one.

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[9] For instance, when a=1, w°=0, β=1 and b=0.5, profits under RTM are negative for m>0.5, while those under EB are always negative

5.3. Comparison between private and public monopoly.

The above finding regarding the occurrence of the same agenda irrespective of whether the firm is public or private poses some relevant questions. Under the chosen bargaining agenda (RTM) does public monopoly obtain, as the conventional wisdom believes, the highest social welfare? How are welfares of single agents affected by the choice of the agenda?

The answers are not univocal: in particular, as regards the first question, surprisingly, the private monopoly may be more efficient than the public one.

Let's define the following differentials (where x is a generic variable assuming the meaning of the subscript i): $\Delta x_i = x_{i,PRI}{}^{RTM} - x_{i,PUB}{}^{RTM}, \quad i = V, q, SW$.

Lemma 1. The wage in the private monopoly firm may be higher than that in the public monopoly firm provided that $w°$ is sufficiently high and β and m sufficiently low.[10] Proof:

$$\Delta w \underset{<}{\overset{>}{\gtrless}} 0 \Leftarrow w° \underset{<}{\overset{>}{\gtrless}} w°° = \frac{(1-2m)\beta}{2m}; \quad \frac{\partial w°°}{\partial x_i} < 0, i = m, \beta..$$

Result 4. *The private monopoly is more efficient than the public one when b, m, and $w°$ are sufficiently high and β is sufficiently low [11]. Proof:*

$$\Delta SW \underset{<}{\overset{>}{\gtrless}} 0 \Leftarrow w° \underset{<}{\overset{>}{\gtrless}} w°* = \frac{\beta[b(1-3m) + \sqrt{b}\sqrt{b(1+m)^2 + 4m}]}{4bm}; \frac{\partial w^{o*}}{\partial m} < 0; \frac{\partial w^{o*}}{\partial b} < 0; \frac{\partial w^{o*}}{\partial \beta} > 0$$

Result 5. *Both consumer's welfare and unions' utility are higher under public monopoly. Proof:*

$$\Delta CS = -\frac{a^2\beta^2(4w° + 3\beta)}{8(2w° + \beta)(w° + \beta)^2(1+b)^2}; \Delta V = -\frac{a^2b^2[2mw° + \beta(m+1)]}{4(1-m)(w° + \beta)(2w° + \beta)(1+b)^2}$$

Therefore our conclusion is interesting: a private monopoly may be more efficient. More interestingly this occurs when the union is strong, but also its utility is highly taken into account by the government. Moreover there is a conflicting view between Government, on the one side, and workers and consumers on the other side as regards the preferred bargaining agenda.

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[10] We refer to De Fraja (1983, p.461) for a thorough analysis as to why the wage paid by the public monopolist may be lower than that a private monopolist would pay.

[11] It is easy to observe that this interesting result is due to the presence of union and that in the absence of union the established result by De Fraja and Del Bono (1989) (see also footnote 1) holds true.

6. Entry and Welfare Considerations

In this section, we briefly examine the issue of the strategic use of the two alternative bargaining agendas, i.e. EB and RTM, as a tool to deter potential market entry in the present context of mixed duopoly.

We focus on the committed bargaining where the entrant is obliged to "join the pack" and adopt the agenda of the incumbent, both under "blockaded duopoly", i.e. duopoly is the given market structure, and monopoly with threat of market entry (Bughin, 1999; Buccella, 2011; Fanti e Buccella 2015c). The principal result of the above mentioned literature is that, in the presence of a private Cournot duopoly with standard substitute goods and constant returns to scale technology, the EB agenda can be used as entry deterrence mechanisms.

For each bargaining agenda, we analyse the following situations. First, the incumbent firm is a private company and the entrant a public one. Second, the incumbent firm is a public company and the potential competitor a private firm. Figure 1 illustrates all the possible sequences of events.

6.1 Committed bargaining with blockaded duopoly

The analysis in the case of blockaded duopoly is straight forward. In fact, from Corollary 2, it is directly derived that RTM is the equilibrium agenda because both the private and the public company always prefer RTM to EB.

Figure 1 Market structures and bargaining configurations
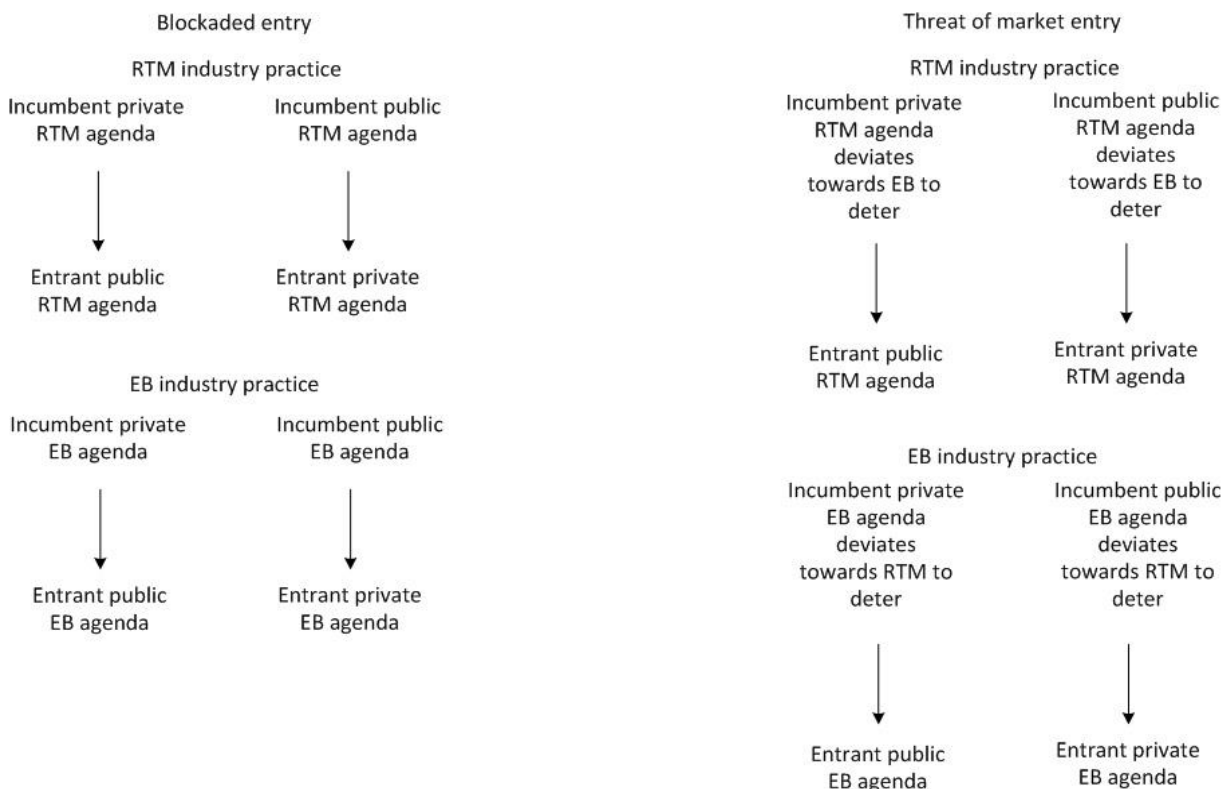
6.2 Committed bargaining with threat of market entry

The analysis is more articulated in case of threat of entry. As in Bughin (1999), Buccella (2011), and Fanti e Buccella (2015c), entry in the industry is modelled as a change from a monopoly to a duopoly market structure. The potential entrant firm faces an exogenous fixed cost denoted by E. To generalise the discussion, and not to make the notation too heavy, in the following we omit the term E which, nonetheless, does not alter the companies' maximization problem.

In the case of entry, the sector is always characterized by a mixed duopoly with the presence of one public and one private firm. Following De Fraja (1993), the firms compete a la Cournot on equal terms in the product market for homogeneous goods and exploit the identical technology.

6.2.1 RTM prevalent industry agenda

Let us first consider the case of RTM as the prevalent agenda in the industry, as in De Fraja (1993). The sequence of moves is as follows. In stage 1, each union-firm bargaining unit simultaneously conducts wage negotiations without having knowledge about the outcome of the negotiations in the rival unit. The bargaining process is assumed to satisfy the asymmetric Nash bargaining solution, calculated by considering the subsequent outcome of the product game which firms will play after wages have been set.[12] In stage 2, after that both firms have negotiated wages, those are announced publicly, and firms simultaneously makes their output and, consequently, employment decisions. As usual the game is solved in the backward fashion. Given the outlined assumptions, the firms' maximization problem is

$$SW_{PUB}{}^{RTM} = CS + \pi_{PRI} + \pi_{PUB} + mV_{PRI} + mV_{PUB} =$$

$$= \frac{\beta}{2}(q_{PUB} + q_{PRI})^2 + \{[a - \beta(q_{PUB} + q_{PRI})]q_{PRI} - w_{PRI}q_{PRI}^2\} +$$

$$\{[a - \beta(q_{PUB} + q_{PRI})q_{PUB}] - w_{PUB}q_{PUB}^2\} + [m(w_{PRI} - w^O)q_{PRI}^2] + $$

$$[m(w_{PUB} - w^O)q_{PUB}^2] \tag{38}$$

$$\pi_{PRI} = [a - \beta(q_{PUB} + q_{PRI})]q_{PRI} - w_{PRI}q_{PRI}^2, \tag{39}$$

for the public and the private company, respectively. In line with De Fraja (1993), the solution of the system of equations represented by the two firms FOCs, lead to the following expressions for the equilibrium output

$$q_{PUB}^* = \frac{a(2w_{PRI} + \beta)}{\Phi} \tag{40}$$

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[12] Following De Fraja (1993, 463) in the Nash product the reference values of union's utility and firm's profit are set to zero.

$$q^*_{PRI} = \frac{2a[w_{PUB}(1-m) - mw^O]}{\Phi} \qquad (41)$$

where

$$\Phi = \beta(\beta + 2w_{PRI}) + (\beta + 4w_{PRI})[(1-m)w_{PUB} + mw^O)]\,.$$

In the first stage of the game, the bargaining problems of the public and private firms take the following form, respectively

$$\max_{w.r.t.\ w_{PUB}} N_{PUB} = \left(SW_{PUB}\right)^{1-b}(V)^b = \begin{bmatrix} \frac{\beta}{2}(q^*_{PUB} + q^*_{PRI})^2 + \\ \{[a - \beta(q^*_{PUB} + q^*_{PRI})]q^*_{PRI} - w_{PRI}q^{*2}_{PRI}\} + \\ \{[a - \beta(q^*_{PUB} + q^*_{PRI})q^*_{PUB}] - w_{PUB}q^{*2}_{PUB}\} + \\ [m(w_{PRI} - w^O)q^{*2}_{PRI}] + [m(w_{PUB} - w^O)q^{*2}_{PUB}] \end{bmatrix}^{1-b} \left((w_{PUB} - w^\circ)q^{*2}_{PUB}\right)^b \qquad (42)$$

$$\max_{w.r.t.\ w_{PRI}} N_{PRI} = \left(\pi\right)^{1-b}(V)^b = \left[[a - \beta(q^*_{PUB} + q^*_{PRI})]q^*_{PRI} - w_{PRI}q^{*2}_{PRI}\right]^{1-b} \left((w_{PRI} - w^\circ)q^{*2}_{PRI}\right)^b . \qquad (43)$$

However, as De Fraja (1993) has already pointed out, the analytical expressions of the solutions for the equilibrium wages are complex and excessively long to be here reported. We take advantage of that author numerical simulations to construct Table 1, where the equilibrium wages, quantities, price and the equilibrium profits in mixed duopoly of the public and private companies are reported. For our purposes, in the last four columns, the social welfare under duopoly with the RTM institution, the social welfare under private monopoly, and the public and private monopoly profits with the EB institution are calculated. Again, strictly following De Fraja (1993, p.463), the numerical simulations consider the following four scenarios: 1) $m=0$, $w^o =0$; 2) $m=0$, $w^o =0.5$; 3) $m=0.5$, $w^o =0$; 4) $m=0.5$, $w^o =0.5$.

As Bughin (1999), Buccella (2011) and Fanti and Buccella (2015c) highlights, in the case of committed bargaining and threat of market entry, if the fixed costs the entrant faces are such that

Monopoly profits EB < E < Duopoly profits RTM , $\qquad (44)$

a duopoly exists under RTM; however, the incumbent retains a monopoly position if it selects EB. On the other hand, if the monopoly profits under EB are larger than the duopoly profits under RTM, the incumbent has the opportunity to commit strategically to the EB agenda to prevent the market entry of a potential competitor under RTM. Our numerical simulations in Table 1 show that, in all the four proposed scenarios, there is a fundamental asymmetry if the incumbent firm is a private or public company.

a) RTM prevalent agenda, incumbent private company, entrant public company

Remark 1 *In the presence of a monopoly with threat of market entry, if the incumbent is a private company and the potential entrant is a public company, the private incumbent firm can use the EB agenda as entry deterrence mechanism. In fact, there is a critical value of the union bargaining power b^τ such that, for $b \leq b^\tau$, $\pi_{PRI}^{Duopoly,RTM} < \pi_{PRI}^{Monopoly,EB}$ as the green boxes in Table 1 reveal.*

Table 1 Numerical simulations, RTM agenda

Default values: a=10, rw=0, beta=0.5 (m=0)

b		w0	w1	q0	q1	p	RTM Duopoly profits (private)	RTM Duopoly Objective (public)	SW mixed duopoly RTM	SW private monopoly EB	EB monopoly profits (private comapny)	SW public monopoly EB
b=0	0	0	0	20	0	0	0	100	100	75	50	100
b=.1	0,1	0,02877	0,01987	16,37081	1,745241	0,941976	1,583453923	91,34170404	91,34170404	61,98347107	45	90,90909091
b=.2	0,2	0,0572	0,04568	14,0622	2,720366	1,608716	4,038246705	85,7629395	85,7629395	52,08333333	40	83,33333333
b=.3	0,3	0,07931	0,07561	12,81383	3,121111	2,03253	5,607208062	82,11003597	82,11003597	44,37869822	35	76,92307692
b=.4	0,4	0,09694	0,10865	12,06235	3,26035	2,338649	6,469876851	79,27098124	79,27098124	38,26530612	30	71,42857143
b=.5	0,5	0,11216	0,14438	11,54044	3,282053	2,588752	6,941178792	76,80544676	76,80544676	33,33333333	25	66,66666667
b=.6	0,6	0,1261	0,18252	11,13618	3,246724	2,808546	7,194589563	74,54984556	74,54984556	29,296875	20	62,5
b=.7	0,7	0,13931	0,22278	10,79971	3,182258	3,009016	7,319422326	72,44153546	72,44153546	25,95155709	15	58,82352941
b=.8	0,8	0,15208	0,26488	10,50591	3,103129	3,195479	7,365345023	72,32703284	70,45256713	23,14814815	10	55,55555556
b=.9	0,9	0,16454	0,30855	10,242	3,01713	3,370436	7,360291883	68,68995985	68,57140545	20,77562327	5	52,63157895
b=.10	1	0,17677	0,35355	10,00018	2,928891	3,535464	7,322094273	66,78995985	66,79	18,75	0,00	50

Default values: a=10, rw=0.5, beta=0.5 (m=0)

b		w0	w1	q0	q1	p	RTM Duopoly profits (private)	RTM Duopoly Objective (public)	SW mixed duopoly RTM	SW private monopoly EB	EB monopoly profits (private comapny)	SW public monopoly EB
b=0	0	0,5	0,5	5,454545	3,636364	5,454545	13,2231405	48,76033058	48,76033058	31,25	25	33,33333333
b=.1	0,1	0,66478	0,58818	4,492118	3,562803	5,97254	13,81288118	43,44799199	43,44799199	26,85950413	22,5	30,3030303
b=.2	0,2	0,78537	0,68054	4,011655	3,385812	6,301267	13,53338207	39,85326364	39,85326364	23,4375	20	27,77777778
b=.3	0,3	0,87498	0,77495	3,735803	3,189183	6,537507	12,96737561	37,16765582	37,16765582	20,71005917	17,5	25,64102564
b=.4	0,4	0,94561	0,87061	3,55475	2,999622	6,722814	12,33238553	35,02129499	35,02129499	18,49489796	15	23,80952381
b=.5	0,5	1,0044	0,96716	3,423017	2,824672	6,876156	11,70613548	33,2331362	33,2331362	16,66666667	12,5	22,22222222
b=.6	0,6	1,05542	1,06436	3,319683	2,665677	7,00732	11,11608637	31,70326176	31,70326176	15,13671875	10	20,83333333
b=.7	0,7	1,10107	1,16209	3,23414	2,521804	7,122028	10,57005315	30,36959152	30,36959152	13,84083045	7,5	19,60784314
b=.8	0,8	1,1428	1,26022	3,160601	2,391661	7,223869	10,06853431	46,80273509	29,1913203	12,73148148	5	18,51851852
b=.9	0,9	1,18158	1,35869	3,095583	2,2737	7,315358	9,608894898	28,1388461	28,1388461	11,77285319	2,5	17,54385965
b=.10	1	1,21807	1,45743	3,036895	2,166502	7,398301	9,187650727	27,19041855	27,19	10,9375	0,00	16,66666667

Default values: a=10, rw=0, beta=0.5 (m=0.5)

b		w0	w1	q0	q1	p	RTM Duopoly profits (private)	RTM Duopoly Objective (public)	SW mixed duopoly RTM	SW private monopoly EB	EB monopoly profits (private comapny)	SW public monopoly EB
b=0	0	0	0	20	0	0	0	100	100	75	50	100
b=.1	0,1	0,05801	0,01989	16,34668	1,756773	0,948271	1,604511987	91,31954445	91,31954445	64,04958678	45	90,90909091
b=.2	0,2	0,117	0,04586	13,96913	2,762097	1,634388	4,164463442	85,73835266	85,73835266	55,55555556	40	83,33333333
b=.3	0,3	0,1633	0,07605	12,68213	3,175882	2,070992	5,8101694	82,19516061	82,19516061	48,81656805	35	76,92307692
b=.4	0,4	0,19964	0,1093	11,92536	3,31308	2,380779	6,687980447	79,53619814	79,53619814	43,36734694	30	71,42857143
b=.5	0,5	0,23035	0,14517	11,4145	3,326835	2,629331	7,1406329	77,27700816	77,27700816	38,88888889	25	66,66666667
b=.6	0,6	0,25784	0,18333	11,03028	3,28162	2,844048	7,358798953	75,23891583	75,23891583	35,15625	20	62,5
b=.7	0,7	0,28338	0,22352	10,71819	3,207172	3,03732	7,442091763	73,34784499	73,34784499	32,00692042	15	58,82352941
b=.8	0,8	0,30764	0,26545	10,45097	3,118765	3,215135	7,445299107	71,57130047	60,70331028	29,32098765	10	55,55555556
b=.9	0,9	0,33096	0,30887	10,21441	3,024462	3,380562	7,39903393	69,89389439	69,89389439	27,00831025	5	52,63157895
b=.10	1	0,35355	0,35355	10,00004	2,928932	3,535514	7,322301383	68,30601025	68,31	25	0,00	50

Default values: a=10, rw=0.5, beta=0.5 (m=0.5)

b		w0	w1	q0	q1	p	RTM Duopoly profits (private)	RTM Duopoly Objective (public)	SW mixed duopoly RTM	SW private monopoly EB	EB monopoly profits (private comapny)	SW public monopoly EB
b=0	0	0,5	0,5	5,454545	3,636364	5,454545	13,2231405	48,76033058	48,76033058	31,25	25	33,33333333
b=.1	0,1	0,691	0,58727	4,886105	3,475194	5,819351	13,1309282	45,35271351	45,35271351	27,89256198	22,5	30,3030303
b=.2	0,2	0,88869	0,67873	4,419881	3,304429	6,137845	12,87084941	42,32716333	42,32716333	25,17361111	20	27,77777778
b=.3	0,3	1,0768	0,77291	4,061456	3,130336	6,404104	12,47324938	39,74583422	39,74583422	22,92899408	17,5	25,64102564
b=.4	0,4	1,24702	0,86876	3,791596	2,960418	6,623993	11,99591107	37,56700338	37,56700338	21,04591837	15	23,80952381
b=.5	0,5	1,39771	0,96565	3,586831	2,79964	6,806765	11,4877411	35,71672825	35,71672825	19,44444444	12,5	22,22222222
b=.6	0,6	1,53061	1,06324	3,427974	2,650269	6,960878	10,98008154	34,1252747	34,1252747	18,06640625	10	20,83333333
b=.7	0,7	1,64842	1,16132	3,301431	2,512847	7,092861	10,49023502	32,73790729	32,73790729	16,86851211	7,5	19,60784314
b=.8	0,8	1,75383	1,25978	3,197917	2,386958	7,207562	10,02646556	44,32566467	31,5321736	15,81790123	5	18,51851852
b=.9	0,9	1,84912	1,35849	3,111163	2,271849	7,308494	9,592223797	30,42084644	30,42084644	14,88919668	2,5	17,54385965
b=.10	1	1,93615	1,45743	3,036884	2,166503	7,398306	9,187662181	29,43733635	29,44	14,0625	0,00	16,66666667

Legend: The parameter m represents the weight of union's utility in the public firm's utility function, b is the union bargaining power, rw (w^o in the main text) the reservation wage, w0 (q0) and w1 (q1) are the equilibrium wages (quantities) in the public (private) firm in the mixed duopoly, respectively, and p is the price level. The reference values for the parameters a and beta are as follows: a=10, beta=0.5. The numerical simulations consider the following four scenarios: 1) m=0, rw=0; 2) m=0, rw=0.5; 3) m=0.5, rw=0; 4) m=0.5, rw=0.5. Furthermore, profits and SW for the private duopoly, private monopoly and public monopoly are also reported.

Therefore, if the labour market is characterized by the RTM institution, an incumbent private company may strategically commit to the EB agenda to deter market entry provided that the union bargaining power is adequately low. This result is in line with the findings of Bughin (1999), Buccella (2011), and Fanti e Buccella (2015c).

The reservation wage seems to play a more crucial role than the unions' "political" weight. The simulations demonstrate that, for an identical reservation wage but different union political weight m, the threshold value of the unions' bargaining power that allows the private incumbent to switch toward the EB agenda to prevent the entry of the public competitor is similar: $b \approx .9$ in scenarios 1 and 3; a value of $b \in (.5, .6)$ in scenarios 2 and 4.

b) RTM prevalent agenda, incumbent public company, entrant private company

Remark 2 *In the presence of a monopoly with threat of market entry, if the incumbent is a public company and the potential entrant is a private company, the public incumbent firm cannot use the EB agenda as entry deterrence mechanism. In fact, the results in Table 1 shows that for the public incumbent company always holds*
$SW_{PUB}^{Duopoly,RTM} > SW_{PUB}^{Monopoly,EB}$.

Intuitively, the rationale for Remark 2 can be that the public company has to include into its objective function also the profits of the private entrant.

6.2.2 EB prevalent industry agenda

Let us now analyze the case of the EB agenda as the practice in place in the industry. The sequence of moves is as follows. In stage 1, each union-firm bargaining unit simultaneously negotiate wages and employment without having knowledge of the bargaining outcome in the rival unit. Also under these circumstances, the negotiation process is supposed to adhere to the asymmetric Nash bargaining solution. Given the outlined assumptions, the bargaining problems of the public and private firms become, respectively

$$\max_{w_{PUB},q_{PUB}} N_{PUB} = \left(SW_{PUB}\right)^{1-b}\left(V\right)^{b} = \begin{bmatrix} \dfrac{\beta}{2}(q_{PUB}^{*}+q_{PRI}^{*})^{2} + \\ \{[a-\beta(q_{PUB}^{*}+q_{PRI}^{*})]q_{PRI}^{*}-w_{PRI}q_{PRI}^{*2}\} + \\ \{[a-\beta(q_{PUB}^{*}+q_{PRI}^{*})q_{PUB}^{*}]-w_{PUB}q_{PUB}^{*2}\} + \\ [m(w_{PRI}-w^{o})q_{PRI}^{*2}]+[m(w_{PUB}-w^{o})q_{PUB}^{*2}] \end{bmatrix}^{1-b} \left((w_{PUB}-w^{o})q_{PUB}^{*2}\right)^{b} \quad (45)$$

$$\max_{w_{PRI},q_{PRI}} N_{PRI} = \left(\pi\right)^{1-b}\left(V\right)^{b} = \left[[a-\beta(q_{PUB}^{*}+q_{PRI}^{*})]q_{PRI}^{*}-w_{PRI}q_{PRI}^{*2}\right]^{1-b}\left((w_{PRI}-w^{o})q_{PRI}^{*2}\right)^{b} .(46)$$

It can be shown that the solution of the system of equations composed by the two firms FOCs lead to the following expressions for the equilibrium wages and outputs

$$w_{PUB}^* = \frac{\{8w^{O3}[(1-m)(b^2-1)+2b]+8w^{O2}[(1-m)(b^2-1)-4b)]+2\beta^2 w^O[(1-m)-5b]+b\beta^3\}}{2(2w^O+\beta)^2(1-m)} \quad (47)$$

$$q_{PUB}^* = \frac{a(2w^O+\beta)}{4w^{O2}+6w^O\beta+\beta^2} \quad (48)$$

$$w_{PRI}^* = w^O + b(w^O+\beta) \quad (49)$$

$$q_{PRI}^* = \frac{2aw^O}{4w^{O2}+6w^O\beta+\beta^2} \quad (50)$$

As for the RTM case, we perform some numerical simulations. We consider the following four scenarios with the values of the parameters extremely close to those in the previous simulations[13]: 1) $m=0$, $w^O=0.01$; 2) $m=0$, $w^O=0.5$; 3) $m=0.5$, $w^O=0.01$; 4) $m=0.5$, $w^O=0.5$. The results are reported in Table 2.

Similarly to the previous case, in the presence of committed bargaining, if the fixed costs the entrant faces are such that

Monopoly profits RTM $< E <$ Duopoly profits EB , (51)

a duopoly exists under EB but the incumbent firm preserves a monopoly position if it selects RTM. In addition, if the monopoly profits under RTM are larger than the duopoly profits under EB, the incumbent has the opportunity to commit strategically to the RTM agenda to preclude entry of a potential competitor under EB. The numerical simulations in Table 2 reveal that there is again a fundamental asymmetry in all the four proposed scenarios if the incumbent firm is a private or public company.

c) EB prevalent agenda, incumbent private company, entrant public company

Remark 3 *In the presence of a monopoly with threat of market entry, if the incumbent is a private company and the entrant a public firm, the RTM agenda cannot be used as an entry deterrence tool. In fact, as expected, for the incumbent private company, it holds that $\pi_{PRI}^{Monopoly,RTM} > \pi_{PRI}^{Duopoly,EB}$.*

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[13] The main difference resides in the fact that we cannot assign under EB a value of the minimum wage equal to zero, otherwise the private firm is priced out of the market, see eq. (50)

Table 2 Numerical simulations, EB agenda

Block 1 — Default values: a=10, rw=0.01, beta=0.5 (10, 0,01, 0,5); EB Duopoly m=0 (0)

	w0	w1	q0	q1	p	EB Duopoly profits (private company)	EB Duopoly objective (public company)	SW mixed duopoly EB	SW private monopoly RTM	RTM Monopoly profits (private company)	SW monopoly RTM (public company)
b=0	0	0,01	0,01	18,54494	0,713266762	0,370899	0,259462231	96,41820021	96,41820021	73,04882737	49,01960784	96,15384615
b=.1	0,1	0,038028	0,061	18,54494	0,713266762	0,370899	0,233516008	86,75302859	86,75302859	60,45036715	44,11764706	87,41258741
b=.2	0,2	0,066041	0,112	18,54494	0,713266762	0,370899	0,207569785	77,09304621	77,09304621	50,86184801	39,21568627	80,12820513
b=.3	0,3	0,094039	0,163	18,54494	0,713266762	0,370899	0,181623562	67,43825308	67,43825308	43,39477989	34,31372549	73,96449704
b=.4	0,4	0,122021	0,214	18,54494	0,713266762	0,370899	0,155677339	57,78864919	57,78864919	37,46596678	29,41176471	68,68131868
b=.5	0,5	0,149989	0,265	18,54494	0,713266762	0,370899	0,129731116	48,14423455	48,14423455	32,67973856	24,50980392	64,1025641
b=.6	0,6	0,177941	0,316	18,54494	0,713266762	0,370899	0,103784893	38,50500915	38,50500915	28,75997213	19,60784314	60,09615385
b=.7	0,7	0,205879	0,367	18,54494	0,713266762	0,370899	0,077838669	28,87097299	28,87097299	25,5092199	14,70588235	56,56108597
b=.8	0,8	0,233801	0,418	18,54494	0,713266762	0,370899	0,051892446	19,24212608	19,24212608	22,78326	9,803921569	53,41880342
b=.9	0,9	0,261708	0,469	18,54494	0,713266762	0,370899	0,025946223	9,61846842	9,61846842	20,4747588	4,901960784	50,60728745
b=.10	1	0,289601	0,52	18,54494	0,713266762	0,370899	0,00	0,00	0,00	18,50249904	0,00	48,07692308

Block 2 — Default values: a=10, rw=.5, beta=0.5 (10, 0,5, 0,5); EB Duopoly m=0 (0)

	w0	w1	q0	q1	p	EB Duopoly profits (private company)	EB Duopoly objective (public company)	SW mixed duopoly EB	SW private monopoly RTM	RTM Monopoly profits (private company)	SW monopoly RTM (public company)
b=0	0	0,5	0,5	5,454545	3,636363636	5,454545	13,2231405	48,76033058	48,76033058	31,25	25	33,33333333
b=.1	0,1	0,659444	0,6	5,454545	3,636363636	5,454545	11,90082645	42,69421488	42,69421488	26,85950413	22,5	30,3030303
b=.2	0,2	0,81	0,7	5,454545	3,636363636	5,454545	10,5785124	36,89256198	36,89256198	23,4375	20	27,77777778
b=.3	0,3	0,951667	0,8	5,454545	3,636363636	5,454545	9,256198347	31,3553719	31,3553719	20,71005917	17,5	25,64102564
b=.4	0,4	1,084444	0,9	5,454545	3,636363636	5,454545	7,933884298	26,08264463	26,08264463	18,49489796	15	23,80952381
b=.5	0,5	1,208333	1	5,454545	3,636363636	5,454545	6,611570248	21,07438017	21,07438017	16,66666667	12,5	22,22222222
b=.6	0,6	1,323333	1,1	5,454545	3,636363636	5,454545	5,289256198	16,33057851	16,33057851	15,13671875	10	20,83333333
b=.7	0,7	1,429444	1,2	5,454545	3,636363636	5,454545	3,966942149	11,85123967	11,85123967	13,84083045	7,5	19,60784314
b=.8	0,8	1,526667	1,3	5,454545	3,636363636	5,454545	2,644628099	7,636363636	7,636363636	12,73148148	5	18,51851852
b=.9	0,9	1,615	1,4	5,454545	3,636363636	5,454545	1,32231405	3,685950413	3,685950413	11,77285319	2,5	17,54385965
b=.10	1	1,694444	1,5	5,454545	3,636363636	5,454545	0,00	0,00	0,00	10,9375	0,00	16,66666667

Block 3 — Default values: a=10, rw=0.01, beta=0.5 (10, 0,01, 0,5); EB Duopoly m=0.5 (0,5)

	w0	w1	q0	q1	p	EB Duopoly profits (private company)	EB Duopoly objective (public company)	SW mixed duopoly EB	SW private monopoly RTM	RTM Monopoly profits (private company)	SW monopoly RTM (public company)
b=0	0	0,01	0,01	18,54494	0,713266762	0,370899	0,259462231	96,41820021	96,41820021	73,04882737	49,01960784	96,15384615
b=.1	0,1	0,066063	0,061	18,54494	0,713266762	0,370899	0,233516008	86,76470439	86,76470439	62,47597078	44,11764706	87,41258741
b=.2	0,2	0,122112	0,112	18,54494	0,713266762	0,370899	0,207569785	77,11380319	77,11380319	54,26598744	39,21568627	80,12820513
b=.3	0,3	0,178145	0,163	18,54494	0,713266762	0,370899	0,181623562	67,46549661	67,46549661	47,74563265	34,31372549	73,96449704
b=.4	0,4	0,234163	0,214	18,54494	0,713266762	0,370899	0,155677339	57,81978466	57,81978466	42,46796758	29,41176471	68,68131868
b=.5	0,5	0,290166	0,265	18,54494	0,713266762	0,370899	0,129731116	48,17666732	48,17666732	38,12636166	24,50980392	64,1025641
b=.6	0,6	0,346154	0,316	18,54494	0,713266762	0,370899	0,103784893	38,53614462	38,53614462	34,50445742	19,60784314	60,09615385
b=.7	0,7	0,402127	0,367	18,54494	0,713266762	0,370899	0,077838669	28,89821653	28,89821653	31,44585061	14,70588235	56,56108597
b=.8	0,8	0,458085	0,418	18,54494	0,713266762	0,370899	0,051892446	19,26288306	19,26288306	28,83306344	9,803921569	53,41880342
b=.9	0,9	0,514028	0,469	18,54494	0,713266762	0,370899	0,025946223	9,63014422	9,63014422	26,58523623	4,901960784	50,60728745
b=.10	1	0,569956	0,52	18,54494	0,713266762	0,370899	0,00	0,00	0,00	24,62995002	0,00	48,07692308

Block 4 — Default values: a=10, rw=0,5, beta=0.5 (10, 0,5, 0,5); EB Duopoly m=0.5 (0,5)

	w0	w1	q0	q1	p	EB Duopoly profits (private company)	EB Duopoly objective (public company)	SW mixed duopoly EB	SW private monopoly RTM	RTM Monopoly profits (private company)	SW monopoly RTM (public company)
b=0	0	0,5	0,5	5,454545	3,636363636	5,454545	13,2231405	48,76033058	48,76033058	31,25	25	33,33333333
b=.1	0,1	0,823333	0,6	5,454545	3,636363636	5,454545	11,90082645	43,2892562	43,2892562	27,89256198	22,5	30,3030303
b=.2	0,2	1,137778	0,7	5,454545	3,636363636	5,454545	10,5785124	37,95041322	37,95041322	25,17361111	20	27,77777778
b=.3	0,3	1,443333	0,8	5,454545	3,636363636	5,454545	9,256198347	32,74380165	32,74380165	22,92899408	17,5	25,64102564
b=.4	0,4	1,74	0,9	5,454545	3,636363636	5,454545	7,933884298	27,66942149	27,66942149	21,04591837	15	23,80952381
b=.5	0,5	2,027778	1	5,454545	3,636363636	5,454545	6,611570248	22,72727273	22,72727273	19,44444444	12,5	22,22222222
b=.6	0,6	2,306667	1,1	5,454545	3,636363636	5,454545	5,289256198	17,91735537	17,91735537	18,06640625	10	20,83333333
b=.7	0,7	2,576667	1,2	5,454545	3,636363636	5,454545	3,966942149	13,23966942	13,23966942	16,86851211	7,5	19,60784314
b=.8	0,8	2,837778	1,3	5,454545	3,636363636	5,454545	2,644628099	8,694214876	8,694214876	15,81790123	5	18,51851852
b=.9	0,9	3,09	1,4	5,454545	3,636363636	5,454545	1,32231405	4,280991736	4,280991736	14,88919668	2,5	17,54385965
b=.10	1	3,333333	1,5	5,454545	3,636363636	5,454545	0,00	0,00	0,00	14,0625	0,00	16,66666667

Legend: see Tab.1 (except for rw=0.01 instead of rw=0).

The reason for the result in Remark 3 is that the private company suffers the competition of the public one, competition which is highly intensive under EB because the overall social welfare, which is the objective of the potential public entrant, is directly linked to the overall output in the economy.

d) EB prevalent agenda, incumbent public company, entrant private company

Remark 4 *In the presence of a monopoly with threat of market entry, if the incumbent is a public company and the potential entrant a private company, then the incumbent can use the RTM agenda as entry deterrence mechanism. In fact, there is a*

threshold value of the union bargaining power b^{T} such that, for $b^{\mathrm{T}} \leq b$,
$SW_{PUB}^{Monopoly,RTM} > SW_{PUB}^{Duopoly,EB}$ *as the yellow boxes in Table 2 reveal.*

The finding in Remark 4 is antipodal to the result in Remark 1. In fact, if the labour market is formerly characterized by the EB institution, a public incumbent may strategically commit to the RTM agenda to deter entry provided that the union bargaining power is sufficiently high. This result is somewhat striking because, in principle, a public company should not be interested in introducing an entry barrier. However, Remark 4 indicates that the incumbent public company has an interest in committing to RTM because the entry of a private competitor under EB when the union power is high can be more detrimental to social welfare. A plausible rationale for this result is that, with an EB duopoly, the profits of the private entrant and the increase of the unions' utility are not large enough to compensate the consumers' losses, generated by the pass through effects of higher negotiated wages on the final product price.

As before, the reservation wage seems to drive this result more than the unions' "political" weight. However, now the role played by the reserve wage seems to be opposite with respect to that played in the case of prevalent RTM agenda for the private monopoly: the public firm may prevent entry more likely when the reservation wage is high (e.g. when manpower is relatively high skilled and there are sizable unemployment benefits). Our numerical simulations show that, for an identical reservation wage but diverse union political weight m, the threshold value of the unions' power that permits the public monopolist to switch toward the RTM agenda to prevent entry is similar: $b \in (0,.1)$ in scenarios 1 and 3; a value of $b \in (.4,.5)$ in scenario 2 and $b \in (.5,.6)$ in scenario 4. Those findings seem to suggest that an incumbent public company, in the presence of low reservation wages, by committing to the RTM agenda can virtually avoid the entrance of a private competitor in the industry.

6.3 Welfare considerations

With regard to social welfare, given that a private (public) monopolist can use the EB (RTM) agenda as a deterrence tool in the presence of threat of entry, it is of crucial interest to check whether the private (public) monopoly with EB (RTM) can be socially more preferable than the mixed public/private duopoly with RTM (EB). The results of the numerical simulations in Table 1 (RTM prevalent industry agenda) unequivocally shows that $SW^{Mixed\ Duopoly,RTM} > SW^{Private\ Monopoly,EB}$: a mixed duopoly with the RTM agenda is socially preferable. On the other hand, the findings in Table 2 (EB prevalent industry agenda) shows that $SW^{Public\ Monopoly,RTM} \overset{>}{\underset{<}{=}} SW^{Mixed\ Duopoly,EB}$ *if* $b \overset{>}{\underset{<}{=}} b^{\mathrm{T}}$. Those observation have the following direct consequence in terms of policy:

Remark 5 *From a social point of view, if the prevalent bargaining agenda in the industry is RTM, the entry of a private competitor in the industry where an incumbent public company operates is always welfare superior than have a monopoly with a private incumbent. Conversely, if the prevalent bargaining agenda in the industry is EB, the entry of a private competitor in the industry where a public incumbent operates can be welfare beneficial only if the unions are adequately weak.*

In other words, there can be a well-grounded rationale for public intervention in sectors of the economy under risk of monopolization. Therefore, the findings of the present work have a striking impact on the governments' decision-making proceedings and antitrust authorities activities. In fact, before designing and implementing any intervention to regulate product and labour markets, the aspects stressed in our study suggest that those institutions should 1) consider the nature of the product market in the industry; and 2) take into account the bargaining framework and the practices there in place.

7. Conclusions

The present paper has investigated a key aspect of labour union-firm management relations, that is the choice of the bargaining agenda in the context of a public/private unionised monopoly and the role of alternative agendas on the market entry. The paper has concentrated the attention on the impact of different bargaining agendas, namely RTM and EB, on profits and the overall social welfare. Our analysis has found that the RTM is the preferred way negotiation agenda both for the private and the public company.[14]

In particular, we have found that wages are identical under RTM and EB, the profits are always higher under RTM, and the union's utility and consumer' surplus are higher under EB, irrespective of whether the industry is characterized by a private or a public monopoly. Moreover, social welfare is higher in the case of public monopoly, while in the case of private monopoly it can be higher under RTM provided that the union's weight is sufficiently low and the reservation wage and union bargaining power high enough. Noteworthy, we also find that private monopoly is socially preferred to the public one and conflict of interests on the preferred agenda arises between Government on one side and workers and consumers on the other side.

We have also analysed the issue of market entry under committed bargaining , where the entrant "join the pack" and follows the industry practice. We have found that the public (private) monopolist may commit to the RTM (EB) agenda to deter the entry of a potential private (public) competitor. In other words, the incumbent may strategically use the agenda as a deterrence tool. In detail, if RTM is the bargaining agenda in place, a public incumbent company cannot switch to the EB agenda to

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[14] This result is not self-evident for the case of public monopoly because it maximizes the social welfare and consumers and workers would prefer EB.

deter the entry of a private competitor. On the other hand, an incumbent private company can use the EB agenda to deter market the entry of a public company, if the union bargaining power is lower than a threshold value. An antipodal result holds if the EB agenda is the established practice in the industry. In this case, the incumbent private company cannot use the RTM agenda to deter the entry of a public competitor. However, an incumbent public company can change to the RTM agenda to deter the entry of a potential private competitor, if the union bargaining power is higher than a threshold value. Thus, also the RTM agenda can be used as an entry deterrence tool. The implications of our findings are far-reaching. If the prevalent bargaining agenda in the industry is RTM, to introduce a privately owned competitor in a publicly monopolised sector is more welfare beneficial for the society than give *a priori* the opportunity to form a private monopoly. On the contrary, if the prevalent industry agenda is EB, to introduce a privately owned competitor in a publicly monopolised sector can be welfare beneficial only if the unions are relatively weak.

To facilitate analytical tractability, the model presents some limitations. For example, we have used specific functional forms to define the demand schedule and the union utility. We have considered only quantity competition and homogenous goods in the product market. The findings in the paper are also far from being exhaustive. A direct step would be to develop the research toward price competition and heterogeneous products. Moreover, the strength of the present results can be verified in an extended game framework where also R&D investments, managerial delegation, externalities in consumption, and capacity choices are taken into account.

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