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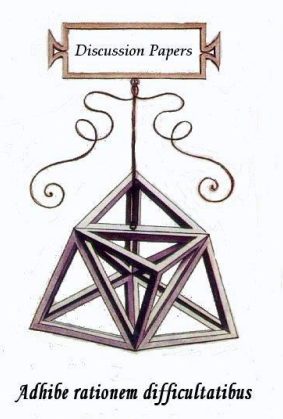

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A GAME-THEORETIC APPROACH TO THE CHOICE OF UNION-OLIGOPOLY BARGAINING AGENDA

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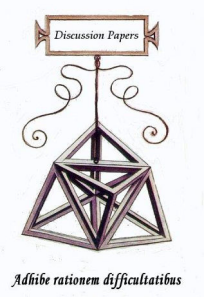


Domenico Buccella and Luciano Fanti

A game-theoretic approach to the choice of union-oligopoly bargaining agenda

Abstract

This paper investigates the selection of the bargaining agenda in a unionized industry with decentralized negotiations for different competition modes. The firms choose the agenda (Right-to-Manage, RTM vs. Efficient Bargaining, EB), considering alternative timing of the bargaining game in the case of mixed duopoly. In fact, the EB (RTM) firm can be either Stackelberg wage follower (leader) or Stackelberg output leader (follower). It is developed a two-stage game in which the typology as well as the timing of the negotiations is endogenous. It is shown that, in pure strategies, no equilibria arise for a wide set of the parameters' space while RTM appears as the unique equilibrium agenda for a different, large combination of the parameters; moreover, multiple, asymmetric equilibria emerge in a limited area of the parameters' space. These results are in sharp contrast to the received literature in which EB can arise as an industry bargaining institution in equilibrium.

Keywords: Efficient Bargaining; Right-to-Manage; Union–oligopoly bargaining agenda.
JEL classification: J51; L20

1. Introduction

Empirical and anecdotal evidence supports the idea that unionization and imperfectly competitive markets go hand in hand. As Booth (1995) recognizes, “It appears to be an empirical regularity that imperfections in the labor market are correlated with imperfections in the product market”. Moreover, the presence of unionized labor markets, the related bargaining institutions, as well as the degree of competition play a vital role in determining the organizational shape of an industry. These subjects assume extreme importance for economists, policymakers and antitrust authorities, in particular for the proper design and implementation of labor, industrial and regulatory policies.

In this framework, the issue of the union(s)-firm(s) bargaining scope is notably relevant. The most commonly detected bargaining models in the real world are, on the one hand, the right-to-manage (RTM) model (e.g. Nickell and Andrews, 1983) in which unionized labor and firms negotiate only wages; and, on the other hand, the efficient bargaining (EB) model (e.g. McDonald and Solow, 1981) in which the firms and unions bargain simultaneously over wages and employment levels.

The analysis of the more profitable bargaining agenda in unionised industries has been first analysed by Dowrick (1990). As reported in the International Handbook of Trade Unions, that author finds “that profits under the right-to-manage (RTM) model exceed those under efficient bargaining (EB)” (Naylor, 2003, p.59). Moreover, this result with regard to the RTM agenda is valid irrespective of whether simultaneous or sequential EB (SEB) are considered: “under unionised monopoly, the firm will prefer to keep employment off the bargaining agenda, whatever the degree of union influence over employment. In other words, the right-to-manage outcome generates higher profits than either the efficient or sequential bargains, for a given level of union influence over the wage” (Naylor, 2003, p.61).

At the current stage, these findings represent the benchmark of the literature on the negotiation agenda between firms and unions. However, it should be noted that those results can be dramatically altered once a more robust analysis conducted in terms of a “game-theoretic approach” is applied. For instance, using this “game-theoretic approach”, Fanti and Buccella (2017) have extended the

analysis of the Handbook as regards the choice of the agenda introducing the SEB model (Manning, 1988a,b). Nonetheless, those authors have restricted the study to 1) the case of quantity competition and 2) without considering a game on the timing of the negotiations.

The question is not whether RTM or EB are more profitable for firms when exogenously compared between them (as made by most of the established literature) as much as whether the strategic interaction between firms leads to a robust equilibrium in a "game-theoretic" sense. This paper contributes to knowledge in the bargaining agenda issue, being the first paper to look the possibility that the timing of the agenda's moves influences the occurrence (if any) of an equilibrium agenda,

In fact, the received economic literature has not dealt with the natural possibility that, in the presence of the EB arrangement in mixed oligopoly, also the timing of the negotiations is a decisional variable at the discretion of firms. More precisely, the EB firm in mixed duopoly can be either Stackelberg wage follower or Stackelberg output leader. To date, the timing of the game of a EB firm against a rival RTM has been always assumed as exogenously given. If the timing of the game is endogenous, the game passes from a 2x2 (two choice variables for each player) to a 3x3 structure of the payoff matrix (three choice variable for each player). Therefore, making use of this correct game-theoretic approach in the presence of a conjectural variation (CV) model, the current paper studies how the interaction between alternative bargaining arrangements, and the impact of different degrees of market competition on the firms' endogenous preferences over the negotiation agenda in a duopoly industry. Thus, the work aims to answer the following research question. If firms can strategically select the bargaining scope, what is the effect of a not univocal specification of the game rules in the case of EB on the endogenous selection of the agenda?

The change from a 2x2 to a 3x3 structure with the endogenous choice of the timing dramatically alters the solutions of the game. New and somehow disquieting results emerges. In fact, a first striking result is that, for a large set of the parameters' space (union bargaining power and conjectural parameter) no equilibria arise in pure strategies. On the other hand, RTM emerges as the unique equilibrium agenda first in the presence of high competition and lower unions' bargaining power and then, as the unions' strength

increases, for a wider range of the conjectural parameter. Moreover, multiple, asymmetric equilibria emerge in a small area of the parameters' space characterized by concurrent collusive firms' behavior and significantly high bargaining power. Finally, in contrast to the received literature, the EB agenda disappears as sub-game perfect equilibrium. Thus, these findings seems to suggest that authorities and policymakers needs to intervene in labor market regulations to fix the specification of the timing in negotiations to guarantee the existence of a "common bargaining practice" in the industry.

The paper contributes to a line of research in the literature dealing with the analysis of the bargaining scope and selection of union-oligopoly negotiation agendas, and represented by Bughin (1999), Petrakis and Vlassis (2000), Vannini and Bughin (2000), Kraft (2006), Buccella (2011) and, more recently, Fanti (2014; 2015), Buccella and Fanti (2015) and Fanti and Buccella (2017).

The rest of the note is organized as follows. Section 2 reviews the related literature. Section 3 develops the model and derives the results. Section 4 closes with a brief discussion.

2. A review of the literature

Petrakis and Vlassis (2000) focus on the possibility of an agreement between firms and unions on the bargaining agenda. The rules of the game are peculiar. At stage 1 each firm/union unit simultaneously decides on the bargaining agenda which can be 1) EB, if there is a consensus by the firm and its union; or 2) RTM, if the firm poses a veto on the inclusion of employment in the agenda. At stage 2, the EB firm implements its employment level while the RTM firm chooses its employment taking into account the rival's choices. Given these hypotheses, the main results are that universal (all firms adopting) EB can never arise as the industry bargaining practice in pure strategy equilibrium; on the other hand, either RTM is universally selected only if the unions' bargaining power is adequately large, or a mixed duopoly equilibrium (one firm selects RTM, the rival EB) if their power is sufficiently low. In the same vein, Kraft (2006) assumes that the EB firm is Stackelberg wage follower in the product market. However, in contrast to Petrakis and Vlassis (2000), that author draws the conclusion that EB is the dominant strategy for firms but firms are cast into a "prisoner's dilemma" situation concerning profits.

Under the assumption that the EB firm in mixed oligopoly is Stackelberg wage follower, Bughin (1999) considers the issue of the strategic selection of the bargaining agenda first in a given duopoly, and then in a monopoly with the threat of entry. Using a CV model, Buccella (2011) revisits Bughin's (1999) and derives the following sub-game perfect Nash equilibria (SPNE) agendas: no matter the degree of competitiveness of the industry, the RTM model is the SPNE 1) in a given duopoly with committed bargaining; and 2) in a given duopoly with flexible bargaining, also in presence of potential entry. Likewise, Fanti (2014) investigates this subject in a duopoly and remarks that the previous results depend crucially on the hypothesis that, in the case of mixed duopoly the timing of the game is as follows (denoted as EB1). In the first stage, the RTM firm and its union negotiate the wage; then, in the second stage, the RTM firm selects employment, and the EB firm simultaneously bargains with its union wage and employment levels.

In an Cournot duopoly framework, Vannini and Bughin (2000) focus on the firms' decision whether to adopt a cost-raising strategy via the recognition of labour unions. Those authors show that unionisation can generate vertical interdependence between the labour and the product markets, that firms can strategically exploit to raise profits. Nonetheless, the firms' profitability is crucially altered by the institutional features of the bargaining process, e.g. the structure and the scope. In particular, Vannini and Bughin (2000) show that, under precise conditions (low union power, low product differentiation, centralised bargaining, EB firm Stackelberg wage follower), firms can prefer EB rather than RTM negotiations, although higher wages.

However, as Buccella (2011) points up, and Fanti (2015), Fanti and Buccella (2015), and Buccella and Fanti (2017) study, it is possible to specify an alternative timing for the game (denoted as EB2): in the first stage, the EB firm and its union concurrently bargain wage and employment levels while the RTM firm and the respective union negotiate the wage; in the second stage, the RTM firm selects its employment level. This modification is not innocuous because different equilibria arise: the set of cases in which the equilibrium implies the selection of EB considerably increases. Thus, the equilibrium bargaining agenda in the industry is sensitive both to the scope and how negotiations are conducted, i.e. the rules and timeline of the game.

The analysis of the bargaining agenda is currently subject of renewed interest. Recent extensions have been devoted to the selection of the negotiation agenda in network industries (Fanti and Buccella, 2016a), in a context of international trade with strategic trade policy (Bandyopadhyay and Bandyopadhyay, 2001; Fanti e Buccella, 2016b), and in the presence of different union preferences toward wages (Fanti and Buccella, 2017). Nonetheless, all those contributions have abstracted from the game-theoretically founded choice of the timing of the bargaining model.

3. The model and the results

All the works described in the previous section scrutinize 2x2 games in which firms can select RTM vis-à-vis either EB1 or EB2. This paper makes a step further: it builds a 3x3 game with a CV model in which firms can negotiate under RTM, EB1 and EB2, making endogenous the choice of the timing.
Consider a duopoly market where firms 1 and 2 compete for homogeneous goods with labor unique factor of production. A constant returns-to-scale technology characterizes the industry, in such a way that one unit of labor, l, is needed for one unit of the output, q. The linear (inverse) market demand is

$$p = 1 - Q \tag{1}$$

where p denotes the price and $Q = \sum_i q_i = \sum_i l_i,\ i = 1,2$, is the total production. Firm's profits are

$$\Pi_1 = (1 - Q - w_1)l_1 \tag{2}$$

$$\Pi_2 = (1 - Q - w_2)l_2 \tag{3}$$

for firm 1 and 2, respectively. The model assumes that the firms decide their production levels according to a Conjectural Variation model (see De Fraja, 1993). Thus define $\phi \in (-1,1)$ as $\phi = dq_j(q_i)/dq_i$: if $\phi = 0$, the model collapses in the Cournot model; for $\phi > 0$, the firms act in a more collusive way, whereas for $\phi < 0$ the industry is more competitive. Both firms are unionized.

Table 1: Unionized duopoly firms' outcomes, alternative timing of the game.

Firm 2 → Firm 1 ↓	RTM	EB 1 (RTM Stackelberg Follower Product market)/ (EB Stackelberg Follower)	EB 2 (RTM Stackelberg Wage Leader)/(EB Stackelberg Leader)
RTM	$\frac{(2-\alpha)^2(1+\phi)(2+\phi)^2}{(2\phi+4-\alpha)^2(3+\phi)^2}; \frac{(2-\alpha)^2(1+\phi)(2+\phi)^2}{(2\phi+4-\alpha)^2(3+\phi)^2}$	$\frac{(1+\phi)^3(2-\alpha)^2}{(2+\phi)^2[4(1+\phi)+\alpha]^2}; \frac{[2(1+\phi)+\alpha][(2+\phi)\alpha^3+(4\phi^2+12\phi+10)\alpha^2+(4\alpha-16)(1+\phi)^2]}{2(2+\phi)(4+\alpha)[4(1+\phi)+\alpha]^2}$	$\frac{(2-\alpha)^2(1+\phi)}{4(3+\phi)^2}; \frac{(1-\alpha)(1+\phi)(2\phi+\alpha+4)^2}{4(3+\phi)^2(2+\phi)^2}$
EB 1 (RTM Stackelberg Follower Product market)/(EB Stackelberg Follower)	$\frac{[2(1+\phi)+\alpha][(2+\phi)\alpha^3+(4\phi^2+12\phi+10)\alpha^2+(4\alpha-16)(1+\phi)^2]}{2(2+\phi)(4+\alpha)[4(1+\phi)+\alpha]^2}; \frac{(1+\phi)^3(2-\alpha)^2}{(2+\phi)^2[4(1+\phi)+\alpha]^2}$	$\frac{(1-\alpha)(1+\phi)}{(3+\phi)^2}; \frac{(1-\alpha)(1+\phi)}{(3+\phi)^2}$	$\frac{(1-\alpha)(1+\phi)}{4(2+\phi)^2}; \frac{(1-\alpha)(1+\phi)}{4(2+\phi)}$
EB 2 (RTM Stackelberg Wage Leader))/(EB Stackelberg Leader)	$\frac{(1-\alpha)(1+\phi)(2\phi+\alpha+4)^2}{4(3+\phi)^2(2+\phi)^2}; \frac{(2-\alpha)^2(1+\phi)}{4(3+\phi)^2}$	$\frac{(1-\alpha)(1+\phi)}{4(2+\phi)}; \frac{(1-\alpha)(1+\phi)}{4(2+\phi)^2}$	$\frac{(1-\alpha)(1+\phi)}{(3+\phi)^2}; \frac{(1-\alpha)(1+\phi)}{(3+\phi)^2}$

Unions maximize the following objective function:

$$\Omega_i = w_i l_i . \tag{4}$$

The bargaining structure in the industry is decentralized at the firm level. The bargaining solution is modelled by the following generalized Nash Product

$$NP = (\Omega_i)^{\alpha}(\Pi_i)^{1-\alpha}, \tag{5}$$

where the parameter $\alpha \in (0,1)$ measures the parties' relative strength, assumed identical across bargaining units. The game is solved by backward induction to derive the sub-game perfect Nash equilibria. The sequence of moves is the following. Each firm selects its bargaining agenda, EB or RTM. The wage and employment levels are simultaneously negotiated in the case of EB; or wages are negotiated before the output decisions in the case of RTM. When both firms select EB, it emerges a situation where one firm acts as the leader while the rival acts as the follower. With respect to the mixed duopoly (firm i chooses EB, the rival j selects RTM), the timing of the game can be as follows:

mixed case 1 (EB1) (Bughin, 1999; Buccella, 2011; Fanti, 2014): Stage 1: Firm j and Union j bargain over the wage. Stage 2: Firm j chooses employment and Firm i and Union i bargain over wage and employment. With this timing, Firm i and Union i, when bargaining over wage and employment, can observe the wage that resulted from bargaining between Firm j and Union j. In this case, firm i acts as Stackelberg wage follower, $i, j = 1,2,\ i \neq j$;

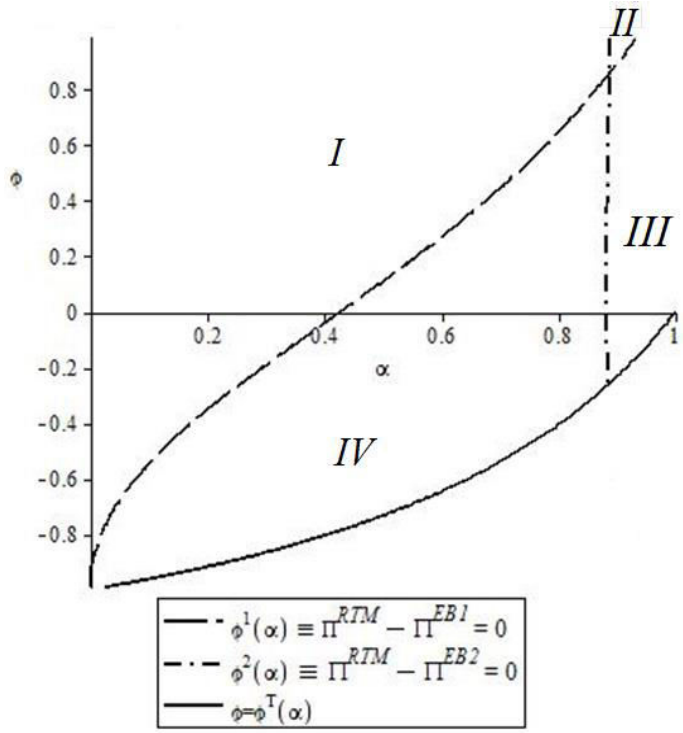
mixed case 2 (EB2) (Fanti, 2015; Buccella and Fanti, 2015): Stage 1: Firm i and Union i bargain over wage and employment while Firm j and Union j bargain over the wage. Stage 2: Firm j chooses employment. With this timing, Firm j when chooses output can observe the wage and employment that resulted from bargaining between Firm i and Union i. In this case, firm i is Stackelberg output leader, $i, j = 1,2,\ i \neq j$.

Using equations (2)-(4) and solving the Nash Product in equation (5), direct computations allow to obtain the expressions in Table 1. With the firms' payoffs in Table 1, it is possible to construct Figure 1. The non-negativity condition on profits implies that $\Pi_i \geq 0$. However, it can be verified that under EB2,

$$\Pi_i^{\mathrm{EB2,RTM}} \geq 0 \Rightarrow \phi^T(\alpha) > \frac{\alpha^3 + 12\alpha^2 + 8\alpha - 32 + \sqrt{\alpha^6 - 8\alpha^5 - 32\alpha^4 + 32\alpha^3 + 128\alpha^2}}{8(4 - \alpha - \alpha^2)}$$

while $\Pi_i^{\mathrm{EB2,RTM}} < 0 \Rightarrow \phi \leq \phi^T(\alpha)$, where the first upper script denotes the agenda selected by firm i while the second upper script refers to the rival firm j's choice. If firm 1 selects RTM negotiations, firm 2 best-reply is RTM if $\phi \geq \phi^1(\alpha)$, while it chooses EB1 if $\phi < \phi^1(\alpha)$. On the other hand, if firm 1 plays EB1, firm 2 replies RTM if $\phi \geq \phi^2(\alpha)$ while it chooses EB2 if $\phi < \phi^2(\alpha)$. Finally, if firm 1 chooses EB2, firm 2 unequivocally replies RTM. Given symmetry, an identical reasoning applies for the strategic choices of firm 2. Those firms' strategic moves generate four regions.

Figure 1: Duopoly profits in the (α, ϕ) *– space*

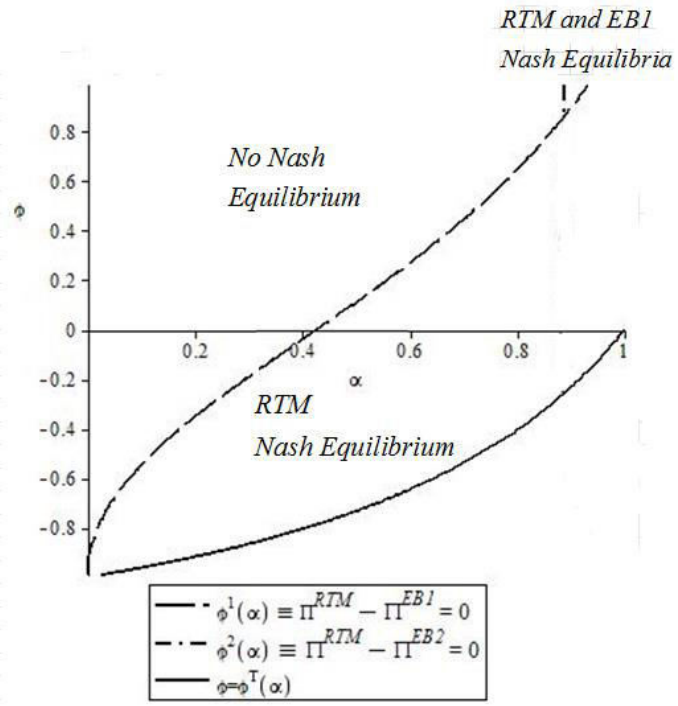


In region I, when firm 1 plays RTM, firm 2 replies EB1. However, when firm 2 plays EB1, in that area the firm 1's best reply is EB2. As a consequence, in region I no Nash Equilibrium arises. In region II, when firm 1 plays RTM, firm 2 again replies EB1. However, in this area, when firm 2 plays EB1, firm 1's best reply is RTM. Thus, multiple asymmetric equilibria emerge. In region III, RTM is the best reply for firms whatever is the strategic choice of the rival: RTM is the dominant strategy. In region IV, RTM is a mutual best response for firms; therefore, RTM is the Nash equilibrium. Proposition 1 summarizes these findings.

Proposition 1 *Under the conjectural variation model, in a 3x3 game in which firms strategically choose the bargaining agenda (RTM, EB1 and EB2): a) in the set* $(\phi \in (\alpha = 0) \,|\, -1 < \phi < 1) \cup \phi \in \phi^1(\alpha) \,|\, 0 \le \alpha < \approx .883 < \phi \le \phi \in \phi^2(\alpha) \,|\, \approx .887 \le \alpha < \approx .888)$ *, there are No Nash Equilibria; b) in the set* $\phi \in \phi^2(\alpha) \,|\, \approx .887 \le \alpha < \approx .888) < \phi < \phi \in \phi^1(\alpha) \,|\, .883 \le \alpha < 1$ *multiple asymmetric RTM/EB1 equilibria arise; and c) in the parameters' set* $\phi^T(\alpha) \le \phi \le \phi^1(\alpha)$ *, RTM is the unique Nash equilibrium of the game.*

Figure 2 graphically shows the game equilibria in the $(\alpha,\phi)-$space. The non-trivial result of no Nash equilibria in a relevant area of the economy's feasible set in Proposition 1 is in sharp contrast to the existing literature that considers 2x2 games. In fact, in a 2x2 game characterized by EB1, Buccella (2011) and Fanti (2014a, Appendix) show that the RTM model is the dominant strategy for firms. Therefore, if the duopolists have the right to select the negotiation agenda, RTM arises as
the unique equilibrium, regardless of the degree of competitiveness of the industry. On the other hand, in a 2x2 game characterized by EB2, Fanti (2015) and Fanti and Buccella (2015) find that in a Cournot duopoly as regards firms, RTM is the unique equilibrium for high values of the union bargaining power; for intermediate values, multiple symmetric equilibria arise in which both firms opt either for RTM or EB while, when the unions are sufficiently weak, the EB becomes the unique equilibrium agenda. Making use of a conjectural variation model with EB2, Buccella and Fanti (2015) further extend the results of Fanti and Buccella (2015). Those authors show that EB is the

Figure 2: Game Equilibria in the $(\alpha,\phi)-$ *space*



unique equilibrium for almost all the degree of market competition when the unions are extremely weak. When the unions' bargaining power increases, both RTM and EB arise as equilibria of the game

for large degrees of market competition while EB is the unique equilibrium in the presence of collusive-like behaviours Finally, if the union is strong, RTM emerges as the unique equilibrium.
Therefore, these findings may provide with an useful insight for authorities and policy makers. Even if the bargaining parties have large degrees of freedom in the conduct of negotiations, a clear intervention in labor regulations is needed to set the rules of the timing to ensure the rise of a "common practice" in the industry, especially in the most observed and realistic cases in which the unions' power is not too high, and whenever firms tend to restrict market rivalry.

4. Conclusion

As known the issue of the bargaining agenda investigates how firms may strategically choose their bargaining agenda opting either for the RTM or the EB institution. However, in mixed duopoly, the specification of the timing of the game lead the firm which selects EB to act either as the Stackelberg wage follower (EB1) or the Stackelberg output leader (EB2). So far the literature has assumed either EB1 or EB2 as exogenously given. Consequently, the conclusions of the literature may appear assumption-dependent. In fact, depending on the exogenous hypotheses with regard to the timing, there are different economic parameters that qualifies either the RTM or the EB equilibrium. However, the timing itself is a decision variable that have to be taken into consideration in a correct game-theoretic approach. This paper shows that using this approach the results are surprising.
It is shown that, in a large area of the parameters' space, the game presents no equilibria in pure strategies. On the other hand, the RTM institution endogenously emerges as the unique equilibrium agenda with low unions' bargaining power and a high degree of competition and, as the unions' strength rises, for larger ranges of the CV parameter. In addition, a restricted area of the parameters' space characterized by collusive firms' behavior and extremely high bargaining power shows multiple, asymmetric equilibria. Moreover, the EB institution disappears as the industry bargaining institution in equilibrium, in contrast to what has recently established the received literature. Therefore, this result suggests that policymakers and antitrust authorities need to intervene in labor market

regulations to set the timing in negotiations in order to ensure that a "common bargaining practice" may emerge in the industry.
The present work has been built on precise assumptions. The intensity of competition in the product market, for instance, can be modeled by introducing product differentiation. Price competition à la Bertrand or à la Hotelling (1929) represent other extensions of the model. Moreover, with regard to the labor unions, different production technologies (e.g., decreasing returns to scale), and the introduction of a more general utility function to weight the preferences over wages and employment, are all elements requiring further analysis. This is left for future research.

Appendix

Mixed duopoly outcomes in Table 1

The analytical derivations of the outcomes concerning the mixed duopoly cases can be found for EB1 in Buccella (2011, Appendix), and for EB2 in Buccella and Fanti (2015, Appendix).

Stackelberg competition with the EB agenda

Assume that firm 1 is the follower while firm 2 the leader. Both firms bargain with their unions the EB agenda. Therefore, the maximization problem in equation (5) for the follower is

$$\max NP_1(w_1, q_1) = (w_1 q_1)^{\alpha} \left\{ \left[1 - q_1 - q_2(q_1) - w_1 \right] q_1 \right\}^{1-\alpha}. \tag{A.1}$$

First order conditions yield the following expressions

$$w_1 = \alpha[1 - q_1 - q_2(q_1)] \ (\textit{rent sharing curve}) \tag{A.2}$$

$$w_1 = 1 + [\alpha(1+\phi) - (2+\phi)]q_1 - q_2 \ (\textit{contract curve}) \tag{A.3}$$

where $\phi = dq_j(q_i)/dq_i$, is the conjectural parameter. Using (A.2) and (A.3), it follows that firm 1's reaction function is

$$q_1 = \frac{(1-q_2)}{2+\phi} \tag{A.4}$$

The leader, firm 2, in solving its bargaining problem, takes into account the follower optimal output response in the successive stage of the game. Therefore, the leader bargaining problem is to maximize

$$\max NP_2(w_2, q_2) = (w_2 q_2)^{\alpha}\left[\left(1 - q_2 - w_2 - \frac{(1-q_2)}{(2+\phi)}\right)q_2\right]^{1-\alpha} \tag{A.5}$$

First order conditions lead to

$$w_2 = \frac{\alpha[(1+\phi)(1-q_2)]}{(2+\phi)} \ (\textit{rent sharing curve}) \tag{A.6}$$

$$w_2 = \frac{(1+\phi)[1-(2-\alpha)q_2]}{(2+\phi)} \ (\textit{contract curve}) \tag{A.7}$$

Solving the system (A.6)-(A.7) for q_2, it is obtained

$$q_2 = \frac{1}{2} \tag{A.8}$$

Replacing (A.8) into (A.6), the leader equilibrium wage is

$$w_2 = \frac{\alpha(1+\phi)}{2(2+\phi)} \tag{A.9}$$

Finally, substitution of (A.8) into (A.4) leads to the follower's output level in equilibrium

$$q_1 = \frac{1}{2+\phi} \tag{A.10}$$

Direct substitutions of equations (A.8)-(A.10) into equations (A.2) allow deriving the follower wage level in equilibrium

$$w_1 = \frac{\alpha(1+\phi)}{2(2+\phi)} \tag{A.11}$$

identical to the leader's wage. Given (A.8)-(A.11), the equilibrium profits and union utilities are derived and reported in Table 1.

References

Bandyopadhyay, S. and Bandyopadhyay, S.C., 2001. Efficient bargaining, welfare and strategic export policy. *Journal of International Trade & Economic Development* 10(2), 133-149.

Booth, A.L., 1995. The Economics of the Trade Union. Cambridge (MA): Cambridge University Press.

Buccella, D., 2011. Corrigendum to "The strategic choice of union–oligopoly bargaining agenda [International Journal of Industrial Organization 17, 1029-40.]". International Journal of Industrial Organization 29, 690-93.

Buccella, D., Fanti, L., 2015. On the strategic choice of union–oligopoly bargaining agenda: Further results. Economics Research International, Vol. 2015, Article ID 530890, 7 pp.

Bughin, J., 1999. The strategic choice of union–oligopoly bargaining agenda. International Journal of Industrial Organization 17, 1029-40.

De Fraja, G., 1993. Staggered vs. synchronised wage setting in oligopoly. European Economic Review 37, 1507-22.

Dobson, P. W., 1997. Union–Firm Interaction and the Right to Manage. Bulletin of Economic Research 49(3), 213-229.

Dowrick, S. (1990). The relative profitability of Nash Bargaining on the labour demand curve or the contract curve. Economics Letters, 33(2), 121-125.

Fanti, L., 2014. When do Firms and Unions agree on a Monopoly Union or an Efficient Bargaining Arrangement? Discussion

Paper n. 181. Department of Economics and Management, University of Pisa.

Fanti, L., 2015. Union-Firm Bargaining Agenda: Right-to-Manage or Efficient Bargaining? Economics Bulletin 35(2), 936-948.

Fanti, L., Buccella, D., 2016a. Bargaining agenda and entry in a unionised model with network effects. Italian Economic Journal, 2(1), 91-121.

Fanti, L. and Buccella, D., 2016b. Strategic trade policy and union-firm bargaining agenda. The Journal of International Trade & Economic Development, *25*(6), 787-808.

Fanti, L., Buccella, D., 2017. Union-firm bargaining agenda revisited: When unions have distinct preferences. Bulletin of Economic Research, online first 13 February 2017, doi:10.1111/boer.12113.

Fanti, L., Buccella, D., 2017. Timing and the Selection of the Bargaining Agenda. In: Fanti, L.,(Ed.), *Oligopoly, Institutions and the Performance of the Firms*. Pisa: Pisa University Press (forthcoming).

Hotelling, H., 1929. Stability in competition. Economic Journal 39(153), 41–57.

Kraft, K., 2006. Wages versus Efficient Bargaining in oligopoly. Managerial and Decision Economics 27, 595–604.

Manning, A., 1987a. An Integration of Trade Union Models in a Sequential Bargaining Framework. The Economic Journal, 97, 121–139.

Manning, A., 1987b. Collective Bargaining Institutions and Efficiency. European Economic Review, 31, 168–176.

McDonald, I. M., Solow, R., 1981. Wage bargaining and employment. American Economic Review, 71(5), 896–908.

Naylor, R. A. (2003). Economic Models of Union Behavior. In: Addison J. T. – Schnabel, C. (eds): *International Handbook of Trade Unions*. Cheltenham: Edward Elgar, 44-85.

Nickell, S., Andrews, M., 1983. Unions, real wages and employment in Britain 1951–79. Oxford Economic Papers, 35, 183–206.

Petrakis, E., Vlassis, M., 2000. Endogenous Scope of Bargaining in a Union–Oligopoly Model: When Will Firms and Unions Bargain over Employment? Labour Economics 7, 261-81.

Vannini, S., and Bughin, J., 2000. To be (unionized) or not to be? A case for cost-raising strategies under Cournot oligopoly. European Economic Review, 44, 1763-81.

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