

(LOCAL) WAGE SETTINGS AND (INTERNATIONAL) ENTRY DETERRENCE

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Abstract

The present paper investigates the use of national wage settings as a mechanism to deter entry *via* foreign direct investment (FDI) in a unionized monopoly industry. A union which sets centralized wages in a multi-unit firm can both decentralize and change the agenda to prevent the market entry of a non-unionized firm. The adoption of the efficient bargaining agenda is especially effective to deter entry because it lowers the fixed-cost threshold the entrant can bear. Moreover, through side-payments, the incumbent and the union can have common interests in modifying the wage setting to reach outcomes that is Pareto-superior to duopoly. However, if the union cedes “too much power” and becomes “too weak”, internal conflicts with the incumbent firm may arise.

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1. Introduction

A clear understanding of the wage settings and, more generally, of the bargaining issues between a firm and its organized workforce is essential for the proper functioning of labour and product markets due to their strict interconnections. Notably, the wage setting process is central, not exclusively for labour markets, but also for the organization of production in the industries and the market of final goods. Moreover, as stressed in the economics literature, the choice of the negotiation agenda and unionization can serve as entry barriers in imperfectly competitive markets (Bughin, 1999; Buccella, 2011; Buccella and Fanti, 2015; Fanti and Buccella, 2015; Vannini and Bughin, 2000).

Those issues are relevant for the organized workforce. In recent years, a large number of companies in the EU, notably multinational enterprises (MNEs), have started to put into practice the opportunity of opting out from national/sector collective agreements when entering a new market. This can occur even if MNEs are unionized in their countries of origin, as is the case of Finnish and Norwegian MNEs in the Baltic states, giving rise to the phenomenon of cross-border “double-breasting” union (Eurofound, 2009). Another example can be seen in the commercial aircraft sector, where Airbus decided to set up a non-unionized plant in Alabama, USA (Reuters.com, 2012). Furthermore, in the automotive sector, Asian and European automakers are steadily expanding their non-union factories in North America (Reuters.com, 2013, 2015). In doing so, MNEs can hire non-unionized workers

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in local labour markets and eventually sign agreements with workers at the company level without the mediation of unions. Thus, the present work investigates how a labour union may use different wage settings to prevent a detrimental (from the union's perspective) entry of a non-unionized firm into a monopoly industry. The model proposed here can be rather flexible in its general interpretation; however, it especially fits with the analysis of the strategic use of wage settings by a national labour union to affect the entry decision *via* the foreign direct investment (FDI) of MNEs.

Within this context, it is evident that the scope of bargaining and the wage setting structure are crucial in the determination of the wage outcomes at the firm level. Broadly considered, negotiations can take place over wages only or regarding both employment levels and wages. The former refers to the right-to-manage (RTM) model (Nickell and Andrews, 1983; Dobson, 1997; Naylor, 2002; López and Naylor, 2004): the union and the firm negotiate wages, but once wages are set, the firm has the right to set them on employment levels. When the labour union has full bargaining power, the RTM model collapses into the monopoly union model (see Dunlop, 1944; Naylor, 1998, 1999; Haucap and Wey, 2004). On the other hand, the latter refers to the efficient bargaining (EB) model (McDonald and Solow, 1981; Espinosa and Rhee, 1989; Bughin, 1995, 1996): the firm and the union negotiate concurrently over wages and employment.

With regard to the wage setting/bargaining structure, there are different levels of centralization. Authors such as Davidson (1988), Horn and Wolinsky (1988a,b), Dowrick (1989), Bárcena-Ruiz and Garzón (2002), Petrakis and Vlassis (2000, 2004), Lommerud, Straume, and Sørsgard (2005), Kraft (2006), Mukherjee (2010), Symeonidis (2008, 2010), Mukherjee and Pennings (2011) and Fanti and Gori (2013) have examined the outcomes of different wage bargaining structures in oligopolies. De Fraja (1993), Dobson (1994) and Banerji (2002) further extend the analysis of sequential wage bargaining in unionized oligopolies. At the firm level, however, a distinction among plant and company-wide agreements should be done. Horn and Wolinsky (1988a) suggest that a firm would take strategic advantage of a multi-unit plant structure to prevent the creation of an encompassing union within the company. However, plant level unions may counter-react by coordinating their activities. This is the subject of the contributions of Buccella (2013a,b). Buccella (2013a) investigates the bargaining regimes arising as sub-game perfect equilibria in a multi-unit, monopoly firm in the presence of labour unions coordination activities. The work considers a sequential game in which the bargaining parties choose whether to coordinate wage negotiations. Wage coordination represents a fixed cost for the firm and the unions, and those costs may attenuate the conflict of interests concerning the centralization level at which negotiations should take place. Buccella (2013b) extends the previous work by introducing into the analysis *per* member variable transaction costs for labour unions in a framework of a multinational company operating across countries.

The present work investigates how a change in the labour union strategies at the firm level may affect the entry *via* the investment of a competitor, notably a foreign company. In doing so, the paper relates to Bughin and Vannini (1995), who examine the strategic investment by a multinational in a host country in the presence of unemployment generated by a union's bargaining power in wage negotiations. In the case of FDI, two sub-cases are considered: full unionization and partial unionization. In the case of full unionization, the local firm and the MNE are both unionized. In the case of partial unionization, the local producer is unionized; however, the MNE may set up a non-unionized production facility

and hire workers at the competitive wage. In the case of partial unionization, the labour demand of the MNE affects the competitive wage in the host country. Therefore, the union threat point during wage negotiations is affected. Given this framework, the authors show that, while full unionization deters the MNE from undertaking FDI, partial unionization increases the incentive for FDI, since union power in the rival's firm creates unemployment. This, in turn, lowers the competitive wage for the MNE, thus creating a cost advantage at the expense of the local producer.

From a different perspective, the issue of market entry deterrence in a unionized industry is considered by Bughin (1999), Buccella (2011), Buccella and Fanti (2015) and Fanti and Buccella (2015). Bughin (1999) focuses on the strategic selection of the bargaining agenda for different market structures (duopoly *vs.* monopoly with threat of entry) and constraints (committed *vs.* flexible bargaining) in a Cournot duopoly with firm-level, decentralized negotiations. Extending Bughin's (1999) framework to a conjectural variation model, Buccella (2011) shows that EB is the equilibrium agenda, without conflict of interests between the parties, only for entry deterrence reasons; in all other cases, conflicts of interest arise because of the difference in the parties' dominant strategies, regardless of the degree of competitiveness of the industry. Considering an alternative timing of the game with respect to Bughin (1999) and Buccella (2011), Buccella and Fanti (2015) show that a rich set of equilibrium outcomes can emerge, including multiple and even asymmetric equilibria (with regard to the union's preferences on the bargaining agenda). Moreover, the set of cases in which the selection of EB arises in equilibrium is substantially larger than in Buccella (2011).

Fanti and Buccella (2015) present a comprehensive framework which generalizes the results of Bughin (1999), Buccella (2011) and Buccella and Fanti (2015) for different timing of the bargaining process.

The present paper relates to the contributions of Bughin (1999), Buccella (2011), Buccella and Fanti (2015) and Fanti and Buccella (2015), as it copes with the analysis of the strategic choice of wage-setting issues as entry deterrence mechanisms in a unionized monopoly industry. However, the present work departs from the analysis of Bughin (1999), Buccella (2011) and Buccella and Fanti (2015) in different aspects. First, in contrast to Bughin (1999), Buccella and Fanti (2015), and Buccella (2011), in which the firms decide the agenda, and Fanti and Buccella (2015), in which the agenda is endogenously determined, the present paper considers the union having the power to set the wage-setting structures (centralized at the company level/decentralized at the plant level) and agendas (a monopoly union setting only wages/introduction also of employment in the negotiations) as a potential entry deterrence mechanisms. Second, the study introduces labour-decreasing returns, which, in turn, imply increasing marginal costs. Despite the fact that labour-decreasing returns are a common assumption in microeconomic modelling, their effects on union-firm bargaining have rarely been investigated. A notable exception is Borghijs and Du Caju (1999). Furthermore, Borghijs (2001) and Fanti and Meccheri (2011, 2012) introduce labour-decreasing returns in unionized duopoly models in the presence of monopoly unions having the power to fix wages unilaterally. Nonetheless, those works do not deal with the market entry analysis. Third, the incumbent is a multi-unit firm, therefore facilitating investigation of the effects of decentralized/centralized structures at the company level.

The primary findings of the paper are as follows. The labour union can use both decentralization of the wage setting and the inclusion of employment in the scope of bargaining (EB agenda) as deterrence tools for the entry of a non-unionized company

in the industry. However, the results show that the EB agenda is more effective than the decentralization with monopoly power in wage determination to prevent entry. This is so because, with the introduction of employment in the agenda, the incumbent firm is committed to producing a larger output than in the case of decentralized wage setting with the monopoly labour union. This implies a reduction of the price of the products and, therefore, a decreased profitability of market entry. Thus, the threshold level of the fixed cost that prevents the entry of the non-unionized market competitors decreases.

The rest of the paper is organized as follows. Section 2 presents the model and derives the analytical results for the centralized/decentralized structures in the presence of the monopoly union and the alternative centralized EB agenda. Section 3 summarizes the key findings and implications and suggests future directions of research within this topic.

2. The Model

This section develops a simple wage-setting model within a multi-unit firm. The model builds on the work of Borghijs and Du Caju (1999), and Buccella (2013a,b). In an economy, there is a monopolized industry in which a multi-unit firm that operates at two plants, denoted A and B, produces homogeneous goods. The two plants have the same technology; labour is the sole factor of production, with decreasing returns to scale due to, for example, organization of production and the complexity of management among plants. The labour supply is adequately large to avoid corner solutions. In this industry, a monopoly labour union operates; the workers of the monopolist are fully unionized. Therefore, the union has full power in setting the wage and fixes a uniform wage rate for all of the workers the monopolist hires.

Entry in the industry is modelled as a change from a monopoly to a duopoly market structure. In the case of entry, a potential entrant faces exogenous fixed costs G ; however, the entrant's workers do not finish under the umbrella of the labour union. This assumption would reflect the practice undertaken by several companies, mainly MNEs, of opting out from national/sector collective agreements in favour of company agreements not involving unions and, therefore, their ability to hire workers at the prevalent competitive wage in the labour market, when entering a new, foreign market (Eurofound, 2009).

The model is solved in the usual backward fashion. The game comprises two stages, and the sequence of moves is as follows. At the pre-stage, the potential entrant announces its entry intention in the monopolized industry. In the first stage, the union in the incumbent firm decides whether to modify the wage setting. In the case of modification, the union may choose between two options: either to move from the centralized to the decentralized wage setting,¹ or change its scope and introduce also employment into the negotiations, adopting, therefore, an EB agenda. In the last stage, if entry is allowed, the oligopoly firms engage

1 As Borghijs and Du Caju (1999) explain, when wages are fixed at the plant level, theoretically it may be that wages are different. With no transaction costs in the product market, the firm can move production without placing restrictions on the cheaper plant, until wages across plants are equalized. However, the process of moving the production from the more expensive plant to the cheaper one is limited and ends before the non-negativity constraint becomes binding. The rationale for this result is that every additional output unit that is shifted is increasingly expensive due to the decreasing returns to scale technology. As a consequence, wage competition between workers at the two plants is less severe than in the presence of constant returns to scale technology where, ultimately, the most expensive plant is shut down.

in Cournot competition and realize output; otherwise, the monopolist chooses the profit-maximizing quantities, and production is allocated between plants.

The production function for each plant is

$$q_i = l_i^{1/2} = \sqrt{l_i}, \quad i = A, B. \quad (1)$$

The choice of the specific technology in Equation 1 implies that each plant faces quadratic costs, which is a conventional example of increasing costs in the literature. Moreover, this specification allows to derive closed form solutions that, unfortunately, cannot be obtained with a more general form like $q_i = l_i^{1/\gamma}$ with $\gamma \in (1, 2)$ (Fanti and Meccheri, 2014).

The linear (inverse) product demand function is represented by

$$p = a - Q \quad (2)$$

where p is the price for the goods, and $Q = \sum_i q_i$ is total output. The firm faces within the company a labour union. The labour union in this case fixes at the company level a unique wage, w . This implies that, when the production (and, therefore, employment) level is determined, the firm resides on its labour demand curve, because this is adjusted after wage bargaining. The union utility function is

$$\Omega = (w - w_0) \left(\sum_i q_i^2 \right), \quad i = A, B \quad (3)$$

where $\sum_i q_i^2$ is the total employment of the firm and $w_0 > 0$ is the reservation wage.

Given that the use of a generic value of the reservation wage $w_k > w_0 > 0$ scales up (down) the bargained wage and, therefore, the values of the union utilities and firm profits maintaining unchanged the qualitative results of the model, w_0 is fixed for analytical convenience at the unity.

2.1 The ex-ante situation: centralized monopoly union

The firm maximizes profits by choosing the total quantity for the market. Hence, the allocation between the two plants is chosen according to respective costs. From (1) and given wages, the total marginal cost for the firm is $MC = wQ$, while total and marginal revenues are $TR = (a - Q)Q$ and $MR = a - 2Q$. Standard optimization techniques (see Borghijs and Du Caju, 1999) yield to the following output allocation in each plant

$$q_i(w) = \frac{a}{2(2+w)}, \quad i = A, B; \quad (4)$$

implying the following labour demand

$$l_i(w) = \left[\frac{a}{2(2+w)} \right]^2$$

with $\frac{\partial q_i}{\partial w} < 0$ and $\frac{\partial l_i}{\partial w} < 0$: each plant's output and employment depend negatively on the common wage rate. The union sets the wage rate by maximizing (3). Thus, the maximization problem is

$$w = \arg \max_w \left\{ \left[\frac{(w-1)a^2}{2(2+w)^2} \right] \right\} \quad (5)$$

whose solution is

$$w_{CMU} = 1 + (3) \quad (6)$$

where *CMU* stands for “centralized monopoly union”. The term in parenthesis is the rent over the competitive wage. Given (6), the quantity produced at each plant is

$$q_{CMU} = \frac{a}{12}. \quad (7)$$

Further substitutions lead to these expressions for the firm profits and union utility under centralized monopoly union wage setting

$$\Pi_{CMU} = \frac{a^2}{12}; \quad \Omega_{CMU} = \frac{a^2}{24}. \quad (8)$$

2.2 Pre-stage and possible change of the union wage setting

At the pre-stage, the potential entrant announces its intention of entry into the industry. Following the announcement, the labour union may strategically decide to change the wage setting in the incumbent firm, ceding part of its monopoly power to prevent the eventual entry of the new, non-unionized firm. For the purposes of the present paper, two options are analysed. First, the union retains the monopoly power in setting the wages; however, its structure is modified to that of a decentralized one. Second, the labour union changes its agenda and starts bargaining with the monopolist over employment and wages; that is, negotiations are dealt with according to the efficient bargaining (EB) model.

2.2.1 Decentralized monopoly union in the incumbent firm

In the first case, the labour union can opt to decentralize the structure of the wage setting at the single-plant level. One may conceive a situation in which the union decides to send delegates at each plant to set wages. Thus, the incumbent firm faces a labour union delegate at each plant, whose utility function is, given (1),

$$\Omega_i = (w_i - 1)q_i^2, \quad i = A, B \quad (9)$$

The profit maximization problem of the firm is similar to the case of the centralized, company-wide wage setting; the firm maximizes profits by choosing the total quantity for the market. Hence, the allocation between the two plants is chosen according to respective costs. From (1) and given the decentralization of the wage setting, total and marginal costs at each plant are now $TC_i = w_i q_i^2$ and $MC_i = 2w_i q_i$. Consequently, the global marginal cost for the firm is $MC = [2w_i w_j / (w_i + w_j)]Q$, while total and marginal revenues are $TR = (a - Q)Q$ and $MR = a - 2Q$ as before. Standard optimization techniques (Borghijs and Du Caju, 1999) lead to the following output allocation in each plant

$$q_i(w_i, w_j) = \frac{aw_j}{2(w_i w_j + w_i + w_j)}, \quad i, j = A, B; \quad i \neq j. \quad (10)$$

Therefore, the labour demand at each plant is as follows

$$l_i(w_i, w_j) = \left[\frac{aw_j}{2(w_i w_j + w_i + w_j)} \right]^2.$$

Straightforward comparative statics reveal that $\partial q_i / \partial w_i < 0$, $\partial l_i / \partial w_i < 0$, $\partial q_i / \partial w_j > 0$ and $\partial l_i / \partial w_j > 0$; output and employment at each plant negatively depend on the own wage rate and positively on the wage rate at the other plant. The rationale for this result is as follows. If the delegate of the union in one plant asks for high wages when negotiations are decentralized, the consequence is a reduction in cost competitiveness with respect to the other plant. This “competitiveness effect” is taken into account only when establishing its own wage, without considering the positive spillovers on the competitive position of the other plant, thus implying a moderation in wage claims. On the contrary, in the case of company-wide wage setting, the labour union is concerned about the cross price effects of high wage demands on the labour demand at each plant, internalizing the positive spillovers. As a consequence, the union is able to increase the wage demand compared to a decentralized, plant-level wage setting. It is worth observing that $q_i / q_j = w_j / w_i$: the necessary condition of equalization of the marginal costs of production across plants is satisfied. Thus, total production cost is minimized and, consequently, profits are maximized (Buccella, 2013a). Given the optimal allocation in (10), the union delegates at each plant determine the wage rate maximizing

$$w_i = \arg \max_{w_i} \left\{ \left[\frac{(w_i - 1)a^2 w_j^2}{4(w_i + w_j + w_i w_j)^2} \right] \right\}. \quad (11)$$

Solving the first-order conditions for w_i , the bargaining unit i 's reaction function is

$$w_i = \frac{3w_j + 2}{w_j + 1}, \quad i, j = A, B; \quad i \neq j. \quad (12)$$

As expected, $\partial w_i / \partial w_j > 0$: an increase in the negotiated wage rate at the other plant rises the bargained wage rate for each union at its own plant due to complementarities. Solving the system of equations in (12) and solving for w_i , the unique economically relevant solution is

$$w_{DMU} = 1 + (\sqrt{3}), \quad (13)$$

where DMU stands for “decentralized monopoly union”. The term in brackets is the rent over the reservation wage. Further substitution of (13) into (10) leads to the production at the single plant

$$q_{DMU} = \frac{a}{2(\sqrt{3} + 3)}. \quad (14)$$

Straightforward substitutions of (13) and (14) allow for the derivation of the following expressions for the firm profits and total union utility

$$\Pi_{DMU} = \sum_i \Pi_{i,DMU} = \frac{a^2}{2(\sqrt{3} + 3)}; \quad \Omega_{DMU} = \sum_i \Omega_{i,DMU} = \frac{a^2 \sqrt{3}}{2(\sqrt{3} + 3)^2}.$$

2.2.2 Centralized EB model in the incumbent firm

Consider now the case that the union keeps the centralized structure but changes the agenda: that is, negotiations within the incumbent firm take place according to an EB scheme. Thus, the labour union bargains with the firm simultaneously regarding the wage paid (w) and employment (production levels). Under the centralized EB, the maximization problem is

$$\max NP(w, q_i, q_j) = [(a - q_i - q_j)(q_i + q_j) - w(q_i^2 + q_j^2)]^\alpha [(w-1)(q_i^2 + q_j^2)]^{1-\alpha} \quad (15)$$

where the parameter $\alpha \in [0,1]$ represents the firm bargaining power. Considering the symmetric solution in first-order conditions ($q_i = q_j = q$), the following expressions are obtained

$$w = (1 - \alpha) \frac{(a - 2q)}{q} + \alpha; \quad w = \frac{(a - 2q)}{q} - \frac{\alpha a}{2q}$$

describing the rent sharing and contract curves, respectively. The solutions of the above system give the equilibrium values of the output and the wage

$$q_{EB} = \frac{a}{6}, \quad (16)$$

$$w_{EB} = 1 + [3(1 - \alpha)] \quad (17)$$

Notice that $w_{EB} < w_{CMU}$: despite keeping centralized activities within the firm, the introduction of employment in the agenda leads the union to cede part of its power in setting the wage. However, this is compensated by the increase in production: in fact $q_{EB} > q_{CMU}$, because, with a risk-neutral union, the contract curve is vertical at the competitive employment level. Making use of the equilibrium values of production and wage, the firm profits and the union utility are

$$\Pi_{EB} = \frac{a^2 \alpha}{6}; \quad \Omega_{EB} = \frac{a^2 (1 - \alpha)}{6}.$$

2.3 Ex-post situation: entry allowed, duopoly outcomes

In the case that entry is viable, the market passes from a monopoly to a duopoly structure. Given the alternatives at the disposal of the labour union, three different cases arise.

2.3.1 Second stage: duopoly with a centralized monopoly union in the incumbent firm

If the labour union does not change the wage setting, maintaining centralization and monopoly power, the profit functions of the firms in the quantity game are

$$\Pi = (a - q_i - q_j - x)(q_i + q_j) - w(q_i^2 + q_j^2) \quad (18)$$

$$P = (a - q_i - q_j - x)x - \varpi x^2 - G \quad (19)$$

for the incumbent and the entrant, respectively. In (19), $\varpi \geq 1$ is the wage paid by the entrant to its workers (exogenously given for the incumbent), x is production level, and G is the exogenous fixed cost that the entrant faces. The FOCs from the maximization of (18) and (19) are

$$q_i = q_j = \frac{(a-x)}{2(2+w)} \quad (20)$$

$$x = \frac{(a-q_i-q_j)}{2(1+\varpi)} \quad (21)$$

representing the firms' reaction functions. Solving the system of Equations (20) and (21), the optimal quantities as functions of the wages are

$$q_i = q_j = \frac{a(1+2\varpi)}{2(2w\varpi+4\varpi+2w+3)} \quad (22)$$

$$x = \frac{a(1+w)}{(2w\varpi+4\varpi+2w+3)} \quad (23)$$

with the standard comparative statics $\frac{\partial q_i}{\partial w} = \frac{\partial q_j}{\partial w} < 0$, $\frac{\partial q_i}{\partial \varpi} = \frac{\partial q_j}{\partial \varpi} > 0$; $\frac{\partial x}{\partial \varpi} < 0$, $\frac{\partial x}{\partial w} > 0$: an increase in the own (rival) wage level decreases (increases) the firm's production. Given the optimal quantities in (22) and (23), the union sets the wage level maximizing

$$w = \arg \max_w \left\{ \frac{(w-1)a^2(1+2\varpi)^2}{2(2w\varpi+4\varpi+2w+3)^2} \right\}. \quad (24)$$

Solving the first-order condition for w , the incumbent firm equilibrium wage is

$$w_{CMU}^D = 1 + \left[\frac{6(1+\varpi)-1}{2(1+\varpi)} \right], \quad (25)$$

where the upper script stands for “duopoly” and the lower script for “centralized monopoly union”, and the term in brackets represents the rent over the competitive wage. An analytical inspection reveals that $\frac{\partial w_{CMU}^D}{\partial \varpi} > 0$, as expected: an increase in the wage rate of the entrant increases the wage rate set by the incumbent union because of strategic complementarities. Making use of (25) the equilibrium quantities are

$$q_{iCMU}^D = q_{jCMU}^D = \frac{a(1+2\varpi)}{4(6\varpi+5)} \quad (26)$$

$$x_{CMU}^D = \frac{a(9+10\varpi)}{4(6\varpi^2+11\varpi+5)} \quad (27)$$

Straightforward substitutions allow for the derivation of the expressions for the incumbent firm profits, union utility, and the entrant firm profits

$$\Pi_{CMU}^D = \frac{a^2(1+2\varpi)(24\varpi^2+34\varpi+11)}{16(1+\varpi)(6\varpi+5)^2}; \quad \Omega_{CMU}^D = \frac{a^2(1+2\varpi)^2}{16(6\varpi^2+11\varpi+5)};$$

$$P_{CMU}^D = \frac{a^2(9+10\varpi)^2}{16(6\varpi+5)(6\varpi^2+11\varpi+5)},$$

with $\frac{\partial \Pi_{CMU}^D}{\partial \varpi} > 0$, $\frac{\partial \Omega_{CMU}^D}{\partial \varpi} > 0$, $\frac{\partial P_{CMU}^D}{\partial \varpi} < 0$: an increase in the wage paid by the entrant decreases (increases) its (the incumbent firm and union) profitability.

2.3.2 Second stage: duopoly with a decentralized monopoly union in the incumbent firm

The second option for the labour union operating within the incumbent firm is to decentralize the wage setting, however, keeping the monopoly power in determining the wage rate at each plant. In this case, the firm profits are

$$\Pi = (a - q_i - q_j - x)(q_i + q_j) - w_i q_i^2 - w_j q_j^2 \quad (28)$$

for the incumbent, while for the entrant it is as in (19). The FOCs from the maximization of (28) lead to the following expressions, which represent the incumbent firm reaction functions for each decentralized unit

$$q_i = \frac{(a - x - 2q_j)}{2(1 + w_i)}, i, j = A, B; i \neq j; \quad (29)$$

while the entrant optimal quantity equals that in (21). Solving the system of equations (29) and (21), the optimal quantities as functions of the wages are

$$q_i = \frac{aw_j(1 + 2\varpi)}{[4w_i w_j(1 + \varpi) + (4\varpi + 3)(w_i + w_j)]}, i, j = A, B; i \neq j, \quad (30)$$

$$x = \frac{a(2w_i w_j + w_i + w_j)}{[4w_i w_j(1 + \varpi) + (4\varpi + 3)(w_i + w_j)]} \quad (31)$$

with the standard comparative statics $\frac{\partial q_i}{\partial w_i} < 0$, $\frac{\partial q_i}{\partial w_j} > 0$, $\frac{\partial q_i}{\partial \varpi} > 0$; $\frac{\partial x}{\partial \varpi} < 0$, $\frac{\partial x}{\partial w_i} > 0$, $\frac{\partial x}{\partial w_j} > 0$, $i, j = A, B; i \neq j$: an increase in the own (other plant, rival) wage level decreases (increases) the plant's production. Given the optimal quantities in (30) and (31), the delegates of the unions at each plant choose the wage level by maximizing

$$w_i = \arg \max_{w_i} \left\{ \left[\frac{(w_i - 1)a^2 w_j^2 (1 + 2\varpi)^2}{\{[4w_i w_j(1 + \varpi) + (4\varpi + 3)(w_i + w_j)]\}^2} \right] \right\}, i, j = A, B; i \neq j. \quad (32)$$

Solving the first-order condition for w_i , the incumbent firm wage at each plant is

$$w_i = \frac{(12w_j + 8)\varpi + 11w_j + 6}{[4\varpi(1 + w_j) + 4w_j + 3]}, i, j = A, B; i \neq j; \quad (33)$$

which leads to the equilibrium wage

$$w_{i,DMU}^D = w_{j,DMU}^D = 1 + \left[\frac{\sqrt{12\varpi^2 + 22\varpi + 10}}{2(1 + \varpi)} \right], i, j = A, B; \quad (34)$$

where the upper script stands for “duopoly” and the lower script for “decentralized monopoly union”, and the term in brackets represents the rent over the competitive wage.

A direct analysis shows that $\frac{\partial w_{i,DMU}^D}{\partial \varpi} > 0$: an increase in the wage rate of the entrant rises the wage rates set by the delegates at each plant of the incumbent union. The rationale for this result is due to the wage strategic complementarities. Furthermore, $w_{DMU}^D < w_{CMU}^D$: given the decentralized structure, each union delegate maximizes the utility of the workers at the single plant.

Using (34), the equilibrium quantities are

$$q_{i,DMU}^D = q_{j,DMU}^D = \frac{a(1+2\varpi)}{2(6\varpi+5+\sqrt{12\varpi^2+22\varpi+10})} \quad (35)$$

$$x_{DMU}^D = \frac{a[4(1+\varpi)+\sqrt{12\varpi^2+22\varpi+10}]}{2[6\varpi^2+11\varpi+5+(1+\varpi)\sqrt{12\varpi^2+22\varpi+10}]}, \quad (36)$$

with $q_{DMU}^D > q_{CMU}^D$ because of the lower wage levels and, therefore, increased competitiveness of the incumbent firm. Further substitutions allow for the derivation of the expressions for the incumbent firm profits, union utility, and the entrant firm profits, given by

$$\Pi_{DMU}^D = \sum_i \Pi_{i,DMU} = \frac{a^2(1+2\varpi)[4(1+3\varpi+2\varpi^2)+(1+2\varpi)\sqrt{12\varpi^2+22\varpi+10}]}{2[6\varpi^2+11\varpi+5+(1+\varpi)\sqrt{12\varpi^2+22\varpi+10}](6\varpi+5+\sqrt{12\varpi^2+22\varpi+10})};$$

$$\Omega_{DMU}^D = \sum_i \Omega_{i,DMU} = \frac{a^2(1+2\varpi)^2\sqrt{12\varpi^2+22\varpi+10}}{8(1+\varpi)(6\varpi+5+\sqrt{12\varpi^2+22\varpi+10})^2};$$

$$P_{DMU}^D = \frac{a^2[4(1+\varpi)+\sqrt{12\varpi^2+22\varpi+10}][6(6\varpi^2+11\varpi+5)+(9+10\varpi)\sqrt{12\varpi^2+22\varpi+10}]}{4(1+\varpi)(6\varpi+5+\sqrt{12\varpi^2+22\varpi+10})^3}.$$

2.3.3 Second stage: duopoly with a centralized efficient bargaining in the incumbent firm

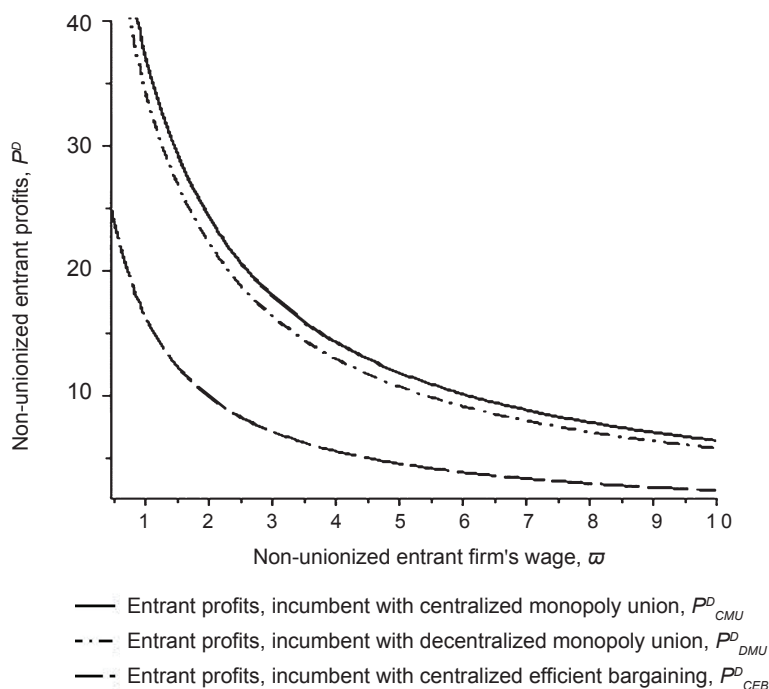
The third alternative for the labour union is to keep the activities centralized, though the agenda changes and introduces employment into negotiations. In other words, the union cedes its monopoly power in wage determination and moves towards the EB model. In this case, the incumbent firm and the union bargain simultaneously over wages and employment

$$\max NP(w, q_i, q_j) = [(a - q_i - q_j - x)(q_i + q_j) - w(q_i^2 + q_j^2)]^\alpha [(w-1)(q_i^2 + q_j^2)]^{1-\alpha} \quad (37)$$

Taking the symmetric solution in the FOCs ($q_i = q_j = q$), the following expressions are obtained

$$w = (1-\alpha)\frac{(a-x-2q)}{q}; \quad w = \frac{(a-x-2q)}{q} - \frac{\alpha(a-x)}{2q}; \quad (38)$$

Figure 1 | Entrant Profits in the Duopoly Market Structure (the plot is drawn for the value of $a = 20$)



Source: Authors calculations.

describing the rent sharing and contract curves, respectively. The entrant optimal quantity is equal to (21). Solving the system of Equations (38) and (21), the equilibrium values for the incumbent and entrant are, respectively,

$$q_{CEB}^D = \frac{a(1+2w)}{2(4w+3)}, \quad w_{CEB}^D = 1 + [(1-2\alpha)], \quad (39)$$

$$x_{CEB}^D = \frac{a}{(4w+3)}, \quad (40)$$

where the upper script stands for “duopoly” and the lower script for “centralized efficient bargaining”, with the standard comparative statics $\frac{\partial q}{\partial w} > 0$; $\frac{\partial x}{\partial w} < 0$.

Given the equilibrium values in (39) and (40), further substitutions allow for the derivation of the incumbent firm profits and union utility, and the entrant firm profits

$$\Pi_{CEB} = \frac{\alpha^2(1-2w)^2}{(3+4w)}, \quad \Omega_{CEB}^D = \frac{(1-\alpha)a^2(1+2w)^2}{(3+4w)^2}, \quad P_{CEB}^D = \frac{a^2(1+w)}{(3+4w)^2},$$

with $\frac{\partial \Pi_{CEB}^C}{\partial w} > 0$, $\frac{\partial \Pi_{CEB}^C}{\partial \alpha} > 0$, $\frac{\partial \Omega_{CEB}^C}{\partial w} > 0$, $\frac{\partial \Omega_{CEB}^C}{\partial \alpha} < 0$, $\frac{\partial P_{CEB}^C}{\partial w} < 0$: given the EB frame-

work with a neutrally oriented union, a change in the relative bargaining power affects the redistribution of the oligopoly rents between the parties, while the production levels remain unaffected.

2.4 First stage: wage setting as entry deterrence mechanism

Consider now the entry. Figure 1 depicts the entrant profit levels in the case of duopoly competition under the different wage settings in the incumbent firm. It is immediately evident that $P_{CEB}^D < P_{DMU}^D < P_{CMU}^D$. The rationale for this result is as follows. With a decentralized monopoly union structure, the incumbent pays lower wages than in the presence of a centralized monopoly union. On the other hand, with the introduction of an efficient bargaining agenda, the incumbent commits to the production level as if it pays the competitive wage; as a consequence, a large output is present in the market, and this in turn lowers the price. If the fixed cost for the entrant is such that

$$P_{DMU}^D \leq G_1^T \leq P_{CMU}^D,$$

where the lower script relative to G stands for “first” and the upper script for “threshold level”, a duopoly exists in the “centralized monopoly union” case; however, if the union changes the structure of its wage setting for a “decentralized monopoly union”, entry is prevented, and the incumbent remains in a monopoly position.

On the other hand, if the fixed cost for the entrant is such that

$$P_{CEB}^D \leq G_2^T \leq P_{DMU}^D,$$

where the lower script relative to G stands for “second” and the upper script for “threshold level”, a duopoly exists with the “decentralized monopoly union”; nevertheless, if the union changes the agenda and opts for the “centralized EB”, entry is prevented, and the industry remains a monopoly.

It needs to be verified whether it is beneficial to change the structure for the labour union. If the monopoly union does not change the wage setting and remains at the centralized level and the fixed costs are $G_1^T \leq P_{CMU}^D$, then entry is not prevented: the union gets Ω_{CMU}^D . If the union changes the wage setting, it may get either Ω_{DMU} or Ω_{EB} , with EB more powerful than the decentralized structure for the monopoly union as entry deterrence mechanism. Union utility comparison and simple algebra lead to the following proposition.

Proposition 1 *If the size of the fixed costs is such that $P_{CEB}^D \leq G \leq G_1^T$,*

$\Omega_{EB} \geq \Omega_{DMU} > \Omega_{CMU}^D$, for $\alpha \in [0, 0.76]$ and $\Omega_{DMU} > \Omega_{EB} > \Omega_{CMU}^D$ for $\alpha \in (0.76, 1]$.

Thus, the union prefers to change the wage setting and cede part of its power to prevent the entry of the non-unionized firm in the industry, which is entry that will harm its utility. The choice between the decentralization of the wage setting and the change of the agenda depends on the size of the fixed costs. In fact, it is straightforward to observe that, when $P_{CEB}^D \leq G_2 \leq P_{DMU}^D$, only the EB can be used to prevent entry.

In the current analysis, it is assumed that the labour union has the power of determining the wage setting. However, it is interesting to investigate whether the change in the wage setting can be also profitable for the incumbent firm; in other words, whether the incumbent firm and the union have a common interest. Comparison of the incumbent profits and simple algebra allow for the derivation of the following proposition.

Agreement with Side-payments	Common interest	No agreement
$\Omega_{EB} \geq \Omega_{DMU}$	$\Omega_{EB} \geq \Omega_{DMU}$	$\Omega_{DMU} \geq \Omega_{EB}$
$\Pi_{DMU} \geq \Pi_{EB}$	$\Pi_{EB} \geq \Pi_{DMU}$	$\Pi_{EB} \geq \Pi_{DMU}$

$\alpha = 0$
 $\alpha \approx 0.63$
 $\alpha \approx 0.76$
 $\alpha = 1$

Proposition 2 $\Pi_{DMU} \geq \Pi_{EB} > \Pi_{CMU}^D$ for $\alpha \in [0, 0.63]$, and $\Pi_{EB} > \Pi_{DMU} > \Pi_{CMU}^D$ for $\alpha \in (0.63, 1]$

Figure 2 depicts the areas in the α – space where the incumbent firm and the union have common interest and may reach a potential agreement with regard to the change of the wage setting. In the first region, delimited by $\alpha \in [0, 0.63]$, $\Omega_{EB} \geq \Omega_{DMU}$, while $\Pi_{DMU} \geq \Pi_{EB}$; thus, the incumbent and the union have divergent preferences. However, if there is the possibility that the union may effectuate a side-payment to the incumbent firm, entry deterrence can be implemented.

Finally, in the third area, delimited by $\alpha \in (0.76, 1]$, $\Omega_{DMU} \geq \Omega_{EB}$ while $\Pi_{EB} > \Pi_{DMU}$; therefore, the incumbent and the union again have divergent preferences. Nonetheless, in this case, the side-payments that the union may effectuate to the incumbent firm are not sufficiently large to implement an agreement. In fact, it is easily derived that the size of the utility differential $\Delta_2(\Omega) = \Omega_{DMU} - \Omega_{EB} > \Omega_{CMU}^D$ for $\alpha \in [0.92, 1]$, when $\varpi = 1$, while $\Delta_2(\Omega) > \Omega_{CMU}^D$ for $\alpha \approx 1$ when $\varpi \rightarrow \infty$. Therefore, for $\alpha \in (0.76, 0.92)$, $\Delta_2(\Omega) < \Omega_{CMU}^D$: if the union transfers the rents to the incumbent, it obtains a Pareto-inferior outcome than duopoly. Moreover, it is easily obtained that $\Pi_{EB} > \Pi_{DMU} + \Delta_2(\Omega) > \Pi_{CMU}^D$. Thus, in this area, even in the presence of possible side-payments, the incumbent does not agree on the wage setting change.

To sum up, the union's concession of part of its monopoly power in wage setting to deter the entry of a non-unionized firm can be facilitated if the incumbent firm does not insist on an "excessive" concession. In fact, if the union cedes too much power and becomes "too weak" (a high value of α), the likelihood that the change of the wage determination process occurs in a smooth way can be lower.

3. Conclusions

The present paper has studied how changes in the wage determination may prevent the entry of a non-unionized firm in a unionized industry. The work has focussed attention on the impact that the threat of entry has on the decision of the labour union of ceding part of its power in the wage determination process.

In a monopoly industry, a labour union is active in the multi-unit incumbent firm and sets the wages at the centralized company level. The entry of a non-unionized firm can affect the union utility; however, the potential entrant has to face some exogenous fixed costs. To deter entry, the union has two options: either to change the structure of the wage setting and decentralize the decisions at the plant level through delegates; or to keep the centralized structure but change the agenda and introduce employment into the negotiations.

The main results of the analysis are as follows. The labour union can use both alternatives as entry deterrence mechanisms in the industry; however, the introduction of the efficient bargaining agenda is more effective than decentralization with monopoly power in wage determination. In fact, the introduction of employment in the agenda commits the incumbent firm to a larger production level than in the presence of a decentralized monopoly labour union. As a consequence, the price of the products lowers, decreasing the profitability of market entry. This, in turn, implies that the threshold level of the fixed cost preventing market entry diminishes.

In the present work, it has been assumed that the labour union has the power to determine the wage setting. However, it has been investigated whether the wage setting change is profitable also for the incumbent, so that potential internal conflicts between the firm and the union are minimized. The analysis has shown that the incumbent and its union can have a direct common interest in changing the wage setting and obtain an outcome that is Pareto-superior to the duopoly with a non-unionized firm through side-payments. When the union becomes too weak, potential internal conflicts may arise between the union and the firm. Therefore, the union concession with regard to its monopoly power in wage setting can be eased if the incumbent does not insist on an “excessive” concession.

These findings ask for additional analyses that are left for future research. A straightforward extension is to investigate if other elements of the wage setting, and more in general, of the bargaining process, such as payment schemes, can strategically be used as entry deterrence mechanisms in imperfectly competitive markets. The proposed analysis can be carried out within the context of the present model or with different assumptions with regard to the production technology. A more comprehensive analysis could call for the evaluation of the overall welfare effects. Moreover, a different form of product market competition (Bertrand, Bertrand–Cournot) can be investigated to check the robustness of the results.

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