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Unions and Entry to Traditional and Network Industries[1]

Sindicatos y su entrada a las industrias tradicionales y de redes

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Abstract

The paper analyzes the effects of unionization on the labor market under Right-to-Manage (rtm) and Sequential Efficient Bargaining (seb) institutions, focusing particularly on the entry of a firm and comparing traditional and network industries. The findings show that under rtm, unions always play a pro-competitive role, while under eb they may become a barrier to entry —in the form of the payment of a fee to obtain a monopoly grant by an authority— into network industries with intense network effects. These results shed light on the importance of there being, on the one hand, unions and different bargaining agendas and on the other, network goods in the shape of industrial competition, with the evident implications of anti-trust and competition policies.

Keywords: sequential efficient bargaining, right-to-manage, firm-union bargaining agenda, entry, network effects.
jel Classification: J51, L13, L21.

Resumen

En este artículo se analizan los efectos de la sindicalización del mercado de trabajo en las instituciones con derechos administrativos (rtm, por sus siglas en inglés) y con negociación secuencial efectiva, (seb, por sus siglas en inglés). Se enfoca en la entrada de una empresa comparando las industrias tradicionales y de redes. Los resultados demuestran que dentro de las rtm, los sindicatos desempeñan un papel pro-competitivo, y en las seb suelen convertirse en una barrera para la entrada de recursos y por lo mismo producir efectos negativos en las industrias de redes. El estudio revela la importancia de la presencia de los sindicatos y las diferentes agendas de negociación, así como las implicaciones evidentes que los bienes de redes provocan en las políticas de competencia.

Palabras clave: negociación secuencial efectiva, derechos administrativos, agenda de negociación sindical, entrada, efectos de las redes.
Clasificación jel: J51, L13, L21.

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Introduction

The role of the bargaining agenda between unionized labor and firms on the competitive structure of industries has been the subject of recent investigations in economic literature (as documented below). Moreover, daily evidence shows that network industries are among the most relevant sectors of advanced contemporary economics. Therefore, given the growing importance of network industries, a study on the impact of unionization with different possible bargaining agendas in those sectors seems opportune. For example, in the recent past, unions have been able to organize workers and propose collective agreements in some large companies operating in network industries such as Silicon Valley giants (Apple, Google and Microsoft, to mention a few). To cite a case, in March 2015, after the state of California had passed legislation in favor of unions, Apple conceded to directly employ security guards for its Cupertino, California campus rather than hiring workers through a subcontractor, accepting the requests of the labor union Service Employees International Union-United Service Workers West (Al Jazeera America, 2015). In September 2015, 38 full-time bug testers employed at Microsoft to review apps voted to create a union, the Temporary Workers of America (Bloomberg Businessweek, 2015). In mid-2016, the Communications Workers of America and the International Brotherhood of Electrical Workers proposed a deal that would replace 27 expired collective bargaining agreements for between 36,000 and 39,000 wireline workers at Verizon Communications Inc. in nine eastern states and the District of Columbia, on the East Coast. Union officials and observers argued that this proposed agreement "stands to boost chances to organize thousands of workers within the telecommunications giant's wireless business." (Bloomberg bna, 2016) Consequently, an investigation into the impact of unionized labor in those industries is extremely relevant for economists, policymakers and antitrust authorities due to the direct implications for the design of regulatory interventions in labor markets and industrial policies. Surprisingly, scant interest on the subject has been recorded in the literature received.

As recent works have highlighted, the union-firm bargaining agenda can act as a barrier to entry to imperfectly competitive markets (Bughin, 1995, 1999; Buccella, 2011; Buccella and Fanti, 2015; Fanti and Buccella, 2015, 2016). Bughin (1995) found that unionized firms prefer to bargain over employment, therefore increasing union utility by producing more than the standard profit-maximizing output, given that firms have a strategic interest in cooperating with their unions to influence the product game. In fact, by committing to production expansion beyond the profit-maximizing output level, one firm is able to heighten profits through the effect upon rivals' reaction curves. This theoretical result seems to be confirmed by an empirical exercise on a panel of firms from four Belgian manufacturing industries (chemicals, engineering, textile and food). On the other hand, Bughin (1999) studies the optimal strategic choice of the negotiation agenda (Right-to-Manage, RTM vs. Efficient Bargaining, EB models) for different market structures (duopoly vs. monopoly with threat of entry). Buccella (2011) and Buccella and Fanti (2015) extend Bughin's 1999 study using a conjectural variation model. Focusing on Cournot competition, Fanti and Buccella (2015) further develop that author's analysis to different timings in the case of EB and the sequential EB (SEB) agenda (Manning, 1987a, b). Those papers do not, however, consider network industries.[4]

Indeed, with several products, utility for the typical consumer increases with the number of other consumers using them, i.e. overall product sales improve the welfare of each consumer.[5] A recently growing body of literature has shown that network externalities are not neutral and may affect several established results obtained with standard goods in industrial organization literature. Hoernig (2012), Bhattacharjee and Pal (2014), and Chirco and Scrimitore (2013) show that the oligopoly managerial delegation literature can change in the presence of network externalities.

Despite the importance of positive consumption externalities, the literature on unionized industries has largely neglected analysis related to network industries. An exception is Fanti and Buccella, (2016) who carried out an analysis of the strategic bargaining agenda choice in a unionized duopoly with network effects. The authors show that if the monopolist has the right to select the negotiation agenda, it may strategically commit either to the simultaneous EB, RTM or SEB to deter entry, depending on the timing of the negotiation process.

Church and Ware (1999, p. 487) (quoted in McAfee *et al.*, 2003, p. 10) distinguish between structural and strategic entry barriers, but they specify that the term "barrier to entry" should be used only for structural barriers, i.e. "a structural characteristic of a market that protects the market power of incumbents by making entry unprofitable." On the other hand, strategic entry barrier is defined

[4] There is also a vast literature which analyzes different aspects of market entry, abstracting from the issue of the union-firm bargaining agenda. For instance, under diverse frameworks, several works have challenged the traditional view that entry decreases the incumbent's profits, see i.a. Tyagi (1999), Naylor (2002a, b) and Mukherjee *et al.* (2009) for vertical relations; Pal and Sarkar (2001) and Mukherjee and Zhao (2009) for asymmetric cost firms; Coughlan and Soberman (2005), Chen and Riordan (2007) and Ishibashi and Matsushima (2009) for differentiated goods; Ashiya (2000) and Ishida *et al.* (2011) for technology. Still, none of them considers network industries.

[5] Typical examples of network goods are telephone and software: it is natural to observe that the utility for a particular consumer using a telephone or a software increases with the number of other telephone or software users. See, for example, Shy (2001), for an extensive survey of the cases of network goods.

as the actions of an incumbent to influence the choice of entry (e.g., inflicting losses to entrants).[6]

This paper does not use the definition of strategic barrier to entry but rather takes a different route and investigates both the role played by unions on entry into standard and network industries and that of different bargaining institutions in the labor market. In other words, it studies how the bargaining agenda and network externality act as structural characteristics of a market, affecting the profits of the incumbent and the entrant and thus the possibility/impossibility of entry, depending on whether the presence of such characteristics permits the monopolist to achieve profit-enhancement relative to the duopoly such that a monopoly grant may be acquired. In this respect, the model presented here assumes that one firm, which plays the role of incumbent to guarantee its monopoly position, pays to create an entry barrier, such as a license fee to sell products or lobbying expenditures to the government to regulate the sector (restricting entry). In other words, for the sake of simplicity, we assume the simpler as well as the "older" type of barrier to entry: an expensive monopoly granted by an authority.[7] This simple example of granted monopoly helps focus on the possible creation of an entry barrier —in the form of payment of a generic monopoly grant— due to an enhancement of monopoly rent originated by the working of our parameters of interest here, that is the network effect and the type of union-firm bargaining agenda. Moreover, the model assumes so-called "committed bargaining", i.e. the entrant has to "join the pack" and adopt the bargaining practice common in the industry. In particular, the paper focuses on RTM and SEB agendas.

The key results follow. It is shown that the role of unions is different under each of the two bargaining institutions. In fact, under RTM, unions always play a role. On the other hand, unions under SEB may become a barrier to entry into network industries, provided that network effects are adequately intense.

The remainder of the paper is organized so that section 2 presents the monopoly/duopoly-union bargaining models, section 3 analyzes the issue of entry and discusses the results and section 4 concludes the paper with some final remarks.

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6 McAfee *at al.* (2003, 2004) provide an extensive discussion of the various definitions of "barriers to entry" in economics.

7 As noted by McAfee *et al.* (2003, 2), the most common impediments to free entry into markets have been government monopoly grants and patents. Historically, many governments have granted monopolies for the purposes of collecting government revenue (e.g. Chinese Empire) or encouraging socially beneficial inventions or, more prosaically, helping royal favorites and replenishing royal coffers (e.g. in England in the time of the Tudors).

I. The Model

The simple mechanism of network effects assumed here is that the surplus that a firm's client obtains directly grows with the number of other clients of the same firm (i.e. Katz and Shapiro, 1985). We begin with the case of monopoly.

Monopoly

Following Fanti and Buccella (2016) and Buccella and Fanti (2016), it is assumed that the monopolist faces the following direct linear demand function:

$$q = a - p + ny \tag{1}$$

where q is the output, y consumer expectation about monopolist's equilibrium production, and the parameter $n \in [0, 1)$ measures network effects intensity (i.e. the higher the value of the parameter, the more intense the network effects).

The inverse demand function is:

$$p = a - q + ny \tag{2}$$

where p is the price of goods. Therefore, the monopolist's profit function is:

$$\pi = (p - w)q \tag{3}$$

where w is the output wage per unit.

Efficient bargaining may either be simultaneously over wage and employment (EB) (Nickell and Andrews, 1983) or sequential, first over wage and then over employment (SEB) (Manning, 1987a, b). Here we focus on the case of SEB, because the game structures under the RTM/SEB agendas have the same number of stages. In fact, in the cases of both RTM and SEB, the monopolist's decisions are made in two stages: in a first stage, under both agendas, the monopolist-union bargaining unit negotiates wages w to maximize the Nash product, while in the second stage *1)* in the RTM case, the monopolist chooses quantity q (alternatively, price p) to maximize profits, *2)* in the SEB case the monopolist-union bargaining unit negotiates quantities q (alternatively, price p) to maximize the Nash product. The workers in this industry are fully unionized, and the union has, as usual (e.g. Pencavel, 1985), the utility function $V = (w - w°)\, l$, where l is employment and $w°$ the reservation wage. Under the standard assumption of constant returns to labor, $q = l$, it follows that $V = (w - w°)q$. Moreover, in the case of duopoly, union power is assumed to be symmetric across bargaining units.

Following Katz and Shapiro (1985), we impose the additional "rational expectations" conditions, i.e. $y = q$, in stage 2. Our equilibrium concept is subgame-perfect Nash equilibrium, and we solve this game by using a backward induction method.

The cases of RTM and SEB are analyzed, respectively, in the sub-sections below.

RTM Institution

At stage 2, solving the monopolist profit maximization problem, the following output function for given consumer expectations is produced:

$$q(y, w) = \frac{a - w + ny}{2} \tag{4}$$

Solving (4) by imposing the "rational expectations" condition mentioned above, the equilibrium quantities at stage 2 are:

$$q(w) = \frac{a - w}{2 - n} \tag{5}$$

Under Right-to-Manage, at stage 1 of the game, the monopolist-union bargaining unit selects *w*, to maximize the following generalized Nash product,

$$\underbrace{\max}_{w.r.t.\ \ w} \quad N = (\Pi)^{1-b} (V)^b = [(a - w - q + ny)q]^{1-b} ((w - w°)q)^b \tag{6}$$

where *b* represents the union's bargaining power.

After substitution of eq. (5) in (6), maximization with respect to *w* leads to:

$$w^{\mathrm{RTM}} = \frac{[ab + w° (2 - b)]}{2} \tag{7}$$

Inserting eq. (7) into eq. (5) we get to the equilibrium output, and further substitutions lead to all the relevant equilibrium outcomes reported in Table 1.

Efficient Bargaining Institution

Under SEB, the monopolist-union bargaining unit maximizes the following generalized Nash product,

$$N = (\Pi)^{1-b}\,(V)^{b} = [(a - w - q + ny)q]^{1-b}\,[(w - w^{\circ})q]^{b} \tag{8}$$

In particular, the monopolist-union bargaining unit selects w at the first stage and l, or equivalently q, at the second stage.

At the second stage, from the first-order condition of the efficient bargaining game between the monopolist and the union, the monopolist's output function is:

$$q(y, w) = \frac{1}{2 - b}\,(a + ny - w) \tag{9}$$

From (9), after imposing the "rational expectations" condition, we obtain the output for given w:

$$q(w) = \frac{[a(b + (2 - n)) + (w(b + n - 2))]}{b^2 + 2b(n - 2) + (2 - n)^2} \tag{10}$$

At the first stage, after substitution of (10) in (8) and usual maximization procedure w.r.t. w, we obtain the wage:

$$w^{SEB} = \frac{ab + w^{\circ}(2 - b)}{2} \tag{11}$$

Inserting (11) into (9), we get the equilibrium output. Further substitutions lead to the equilibrium expressions reported in Table 1.

Table 1. *Monopoly Outcomes*

	quantity	wage	profits	union utility
RTM	$q^{RTM}=\frac{(2-b)(a-w^{\circ})}{2(2-n)}$	$w^{RTM}=\frac{ab+w^{\circ})(2-b)}{2}$	$\pi^{RTM}=\frac{(2-b)^2(a-w^{\circ})^2}{[2(2-n)]^2}$	$V^{RTM}=\frac{b(2-b)(a-w^{\circ})^2}{4(2-n)}$
SEB	$q^{SEB}=\frac{(a-w^{\circ})(2-b)}{2(2-b-n)}$	$w^{SEB}=\frac{ab+w^{\circ}(2-b)}{2}$	$\pi^{SEB}=\frac{(1-b)(a-w^{\circ})^2(2-b)^2}{4(2-b-n)^2}$	$V^{SEB}=\frac{b(2-b)(a-w^{\circ})^2}{4(2-b-n)}$

Duopoly

There are two firms in duopoly: firm 1, assumed to be the incumbent, and firm 2, the entrant. The inverse demand function becomes:

$$p = a - q_1 - q_2 + n(y_1 + y_2) \tag{12}$$

The firms' profit functions are:

$$\pi_1 = (p - w_1)q_1 \tag{13}$$

$$\pi_2 = (p - w_2)q_2 - E \tag{14}$$

for firm 1 and 2, respectively. E is an exogenous fixed cost the entrant has to face. On the other hand, the union utility function is:

$$V_{\text{i}} = (w_{\text{i}} - w^{\circ})q_{\text{i}} \quad \text{i} = 1, 2. \tag{15}$$

Firms' decisions are made in two stages: in a first stage, both in the RTM and EB cases, firm-union bargaining units i and j simultaneously and non-cooperatively bargain over wages w_i and w_j to maximize the Nash product, while in the second stage *i)* in the RTM case, firms i and j simultaneously and non-cooperatively choose quantities q_i and q_j to maximize profits, *ii)* in the SEB case firm-union bargaining units i and j simultaneously and non-cooperatively bargain quantities q_i and q_j to maximize the Nash product.

Table 2. *Duopoly Outcomes*

	quantity	wage	profits	union utility
RTM/RTM	$q_i^{RTM/RTM} = \frac{(2-b)(2-n)(a-w^\circ)}{(3-2n)[4-2n-b(1-n)]}$	$w_i^{RTM/RTM} = \frac{ab-2w^\circ(n+b)+w^\circ(4+bn)}{4-2n-b(1-n)}$	$\pi_i^{RTM/RTM} = \frac{(2-b)^2(2-n)^2(a-w^\circ)^2}{(3-2n)^2[4-2n-b(1-n)]^2}$	$V_i^{RTM/RTM} = \frac{b(2-b)(2-n)(a-w^\circ)^2}{(3-2n)[4-2n-b(1-n)]^2}$
SEB/SEB	$q_i^{SEB/SEB} = \frac{(2-b)(2-b-n)(a-w^\circ)}{(3-b-2n)[(4-2n)-b(3-n)]}$	$w_i^{SEB/SEB} = \frac{ab(1-b)+bw^\circ[b(4-n)]+2w^\circ(2-n)}{[(4-2n)-b(3-n)]}$	$\pi_i^{SEB/SEB} = \frac{(1-b)(2-b)^2(2-b-n)^2(a-w^\circ)^2}{(3-b-2n)^2[(4-2n)-b(3-n)]^2}$	$V_i^{SEB/SEB} = \frac{b(1-b)(2-b)(2-b-n)(a-w^\circ)^2}{(3-b-2n)[(4-2n)-b(3-n)]^2}$

Duopoly with RTM

Given (12) and imposing the "rational expectations" conditions, i.e. $y_i = q_i$, $i = 1, 2$, the firm maximization problem under RTM leads to:

$$q_i = \frac{a - w_i - (1-n)q_j}{2-n} \quad i \neq j, \quad i, j = 1, 2 \tag{16}$$

Solving the system of equations in (16), the firms' output decision as a function of wages is:

$$q_i = \frac{a - (2-n)w_i + (1-n)w_j}{3-2n} \quad i \neq j, \quad i, j = 1, 2 \tag{17}$$

At the first stage of the game, under RTM, each firm-union bargaining unit chooses w to maximize the following generalized Nash product,

$$\underbrace{\max}_{w.r.t.\ \ w_i} N = (\pi_i)^{1-b}\,(V_i)^b = \{[a - w_i - q_i - q_j + n(q_i + q_j)]q_i\}^{1-b}\,[(w_i - w^\circ)q_i]^b \tag{18}$$

where b is union bargaining power. After substitution of (17) in (18), maximization *w.r.t.* w_i leads to:

$$w_i = \frac{[a - (1-n)w_i - (2-n)w^\circ]b - 2(2-n)w^\circ}{4-2n} \quad i \neq j, \quad i, j = 1, 2 \tag{19}$$

Solving the system of equations in (19), the equilibrium wages are:

$$w_i^{RTM/RTM} = \frac{ab - 2w^\circ\,(n+b) + w^\circ(4+bn)}{4-2n-b(1-n)} \tag{20}$$

where the apex, e.g. *RTM/RTM*, indicates the case of duopoly. Further substitutions lead to the equilibrium outcomes reported in Table 2.

Duopoly with Sequential Efficient Bargaining Institution

Under the SEB institution, each firm-union pair maximizes the following generalized Nash product,

$$N = (\pi_i)^{1-b}(V_i)^b = \{[a - w_i - q_i - q_j + n(y_i + y_j)]q_i\}^{1-b}[(w_i - w^\circ)q_i]^b \; i, j = 1, 2 \quad (21)$$

Thus, each firm-union pair negotiates in the case of SEB, first w_i and then q_i.

In the last stage, the FOC of the efficient bargaining game between each firm and its union leads to the output level:

$$q_i(y_i, y_j, q_j) = \frac{1}{2-b}[a - q_j + n(y_i + y_j) - w_i] \quad i, j = 1, 2 \qquad (22)$$

From (22), after imposing the "rational expectations" condition, we obtain the output level for given w_i:

$$q_i(w_i, w_j) = \frac{[a(1-b) - (2-n-b)w_i + (1-n)w_j)]}{(1-b)(3-2n-b)} \quad i, j = 1, 2 \qquad (23)$$

At the first stage, after substitution of (23) in (21), the usual maximization procedure w.r.t. w_i leads to:

$$w_i^{SEB/SEB} = \frac{ab(1-b) + b^2w^\circ + b[(n-4)w^\circ + w_j(1-n))] + 2w^\circ(2-n)}{2(2-b-n)} \quad i \neq j, i, j = 1, 2 \quad (24)$$

Solving for w_i the system of equations in (24), the equilibrium wages are:

$$w_i^{SEB/SEB} = \frac{ab(1-b) + bw^\circ[b(4-n)] + 2w^\circ(2-n)}{[(4-2n) - b(3-n)]} \quad i, j = 1, 2 \qquad (25)$$

Consequently, after the usual substitutions, the equilibrium outcomes are those reported in Table 2.

II. Results

To analyze the structural characteristics of the different bargaining institutions in a unionized labor market as entry barriers, let us assume that to preserve its monopolist position the incumbent has to pay a cost T to establish a barrier to entry, such as a license fee to be paid to the government or lobby expenditures to regulate the industry. Therefore, we implicitly conjecture that in the absence of the key ingredients of this model —network effects and different bargaining agendas—, the cost T to establish a barrier to entry could not be paid, because the monopoly rent either would not be sufficient to pay T or would, after such a payment, be less than the duopoly rent. Without loss of generality, let us also suppose exogenous fixed cost E for the entrant is null. Defining the incumbent's profit differentials as:

$$\Delta_{RTM} = (\pi^{M/RTM} - T) - \pi^{RTM/RTM} = \frac{(2-b)^2(a-w^{\circ})^2(n-1)[2n(b-1)-3b+4]\,[2n^2(b-3)+(22-5b)n+3b-20]}{4\{[(b-2)n-b+4]^2(2n-3)^2(2-n)^2\}} - T$$

$$\Delta_{SEB} = (\pi^{M/SEB} - T) - \pi^{SEB/SEB} = \frac{(1-b)^2(2-b)^2(a-w^{\circ})^2(n-1)(b-4+2n)\,[(n-5)b^2+(2n^2-15n+21)b-6n^2+22n-20]}{4(n+b-2)^2(b+2n-3)^2[b(n-3)-2(n-2)]^2} - T$$

The following exercise in Tables 3 (RTM) and 4 (SEB) show the relationship between the bargaining institutions in the labor market and the incentive to block entry.

Table 3. *Profit Differentials for Different Levels of Network Effects under* RTM
All values are calculated for a = 1, w° = 0 and E = 0

b	n	Pi(mono)	Pi(duo)	T	Pi(mono)-T	Δ(diff)
0	0	0.25	0.111111111	0.1389	0.1111	-0.000011
0.05	0	0.23765625	0.108315975	0.1389	0.09875625	-0.009560
0.1	0	0.225625	0.105486157	0.1389	0.086725	-0.018761
0.15	0	0.21390625	0.102621765	0.1389	0.07500625	-0.027616
0.2	0	0.2025	0.099722992	0.1389	0.0636	-0.036123
0.25	0	0.19140625	0.096790123	0.1389	0.05250625	-0.044284
0.3	0	0.180625	0.093823553	0.1389	0.041725	-0.052099
0.35	0	0.17015625	0.090823794	0.1389	0.03125625	-0.059568
0.4	0	0.16	0.087791495	0.1389	0.0211	-0.066691
0.45	0	0.15015625	0.084727457	0.1389	0.01125625	-0.073471
0.5	0	0.140625	0.081632653	0.1389	0.001725	-0.079908
0.55	0	0.13140625	0.07850825	0.1389	-0.00749375	-0.086002
0.6	0	0.1225	0.075355632	0.1389	-0.0164	-0.091756
0.65	0	0.11390625	0.072176431	0.1389	-0.02499375	-0.097170
0.7	0	0.105625	0.068972554	0.1389	-0.033275	-0.102248
0.75	0	0.09765625	0.06574622	0.1389	-0.04124375	-0.106990
0.8	0	0.09	0.0625	0.1389	-0.0489	-0.111400
0.85	0	0.08265625	0.059236863	0.1389	-0.05624375	-0.115481
0.9	0	0.075625	0.055960227	0.1389	-0.063275	-0.119235
0.95	0	0.06890625	0.052674012	0.1389	-0.06999375	-0.122668
0.99	0	0.06375625	0.050041145	0.1389	-0.07514375	-0.125185

b	n	Pi(mono)	Pi(duo)	T	Pi(mono)-T	Δ(diff)
0	0.4	0.390625	0.20661157	0.1389	0.251725	0.04511
0.05	0.4	0.371337891	0.200145257	0.1389	0.232437891	0.03229
0.1	0.4	0.352539063	0.193661151	0.1389	0.213639063	0.01998
0.15	0.4	0.334228516	0.18716183	0.1389	0.195328516	0.00817
0.2	0.4	0.31640625	0.180650089	0.1389	0.17750625	-0.00314
0.25	0.4	0.299072266	0.174128966	0.1389	0.160172266	-0.01396
0.3	0.4	0.282226563	0.167601754	0.1389	0.143326563	-0.02428
0.35	0.4	0.265869141	0.161072024	0.1389	0.126969141	-0.03410
0.4	0.4	0.25	0.154543643	0.1389	0.1111	-0.04344
0.45	0.4	0.234619141	0.148020804	0.1389	0.095719141	-0.05230
0.5	0.4	0.219726563	0.141508043	0.1389	0.080826562	-0.06068
0.55	0.4	0.205322266	0.135010273	0.1389	0.066422266	-0.06859
0.6	0.4	0.19140625	0.128532808	0.1389	0.05250625	-0.07603
0.65	0.4	0.177978516	0.1220814	0.1389	0.039078516	-0.08300
0.7	0.4	0.165039063	0.115662271	0.1389	0.026139063	-0.08952
0.75	0.4	0.152587891	0.109282153	0.1389	0.013687891	-0.09559
0.8	0.4	0.140625	0.102948326	0.1389	0.001725	-0.10122
0.85	0.4	0.129150391	0.096668666	0.1389	-0.009749609	-0.10642
0.9	0.4	0.118164063	0.090451693	0.1389	-0.020735938	-0.11119
0.95	0.4	0.107666016	0.084306625	0.1389	-0.031233984	-0.11554

b	n	Pi(mono)	Pi(duo)	T	Pi(mono)-T	Δ(diff)
0	0.6	0.510204082	0.308641975	0.1389	0.371304082	0.062662106
0.05	0.6	0.485012755	0.297639586	0.1389	0.346112755	0.048473169
0.1	0.6	0.460459184	0.286681784	0.1389	0.321559184	0.034877399
0.15	0.6	0.436543367	0.275774047	0.1389	0.297643367	0.02186932
0.2	0.6	0.413265306	0.264922145	0.1389	0.274365306	0.009443161
0.25	0.6	0.390625	0.254132161	0.1389	0.251725	-0.002407161
0.3	0.6	0.368622449	0.243410504	0.1389	0.229722449	-0.013688055
0.35	0.6	0.347257653	0.232763927	0.1389	0.208357653	-0.024406274
0.4	0.6	0.326530612	0.222199549	0.1389	0.187630612	-0.034568937
0.45	0.6	0.306441327	0.21172487	0.1389	0.167541327	-0.044183543
0.5	0.6	0.286989796	0.201347798	0.1389	0.148089796	-0.053258002
0.55	0.6	0.26817602	0.191076665	0.1389	0.12927602	-0.061800645
0.6	0.6	0.25	0.180920259	0.1389	0.1111	-0.069820259
0.65	0.6	0.232461735	0.170887842	0.1389	0.093561735	-0.077326107
0.7	0.6	0.215561224	0.160989178	0.1389	0.076661224	-0.084327954
0.75	0.6	0.199298469	0.151234568	0.1389	0.060398469	-0.090836099
0.8	0.6	0.183673469	0.141634871	0.1389	0.044773469	-0.096861402
0.85	0.6	0.168686224	0.132201544	0.1389	0.029786224	-0.10241532
0.9	0.6	0.154336735	0.122946672	0.1389	0.015436735	-0.107509938
0.95	0.6	0.140625	0.113883007	0.1389	0.001725	-0.112158007
0.99	0.6	0.130114796	0.106778762	0.1389	-0.008785204	-0.115563966

b	n	Pi(mono)	Pi(duo)	T	Pi(mono)-T	Δ(diff)
0	0.9	0.826446281	0.694444444	0.1389	0.687546281	-0.00690
0.05	0.9	0.785640496	0.663167221	0.1389	0.646740496	-0.01643
0.1	0.9	0.745867769	0.632472796	0.1389	0.606967769	-0.02551
0.15	0.9	0.707128099	0.602370164	0.1389	0.568228099	-0.03414
0.2	0.9	0.669421488	0.572868445	0.1389	0.530521488	-0.04235
0.25	0.9	0.632747934	0.543976894	0.1389	0.493847934	-0.05013
0.3	0.9	0.597107438	0.515704895	0.1389	0.458207438	-0.05750
0.35	0.9	0.5625	0.488061966	0.1389	0.4236	-0.06446
0.4	0.9	0.52892562	0.461057766	0.1389	0.39002562	-0.07103
0.45	0.9	0.496384298	0.434702087	0.1389	0.357484298	-0.07722
0.5	0.9	0.464876033	0.409004867	0.1389	0.325976033	-0.08303
0.55	0.9	0.434400826	0.383976185	0.1389	0.295500826	-0.08848
0.6	0.9	0.404958678	0.359626265	0.1389	0.266058678	-0.09357
0.65	0.9	0.376549587	0.33596548	0.1389	0.237649587	-0.09832
0.7	0.9	0.349173554	0.313004352	0.1389	0.210273554	-0.10273
0.75	0.9	0.322830579	0.290753556	0.1389	0.183930579	-0.10682
0.8	0.9	0.297520661	0.269223923	0.1389	0.158620661	-0.11060
0.85	0.9	0.273243802	0.24842644	0.1389	0.134343802	-0.11408
0.9	0.9	0.25	0.228372254	0.1389	0.1111	-0.11727
0.95	0.9	0.227789256	0.209072675	0.1389	0.088889256	-0.12018
0.99	0.9	0.210764463	0.194184035	0.1389	0.071864463	-0.12232

The first column shows union bargaining power. The second reports a given level of network effects. The third column lists the values of monopoly profits calculated according to the expressions in Table 1. The fourth column reports the duopoly profits in Table 2. The fifth column reports the amount of the license fee/lobby costs, T. Those costs are fixed at a level such that when the firm produces standard goods $n = 0$, it cannot maintain the monopoly position when $b \longrightarrow 0$, i.e. when the labor market approaches the competitive one. The sixth column reports the monopolist's net profits. Finally, the seventh column evaluates the difference between the monopolist's net profits and duopoly profits. When the value of the profit differential is positive for the incumbent, paying T is advantageous and keeps the potential entrant out of the market. By contrast, a duopoly is better when the value of the profit differential is negative. An inspection of the numerical examples in Tables 3 and 4 and exhaustive graphic analyses led to the following results.

Result 1. *Under RTM, the profit differential always decreases monotonically with increasing union power for whatever intensity of network effects (see Table 3 and Fig. 1)*

Result 2. *Under SEB, the profit differential either decreases monotonically with increasing union power or experiences a "humped" function of union power, depending on whether the intensity of network effects is sufficiently low or high (see Table 4 and Fig. 2).*

Note that by widening the profit differential, the presence of positive entry costs, $E > 0$, reinforces the above results. Those findings indicate that while under RTM the presence of unions always works to "favor" entry of a firm irrespective of whether the produced good is a network or a traditional good; under SEB this holds only if network effects are not intense.

In other words, under SEB, if network externalities are sufficiently intense, unions become a device used by a monopolist to resist entry of a rival firm, except for extremely high values of union power.

Figure 1 refers to the case of RTM and shows that, for $b \longrightarrow 1$, a negative monotonic relation always exists in the profit differential. Noteworthy, if the union has sufficiently low bargaining power, it is more advantageous for the incumbent to pay to establish the barrier for intermediate values of network effects than for extremely low/high network externality intensity. This reflects the fact that network externalities are themselves a structural barrier to entry (Buccella and Fanti, 2016).

Table 4. *Profit Differentials for Different Levels of Network Effects under* SEB
All values are calculated for a = 1, w° = 0 and E = 0

b	n	Pi(mono)	Pi(duo)	T	Pi(mono)-T	Δ(diff)
0	0	0.25	0.111111111	0.1389	0.1111	-0.000011
0.05	0	0.2375	0.106486992	0.1389	0.0986	-0.007886992
0.1	0	0.225	0.101872619	0.1389	0.0861	-0.015772619
0.15	0	0.2125	0.097265632	0.1389	0.0736	-0.023665632
0.2	0	0.2	0.092662948	0.1389	0.0611	-0.031562948
0.25	0	0.1875	0.088060541	0.1389	0.0486	-0.039460541
0.3	0	0.175	0.083453164	0.1389	0.0361	-0.047353164
0.35	0	0.1625	0.078833962	0.1389	0.0236	-0.055233962
0.4	0	0.15	0.074193938	0.1389	0.0111	-0.063093938
0.45	0	0.1375	0.069521218	0.1389	-0.0014	-0.070921218
0.5	0	0.125	0.0648	0.1389	-0.0139	-0.0787
0.55	0	0.1125	0.060009033	0.1389	-0.0264	-0.086409033
0.6	0	0.1	0.055119376	0.1389	-0.0389	-0.094019376
0.65	0	0.0875	0.050090997	0.1389	-0.0514	-0.101490997
0.7	0	0.075	0.044867492	0.1389	-0.0639	-0.108767492
0.75	0	0.0625	0.039367599	0.1389	-0.0764	-0.115767599
0.8	0	0.05	0.033471074	0.1389	-0.0889	-0.122371074
0.85	0	0.0375	0.026994152	0.1389	-0.1014	-0.128394152
0.9	0	0.025	0.019644702	0.1389	-0.1139	-0.133544702
0.95	0	0.0125	0.010935126	0.1389	-0.1264	-0.137335126
0.99	0	0.0025	0.002427834	0.1389	-0.1364	-0.138827834

b	n	Pi(mono)	Pi(duo)	T	Pi(mono)-T	Δ(diff)
0	0.4	0.390625	0.20661157	0.1389	0.251725	0.04511343
0.05	0.4	0.375897503	0.199206064	0.1389	0.236997503	0.037791439
0.1	0.4	0.361	0.191778086	0.1389	0.2221	0.030321914
0.15	0.4	0.345912604	0.184322361	0.1389	0.207012604	0.022690243
0.2	0.4	0.330612245	0.176832257	0.1389	0.191712245	0.014879988
0.25	0.4	0.315072016	0.169299359	0.1389	0.176172016	0.006872657
0.3	0.4	0.299260355	0.161712896	0.1389	0.160360355	-0.001352541
0.35	0.4	0.28314	0.15405892	0.1389	0.14424	-0.00981892
0.4	0.4	0.266666667	0.146319159	0.1389	0.127766667	-0.018552492
0.45	0.4	0.249787335	0.138469331	0.1389	0.110887335	-0.027581996
0.5	0.4	0.232438017	0.130476665	0.1389	0.093538017	-0.036938649
0.55	0.4	0.214540816	0.122296125	0.1389	0.075640816	-0.046655308
0.6	0.4	0.196	0.113864515	0.1389	0.0571	-0.056764515
0.65	0.4	0.176696676	0.105090994	0.1389	0.037796676	-0.067294318
0.7	0.4	0.156481481	0.09584121	0.1389	0.017581481	-0.078259728
0.75	0.4	0.13516436	0.085909631	0.1389	-0.00373564	-0.089645272
0.8	0.4	0.1125	0.074968763	0.1389	-0.0264	-0.101368763
0.85	0.4	0.088166667	0.062470005	0.1389	-0.050733333	-0.113203338
0.9	0.4	0.061734694	0.047434884	0.1389	-0.077165306	-0.12460019
0.95	0.4	0.032618343	0.027971102	0.1389	-0.106281657	-0.134252758
0.99	0.4	0.006853668	0.00661581	0.1389	-0.132046332	-0.138662141

b	n	Pi(mono)	Pi(duo)	T	Pi(mono)-T	Δ(diff)
0	0.6	0.510204082	0.308641975	0.1389	0.371304082	0.062662106
0.05	0.6	0.495524691	0.299305488	0.1389	0.356624691	0.057319204
0.1	0.6	0.480621302	0.28990696	0.1389	0.341721302	0.051814341
0.15	0.6	0.46546	0.280436713	0.1389	0.32656	0.046123287
0.2	0.6	0.45	0.270882878	0.1389	0.3111	0.040217122
0.25	0.6	0.434191871	0.261230742	0.1389	0.295291871	0.03406113
0.3	0.6	0.417975207	0.251461826	0.1389	0.279075207	0.027613381
0.35	0.6	0.40127551	0.241552589	0.1389	0.26237551	0.020822922
0.4	0.6	0.384	0.231472551	0.1389	0.2451	0.013627449
0.45	0.6	0.366031856	0.221181534	0.1389	0.227131856	0.005950322
0.5	0.6	0.347222222	0.210625462	0.1389	0.208322222	-0.00230324
0.55	0.6	0.327378893	0.199729821	0.1389	0.188478893	-0.011250928
0.6	0.6	0.30625	0.188389081	0.1389	0.16735	-0.021039081
0.65	0.6	0.2835	0.176448941	0.1389	0.1446	-0.031848941
0.7	0.6	0.258673469	0.163675103	0.1389	0.119773469	-0.043901634
0.75	0.6	0.231139053	0.149695295	0.1389	0.092239053	-0.057456242
0.8	0.6	0.2	0.133884298	0.1389	0.0611	-0.072784298
0.85	0.6	0.163946281	0.115116592	0.1389	0.025046281	-0.090070311
0.9	0.6	0.121	0.091175974	0.1389	-0.0179	-0.109075974
0.95	0.6	0.068055556	0.057138534	0.1389	-0.070844444	-0.127982978
0.99	0.6	0.015171029	0.014538135	0.1389	-0.123728971	-0.138267106

b	n	Pi(mono)	Pi(duo)	T	Pi(mono)-T	Δ(diff)
0	0.9	0.826446281	0.694444444	0.1389	0.687546281	-0.006898163
0.05	0.9	0.819132653	0.686132026	0.1389	0.680232653	-0.005899373
0.1	0.9	0.81225	0.678044485	0.1389	0.67335	-0.004694485
0.15	0.9	0.805851801	0.67020596	0.1389	0.666951801	-0.00325416
0.2	0.9	0.8	0.662643606	0.1389	0.6611	-0.001543606
0.25	0.9	0.794766436	0.655387839	0.1389	0.655866436	0.000478597
0.3	0.9	0.790234375	0.648472454	0.1389	0.651334375	0.002861921
0.35	0.9	0.7865	0.641934432	0.1389	0.6476	0.005665568
0.4	0.9	0.783673469	0.635813149	0.1389	0.644773469	0.008960321
0.45	0.9	0.781878698	0.630148375	0.1389	0.642978698	0.012830323
0.5	0.9	0.78125	0.624975888	0.1389	0.64235	0.017374112
0.55	0.9	0.781921488	0.620318314	0.1389	0.643021488	0.022703174
0.6	0.9	0.784	0.616166189	0.1389	0.6451	0.028933811
0.65	0.9	0.7875	0.612438211	0.1389	0.6486	0.036161789
0.7	0.9	0.7921875	0.608894727	0.1389	0.6532875	0.044392773
0.75	0.9	0.797193878	0.604938272	0.1389	0.658293878	0.053355606
0.8	0.9	0.8	0.599112426	0.1389	0.6611	0.061987574
0.85	0.9	0.7935	0.587671562	0.1389	0.6546	0.066928438
0.9	0.9	0.75625	0.559602266	0.1389	0.61735	0.057747734
0.95	0.9	0.6125	0.472218917	0.1389	0.4736	0.001381083
0.99	0.9	0.210764463	0.191169581	0.1389	0.071864463	-0.119305118

By contrast, in the case of SEB, the values reported in Table 4 and Figure 2 show that if the network effects are sufficiently strong, a non-monotonic relation exists in the profit differential for $b \longrightarrow 1$. In fact, it can be shown that, provided that $n \geq n° = 0.835$:

1) $\frac{\partial \Delta_{SEB}}{\partial b} \geq 0$ for $b \leq b°(n)$ where $b°(n) = \left\{ b(n) \colon \left. \frac{\partial \Delta_{SEB}}{\partial b} \right|_{n \geq n°} = 0 \right\}$;

and 2) $b° \longrightarrow 1$ for $n° \longrightarrow 1$

That is, in a monopolistic industry characterized by "strong" network goods and a unionized labor market with an efficient bargaining institution, negotiations with a union help to prevent entry of a rival firm. An intuitive explanation of this result may be as follows. At equilibrium, for a given level of the network effect, the incumbent produces at a point on the demand curve in which the price elasticity of demand under monopoly is larger than duopoly, that is, ε^{*SEB} $(\bar{n}, b) > \varepsilon^{*SEB}$ $(\bar{n}, b)$. Defining the marginal revenue differential of the two market structures as $\Delta MR^{SEB} = (MR^{SEB} - MR^{SEB/SEB})$, algebraic passages lead to:

Figure 1. *Plot of the Profit Differential between Monopoly and Duopoly under RTM (Δ_{RTM}) in Table 3, for Different Network Effect Intensities. The figure is drawn for a = 1, w° = 0 and T = .1389.*

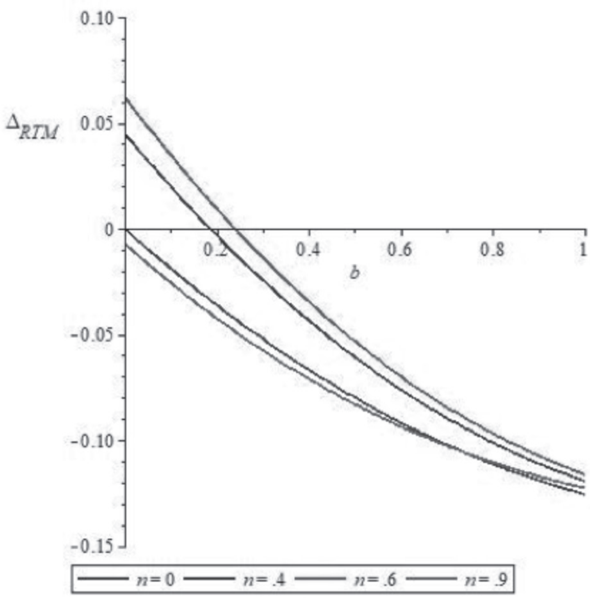
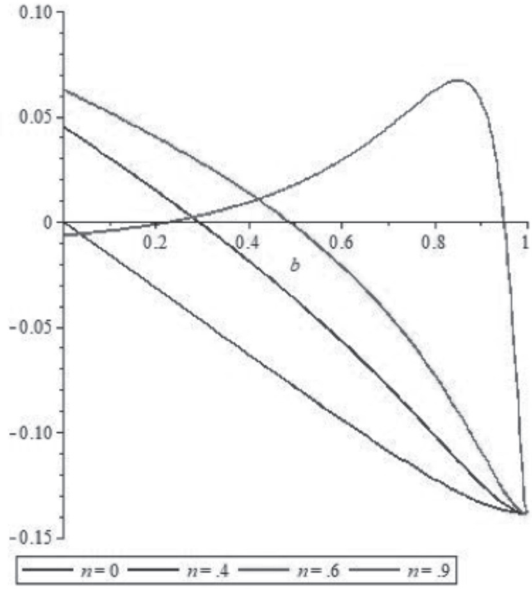


Figure 2. *Plot of the Profit Differential between Monopoly and Duopoly under SEB (Δ_{SEB}) in Table 4, for Different Network Effect Intensities. The figure is drawn for a = 1, w° = 0 and T = .1389.*



$$\Delta MR^{SEB}(\bar{n}, b) = \underbrace{(p^{SEB}(\bar{n}, b) - p^{SEB/SEB}(\bar{n}, b)}_{+} + \underbrace{\left(\frac{p^{SEB/SEB}(\bar{n}, b)}{\varepsilon^{SEB/SEB}(\bar{n}, b)} - \frac{p^{SEB}(\bar{n}, b)}{\varepsilon^{SEB}(\bar{n}, b)}\right)}_{+/-} \gtreqless 0$$

The first term of the above expression is unambiguously positive. On the other hand, the sign of the second term depends on the precise values of the parameters $(\bar{n}, b)$, because $\frac{1}{\varepsilon^{*SEB}(\bar{n}, b)} < \frac{1}{\varepsilon^{*SEB/SEB}(\bar{n}, b)}$. Provided that the network effects are adequately strong, the area in figure 2 where $\Delta_{SEB} < 0$ defines the combination of the parameters $(\bar{n}, b)$ such that the quantity variation effect under SEB between the two market structures dominates the price differential effect on the incumbent's revenues and indicates at which level of union bargaining power the relative elasticity differential is maximal. This, in turn, determines the profit differential and, consequently, the ability of the incumbent to pay the license/lobbying costs to create the barrier to entry. On the other hand, in the case of entry, it is easy to see from Figure 2 that the amount of the entrant's prohibitive fixed cost threshold becomes smaller than the threshold in the absence of unions only for values of union power practically next to one, that is, in the rather implausible case of unions controlling firms.

Conclusions

The paper investigated the effects of unionization of the labor market on the entry of a firm under the RTM and SEB institutions. For simplicity, we assumed the "oldest" type of barrier to entry, such as the existence of possible government patents and monopoly grants —which requires a fixed fee payment by the granted monopolist— are barriers to the entry of new enterprises. Then, the cases of traditional and network industries are compared. The findings show that under RTM, unions always play a pro-competitive role, while under SEB they may become a barrier to entry[8] in network industries with intense network effects. These results shed light on the importance of presence, on the one hand, of unions and different bargaining agendas and on the other, of network goods in the shape of industrial competition, with the evident anti-trust and competition policy implications. Furthermore, these results offer the empirically testable implication (at the current stage, lacking in the literature) that scarcely competitive structures should often prevail in strong network industries with efficient bargaining practices.

Further steps for future research can be the analysis of entry, extending the model with vertical relationships in the industry to price competition with differentiated goods. Moreover, the model may contemplate that firms would hire a manager to bargain with the union. An interesting development could also be the investigation of different production technologies such as convex cost functions. Finally, an investigation of the bargaining agenda selection in network industries is definitely called for in a context in which the incumbent strategically chooses the output level such that the potential competitor finds market entry disadvantageous (i.e. a strategic barrier to entry à la Dixit-Spence).

Compliance with Ethical Standards:
Funding: No institution has funded this study.

[8] In the sense that under SEB the monopoly firm is able to pay the fee for granting the monopoly position by the authority, while under RTM the monopoly firm can no longer pay it and thus "accommodates".

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