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Managerial Delegation in a Mixed Duopoly with a Foreign Competitor

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Abstract

We examine firms' decisions to hire managers in a duopoly where a public firm competes with a foreign private firm. In contrast with the case in which the public firm competes with a domestic private firm -where only the private firm decides to hire a manager- we find that both firms hire managers. This leads to a social welfare higher than the one obtained when neither firm hires a manager.

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1. Introduction.

This paper examines firms' decisions to hire managers when a public firm with social welfare objectives competes with a foreign private firm with profit objectives.

The issue of strategic managerial contracting in the context of private firms has been widely analyzed since the early contributions of Fershtman and Judd (1987) and Sklivas (1987), who showed that owners of profit-maximizing-firms have an incentive to hire managers that pursue objectives different from simple profit maximization. By doing so in a publicly observable way, owners pre-commit to a strategy they find profitable when the reaction of their competitors is taken into account.

Strategic managerial contracting in the context of mixed markets, where public firms and private firms compete, has been studied by, among others, Barros (1995), White (2001) and Barcena-Ruiz (2007)[1]. Barros (1995) studies the effects of managerial contracting in a model that includes both agency problems within the firm and strategic motives. White (2001) concentrates on the strategic aspects of managerial contracting and endogenizes firms' decisions to hire managers. Bárcena-Ruiz (2007) follows White's approach and investigates the effect of changing the mode of product-market competition –from Cournot to Bertrand. Our approach is similar to Bárcena-Ruiz (2007) and White (2001), which we closely follow.

Most models of mixed markets -including Barros (1995), White (2001) and Bárcena-Ruiz (2007)- assume that private firms are domestic. Some exceptions are Fjell and Pal (1996), Fjell and Heywood (2002) Matsumura (2003) and Lu (2006, 2007), who include foreign private firms. The introduction of such firms into the analysis is important because in reality mixed oligopolies often include them and this inclusion alters the objective function of the public firm. Yet, there is no analysis of the effect of foreign ownership of private firms in the hiring of managers in mixed markets. In this paper we attempt to fill this gap by considering a duopoly consisting of a state-owned firm and a foreign private firm.

Our main results are that, if the weight associated to the foreign firm's profits in the social welfare function is low enough, then: i) in contrast with the case in which the private firm is domestic – where the public firm decides not hire a manager- in equilibrium both the public and the foreign private firm hire managers, and ii) this equilibrium is associated with a social welfare higher than the one obtained when neither firm hires a manager.

2. The Model.

We consider a duopolistic model in which a public firm (firm 0) and a foreign private firm (firm 1) compete in a homogeneous product market. The inverse demand function is given by

$$p = a - q_0 - q_1$$

[1] Nakamura and Inoue (2007) and Nishimori and Ogawa (2005) also consider models with managerial contracting in mixed oligopolies, along the lines of Barros (1995) and White (2001). They do not analyze, however, the decision to hire managers, which is the focus of our paper.

where q_i, i= 0,1, represents firm i's output.

We assume, as in White (2001), that both firms have constant marginal costs and –to avoid trivial results, as will later become clear- that the public firm is less efficient than the private one: $0 < c_1 < c_0$, where c_i denotes firm i's marginal cost.

The owners of the foreign private firm seek to maximize the firm's profits:

$$\pi_1 = pq_1 - c_1 q_1 \tag{1}$$

In contrast, the owners of the public firm maximize social welfare, defined as the sum of: i) consumer surplus, ii) the profits of the public firm, and iii) a proportion $\gamma \in [0,1]$ of the profits of the foreign private firm:

$$W = (q_0 + q_1)^2 / 2 + (p - c_0)q_0 + \gamma(p - c_1)q_1 \tag{2}$$

This definition contains as a particular case (when $\gamma = 0$) the usual assumption that the profits of the foreign private firm are excluded from social welfare. Yet, it also allows for the situations suggested by Fjell and Pal (l996) in which a fraction of the foreign firm's profits could be included in the social welfare, as well as partial foreign ownership.

The owners of each firm can hire a manager to make the firm's production decisions. If this happens, the manager of firm i seeks to maximize a linear function O_i of firm i's profits π_i and revenues R_i:

$$O_i = \beta_i \pi_i + (1 - \beta_i) R_i \tag{3}$$

This manager's objective function is supported by the assumption that the manager is offered a managerial contract of the form $M_i = \alpha_i O_i + T_i$, where α_i and T_i are terms that do not affect the manager's incentives but allow the firm to adjust the manager's payment to his opportunity cost.

The manager's objective function O_i can be rewritten as:

$$O_i = (p - \beta_i c_i) q_i \tag{4}$$

which makes it clear that the term β_i can be interpreted as a discount factor on costs: the manager is instructed to consider $\beta_i c_i$ as the marginal cost of production. This incentive parameter β_i allows the owner of the firm to make their manager a more ($\beta_i < 1$) or less ($\beta_i > 1$) aggressive competitor than a profit maximizing firm.

We follow Bárcena-Ruiz (2007) and White (2001) and examine the following three-stage game: in the first stage, the owners of each firm choose whether or not to hire a manager. In the second stage, the owners of firms who hired managers select incentive parameters for them. In the third stage, the managers of the firms or, in their absence, their owners, choose the firms' outputs.

3. Analysis of the different hiring decisions

To look for the subgame perfect equilibrium of the game, we first examine each of the (four) subgames that follow the initial firms' hiring decisions and solve the game backwards.

3.1 Both firms hire managers

When both firms hire managers, the simultaneous maximization of these managers' objective functions, as given by (4), leads to the following output at stage three:

$$q_i^b = \frac{a - 2\beta_i c_i + \beta_j c_j}{3}, \text{ i=0, 1; j= 1 - i} \tag{5}$$

where the superscript b denotes that both firms hire managers.

At stage two, the owners of the public firm choose β_0 to maximize social welfare, as given by (2), and the owners of the foreign private firm choose β_1 to maximize the firm's profits, as given by (1). Both types of owners anticipate stage-three output quantities as given by (5). Simultaneous maximization of these objective functions leads to the following choice of incentive parameters:

$$\beta_0^b = 1 - \frac{(4-3\gamma)(a-c_0) - 6\gamma(c_0 - c_1)}{(4-3\gamma)c_0}$$

$$\beta_1^b = 1 - \frac{2(c_0 - c_1)}{(4-3\gamma)c_1} \tag{6}$$

According to equation (6), the private manager's incentive parameter β_1^b is less than one for all $\gamma \in [0,1]$, while such an assertion cannot be made for the public manager's incentive parameter β_0^b. On the other hand, β_0^b (β_1^b) is increasing (decreasing) in γ. So, as the weight attached to the foreign firm's profits decreases, β_0^b decreases and the public firm's manager is more aggressive, while the opposite happens to the foreign firm's manager. In the polar case where $\gamma = 0$ (and, more generally, when γ is sufficiently low) both incentive parameters are smaller than one. This is in contrast with White (2001) –which corresponds to the case $\gamma = 1$ - in which only β_1^b is unambiguously smaller than one.

Replacing the incentive parameters given in equation (6) into the output functions (equation 5) we obtain:

$$q_0^b = \frac{(4-3\gamma)(a-c_0) - (2+3\gamma)(c_0 - c_1)}{(4-3\gamma)}, \qquad q_1^b = \frac{4(c_0 - c_1)}{(4-3\gamma)}$$

$$\pi_1^b = \frac{8(c_0 - c_1)^2}{(4-3\gamma)^2}$$

$$W^b = \frac{(-2+3\gamma)(c_0 - c_1)\{(4-3\gamma)(a-c_0)-(2+3\gamma)(c_0-c_1)\}}{(4-3\gamma)^2}$$
$$+\frac{1}{2}\left\{\frac{(4-3\gamma)(a-c_0)+(2-3\gamma)(c_0-c_1)}{(4-3\gamma)}\right\}^2 + \frac{\gamma 8(c_0-c_1)^2}{(4-3\gamma)^2}$$

Notice that, as in White (2001), when $c_0 = c_1$ the foreign private firm produces nothing and the public firm produces the socially optimal output, $q_0^b = (a - c_0)$ (which implies $p = c_0$). To avoid this (trivial) result, we keep White's assumption that $0 < c_1 < c_0$.

Notice also that public output is strictly positive if and only if

$$c_0 < \frac{(4-3\gamma)a + (2+3\gamma)c_1}{6} \equiv \bar{c}_0^b \qquad (7)$$

We will assume condition (7) ($c_0 < \bar{c}_0^b$) throughout. If this condition holds for $\gamma = 1$ (in which case it coincides with the assumption made in White (2001)) it will also hold for all $\gamma < 1$.

3.2 Only the foreign private firm hires a manager

At the third stage, the manager of the foreign private firm maximizes the objective function given by equation (4) and the owners of the public firm maximize social welfare, as given by equation (2). These maximization problems lead to:

$$q_0^f = 0, \qquad q_1^f = \frac{a - \beta_1 c_1}{2} \quad \text{if} \quad \beta_1 < \beta_1 *$$

$$q_0^f = \frac{(2-\gamma)(a-c_0) - \gamma(c_0 - \beta_1 c_1)}{(2-\gamma)}, \qquad q_1^f = \frac{c_0 - \beta_1 c_1}{(2-\gamma)} \quad \text{if} \quad \beta_1 \geq \beta_1 * \qquad (8)$$

where the superscript f indicates that only the foreign firm hires a manager, and

$\beta_1 * \equiv \dfrac{\gamma a - 2(a - c_0)}{\gamma c_1}$, with $\beta_1 * < 1$ if condition (7) holds.

At stage two, the owners of the foreign private firm choose the incentive parameter β_1 to maximize the firm's profits. Let $\gamma * \equiv \dfrac{2a - 2c_0}{2a - c_0 - c_1}$ where $0 < \gamma * < 1$.

When $\gamma > \gamma *$, the solution of the foreign firm maximization problem is:

$$\beta_1^f = \beta_1 *$$

$$q_0^f = 0, \qquad q_1^f = \frac{a - c_0}{\gamma}$$

$$\pi_1^f = \frac{\gamma(a - c_0)(c_0 - c_1) - (1-\gamma)(a - c_0)^2}{\gamma^2}$$

$$W^f = \frac{1}{2}\{\frac{a - c_0}{\gamma}\}^2 + \frac{\gamma(a - c_0)(c_0 - c_1) - (1-\gamma)(a - c_0)^2}{\gamma}$$

When $\gamma \leq \gamma^*$, maximization of the foreign firm's profits leads to:

$$\beta_1^f = \frac{(2-\gamma)c_1 - \gamma c_0}{2(1-\gamma)c_1},$$

$$q_0^f = \frac{(2-\gamma)(a - c_0) - \gamma(c_0 - \beta_1 c_1)}{(2-\gamma)}, \qquad q_1^f = \frac{(c_0 - c_1)}{2(1-\gamma)}$$

$$\pi_1^f = \frac{(c_0 - c_1)^2}{4(1-\gamma)}$$

$$W^f = \frac{1}{2}\{\frac{2a - c_0 - c_1}{2}\}^2 - \frac{(c_0 - c_1)\{2(1-\gamma)(a - c_0) - \gamma(c_0 - c_1)}{4(1-\gamma)} + \frac{\gamma(c_0 - c_1)^2}{4(1-\gamma)}$$

3.3 *Only the public firm hires a manager*.

In this case, at the third stage the manager of the public firm maximizes the objective function given by equation (4), while the owners of the private firm maximize profits. This leads to the output functions:

$$q_0^p = \frac{a - 2\beta_0 c_0 + c_1}{3}, \qquad q_1^p = \frac{a + \beta_0 c_0 - 2c_1}{3}$$

Where the superscript p indicates that only the public firm hires a manager.

At the second stage, the owners of the public firm choose the incentive parameter β_0 to maximize social welfare. This results in:

$$\beta_0^p = \frac{a(2\gamma - 3) + 6c_0 - 4\gamma c_1}{(3-2\gamma)c_0}$$

$$q_0^p = \frac{(3-2\gamma)(a - c_0) - (2\gamma+1)(c_0 - c_1)}{(3-2\gamma)}, \qquad q_1^p = \frac{2(c_0 - c_1)}{(3-2\gamma)}$$

$$\pi_1^p = \frac{4(c_0 - c_1)^2}{(3-2\gamma)^2}$$

$$W^p = \frac{1}{2}\left\{\frac{(a-c_0)(3-2\gamma)+(c_0-c_1)(1-2\gamma)}{(3-2\gamma)}\right\}^2$$
$$+\frac{(2\gamma-1)(c_0-c_1)\{(3-2\gamma)(a-c_0)-(2\gamma+1)(c_0-c_1)\}}{(3-2\gamma)^2}+\frac{\gamma 4(c_0-c_1)^2}{(3-2\gamma)^2}$$

Condition (7), which guarantees that $q_0^b > 0$, also implies that $q_0^p > 0$

3.4 Neither firm hires a manager

In this case, at stage three the owners of the foreign private firm will maximize profits while the owners of the public firm will maximize social welfare. The simultaneous solution of these problems yields:

$$q_0^n = \frac{(2-\gamma)(a-c_0)-\gamma(c_0-c_1)}{(2-\gamma)}, \quad q_1^n = \frac{(c_0-c_1)}{(2-\gamma)} \tag{9}$$

where the superscript n indicates that neither firm hires a manager and, again, condition (7) guarantees $q_0^n > 0$. These output choices imply:

$$\pi_1^n = \frac{(c_0-c_1)^2}{(2-\gamma)^2}$$

$$W^n = \frac{1}{2}\left\{\frac{(2-\gamma)(a-c_0)+(1-\gamma)(c_0-c_1)}{(2-\gamma)}\right\}^2$$
$$+\frac{(1-\gamma)(c_1-c_0)\{(2-\gamma)(a-c_0)-\gamma(c_0-c_1)\}}{(2-\gamma)^2}+\frac{\gamma(c_0-c_1)^2}{(2-\gamma)^2}$$

4. Managerial Game Solution.

We can now analyze the first stage of the game, in which owners decide whether or not to hire a manager. The solution is given in the following proposition, where $\gamma^{**} \equiv \min\{\gamma^*, 0.7494\}$, with $0 < \gamma^{**} < 1$:

Proposition 1. In the subgame perfect equilibrium, i) if $\gamma \le \gamma^{**}$, both the public firm and the foreign private firm hire managers, while ii) if $\gamma > \gamma^{**}$, only the private firm hires a manager.

Proof: See appendix.

To gain some intuition for why the managerial solution prevails for low values of γ, let us compare this result with White (2001), which corresponds to the case γ =1 -when the whole private firm's profits are included in social welfare. It is useful to perform this comparison in terms of how much output is produced and how this production is shared between the public firm and the more efficient private firm when i) both firms hire managers, and ii) only the private firm does so. This comparison shows that the managerial solution becomes more attractive both in terms of output level and output allocation for low values of γ.

When $\gamma=1$, total output is higher if only the private firm hires a manager than if both firms do. Moreover, this higher output is produced more efficiently, since all production is carried out by the more efficient private firm, while output production is shared between the two firms when both of them hire managers. Thus, by not hiring a manager, the public firm obtains a better outcome both in terms of total output production and output allocation.

Now, as we reduce γ, we reach a point (γ^*) below which public output is no longer zero if only the private firm is run by a manager. For low values of γ, the choice of the public firm also hiring a manager becomes more attractive both in terms of output production and allocative efficiency:

i) When $\gamma \leq \gamma^{**}$, private output is higher -and public output is lower- when both firms hire managers than when only the foreign firm does so. Thus, for small values of γ a higher fraction of total output is produced by the more efficient firm when both firms hire managers than when only the private firm does so.

ii) When $\gamma \leq \gamma^*$, the difference in total output between both regimes decreases as we reduce γ until it becomes zero when $\gamma=0$.

We finally analyze the effect of hiring managers on social welfare, as compared with a situation in which owners make output decisions.

Proposition 2. For any $\gamma \in [0,1]$, social welfare is higher when both the public and the foreign private firm hire managers than when neither of them do so.

Proof: See appendix.

The positive effect of hiring managers on social welfare that White (2001) finds for the case $\gamma=1$ extends to the case $\gamma<1$. As in White (2001), this effect s occurs despite the fact that the managerial regime yields a lower total output (and thus a lower consumer surplus) than the one obtained when the owners make decisions. But, it is worth mentioning that as γ is reduced the difference in total output between both regimes –and thus the difference in consumer surplus- is also reduced until it completely vanishes for $\gamma = 0$.

Conclusion.

In this paper, we have examined the effect on changing the nationality of the private firm in a mixed duopoly where firms may hire managers to make output decisions. We have done this in a setting that allows for situations intermediate between the usual cases of (total) domestic or foreign ownership of the private firm. We have found that the result that only the private firm hires a manager does not hold when the weight associated to the private firm's profits is sufficiently low. In such a case, both firms hire managers. This translates into a social welfare higher than the one that would prevail if neither firm hired managers.

Appendix.

Proof of Proposition 1.

We will show that $W^p > W^n$, $W^b > W^f$ if and only if $\gamma < \gamma^{**} \equiv \min\{\gamma^*, 0.7494\}$, $\pi_1^b > \pi_1^p$ and $\pi_1^f \geq \pi_1^n$ (with strict inequality for $\gamma > 0$). We have:

$$W^n - W^p = \frac{(-3+2\gamma)(c_0 - c_1)^2}{2(2-\gamma)^2(3-2\gamma)^2} < 0$$

The comparison of W^b and W^f requires consideration of two different cases.

When $\gamma < \gamma^*$:

$$W^b - W^f = (c_0 - c_1)^2 \left\{ \frac{32 - 56\gamma + 11\gamma^2 + 9\gamma^3}{8(4-3\gamma)^2(1-\gamma)} \right\} > 0 \text{ if and only if } \gamma < 0.7494$$

When $\gamma > \gamma^*$:

$$W^b - W^f = -(a - c_0)^2 \left\{ \frac{(1-\gamma)^2}{2\gamma^2} \right\} - (a - c_0)(c_0 - c_1) + (c_0 - c_1)^2 \left\{ \frac{(2-3\gamma)(6+3\gamma) + 16\gamma}{2(4-3\gamma)^2} \right\},$$

which is negative when condition (7) holds. To see this, rewrite condition (7) as $(2+3\gamma)(c_0 - c_1) - (4-3\gamma)(a - c_0) \leq 0$.

Maximization of $(W^b - W^f)$ when $\gamma > \gamma^*$ with respect to $(c_0 - c_1)$ and $(a - c_0)$ subject to $(c_0 - c_1) \geq 0$, $(a - c_0) \geq 0$ and condition (7) shows that $W^b - W^f$ achieves a maximum of zero when $(c_0 - c_1) = (a - c_0) = 0$ and is negative for other values.

$$\pi_1^b - \pi_1^p = 4(c_0 - c_1)^2 \left\{ \frac{2 - \gamma^2}{(4-3\gamma)^2(3-2\gamma)^2} \right\} > 0$$

To prove that $\pi_1^f \geq \pi_1^n$ (with strict inequality for $\gamma > 0$) we can directly compare their values which, for the case $\gamma < \gamma^*$ yields:

$$\pi_1^f - \pi_1^n = \frac{\gamma^2 (c_0 - c_1)^2}{4(1-\gamma)(2-\gamma)^2} > 0 \text{ (except for } \gamma = 0),$$

or we can use a revealed preference argument: π_1^f is the maximum profit than can be obtained when only the foreign firm chooses an incentive parameter β_1^f for its manager at stage two. One option available for this firm is to set $\beta_1 = 1$ -thus instructing its manager to maximize profits- in which case the stage-three market equilibrium will be exactly the same as the one obtained when neither firm has a manager. This can be seen by comparing the output choices q_0^n, q_1^n in equation (9) with the values that q_0^f, q_1^f take when the foreign firm sets the incentive parameter $\beta_1 = 1 > \beta*$ in equation (8). Since the foreign firm does not choose $\beta_1^f = 1$ at stage two (except for $\gamma = 0$), it must be $\pi_1^f > \pi_1^n$.

Proof of Proposition 2.

$$W^n - W^b = \frac{(c_0 - c_1)^2}{2(4-3\gamma)^2(2-\gamma)^2}\{-32 + 40\gamma - 15\gamma^2 + 2\gamma^3\} < 0$$

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