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# How privatization affects the strategic choice of managerial incentives: the case of international mixed duopoly

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## Abstract

This paper studies a mixed duopoly where a semi-public firm competes with a foreign private firm. The firm's owners have the option to hire a manager. A novel incentive scheme of semi-public firm's manager is utilized which takes into account the social goals of public authority. In contrast to the results in the existing literature, the paper shows that the decision to hire manager depends on the state-ownership share in the semi-public firm. Yet the paper finds that there exists an equilibrium in which only the semi-public firm hires a manager.

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# 1 Introduction

Orthodox economic theory tends to view firms as entities whose sole objective is to maximize their own profit. However, Baumol (1958) suggested maximization of sales revenue as an alternative to profit-maximization objective. In many companies, ownership and management are separated, so managerial decision processes are rather complex. In the 1980s, Vickers (1985), Fershtman (1985), Fershtman and Judd (1987), and Sklivas (1987), consider profit maximizing firms that hire managers that do not maximize profits. The owner of each firm provides a delegation contract for his manager, which is a linear combination of profits and sales (the so-called VFJS contracts). VFJS examine a two-stage oligopoly model, where in the first stage (the "contract stage") the profit-maximizing owners choose compensation schemes for their managers. In the second stage, managers, knowing compensation schemes, compete in quantities. They show that, when competing in strategic substitutes, owners encourage their managers to produce beyond the profit maximization level (i.e. they motivate managers to behave aggressively) and firms end up in a prisoners' dilemma as a result.

Barros (1995) and White (2001) have extended the VFJS model to mixed oligopoly markets. Barros (1995), investigates the use of incentive contracts as strategic variables in a mixed duopoly in which both the public and private firms provide managers with incentive schemes based on a linear combination of profit and sales revenue. She shows that welfare is higher when both firms hire managers compared to when neither firm does this. White (2001), extends the analysis of Barros (1995) by considering a mixed oligopoly. He shows that if the hiring of managers is endogeneized, only private firms will hire managers in equilibrium. In this equilibrium, the public firm ceases to produce and exists only to impose discipline on private firms[1]. Unfortunately, this dramatic result is totally based on the restrictions on the structure of managerial incentive contracts, restrictions particularly harmful to the public firm. In fact, VFJS contract creates an asymmetry between public and private firms since the welfare maximization objective is qualitatively different from this type of contract[2].

According to Baker (2002), delegation is more efficient the more closely the incentives of managers are aligned with those of the owners. In this paper, we formulate the incentive schemes of the public firm manager such that these incentives be aligned with those of owners. So the public owner offers its manager an incentive contract that is a linear combination of social welfare and the public firm's sales revenue. The private firm owner provides its managers a VFJS contract. The incentive scheme of each manager is then a linear combination of the firm's objective and a variable of interest for the manager.

The originality of the paper is that, to our knowledge, no theoretical study deals with competition between a semi-public firm and a foreign private firm in a context where the incentive contract takes into account the objective of the owners of the firms. The only paper that considers public firm objective in managerial contract is Ouattara (2013). However, this paper doesn't analyze the case of foreign competition. The introduction of a foreign private firm in the analysis is clearly relevant because in many industries, such as airlines, tobacco, banking, the public firms compete with foreign private firms. The presence of a foreign firm in market changes the welfare function and therefore the goal of the semi-public firm. Moreover, partial privatization of a public firm would be interesting to analyze the impact of the government's ownership in the incentive schemes of both the private firm and the partially privatized firm. In the mixed oligopoly literature, only Barcena (2010) has applied the VFJS contract by considering a partial privatized firm rather than a public firm. He shows that in equilibrium, it is a dominant strategy for the owner of both firms to hire managers[3].

In this paper, we analyze a homogenous Cournot mixed duopoly with quadratic cost function[4]. In

[1] Note that White (2001) assumed linear cost of production. In addition, the public firm faces strictly higher marginal costs.

[2] VFJS contract presents an advantage for private firms, since the profit maximization is a special case of VFJS contract.

[3] This result differs from that of White (2001) who finds that only private firm hires a manager in equilibrium.

[4] In mixed oligopoly literature, a number of studies assumes that firms have constant marginal cost and that private firms are more efficient than public firms (Megginson and Netter, 2001; White, 2001; Lu, 2007). This inefficiency of public firms is justified by informational and institutional aspects of the market (Hsin and Ogawa, 2005). On such

this situation, we consider a three-staged game: in the first stage, each firm's owner chooses whether or not to hire a manager. In the second stage of the game, if owners have hired a manager, they commit to their type of contract to compensate their manager. Finally, once the managers are provided with the incentive schemes, they compete in the marketplace at the third stage.

We show that the degree of privatization affects the incentive parameters of firms' managers. In contrast with the literature -where the owners provide incentives to their managers to produce more-, we show that when both firms hire managers, managers are instructed to produce less if the percentages of share of government in semi-public firm is sufficiently high. When we endogenize the decision to hire manager, we show that in equilibrium, this decision depends on the degree of privatization. This is in contrast with the result obtained when owners provide a VFJS contract for their managers, where both firms hire a manager in equilibrium (Barcena-Ruiz, 2010). In our model, we show that both firms hire a manager in equilibrium only if the degree of privatization is sufficiently low. If the degree of privatization is high, the equilibrium is such that only a single firm hires a manager.

The rest of the paper is organized as follows. In section 2, we formulate the basic setting of the model. Section 3 analyses whether or not firms hire managers and examines the optimal privatization policy. The third section offers some concluding remarks.

## 2 The model

We consider an industry consisting of two firms with a single homogeneous output. One of the firms is jointly owned by the public sector and private domestic shareholders (semi-public firm), and the other firm is a foreign private firm. The semi-public firm is denoted by 0, and the foreign private firm by 1.

The inverse demand function is given by:

$$p = 1 - Q$$

where $Q$ is the total output of the good ($Q = q_0 + q_1$).

Both firms have identical technology represented by the quadratic cost function $C(q_i) = q_i^2$.

The profit function of the firm $i$ is given as:

$$\pi_i = pq_i - q_i^2 \qquad (i = 0, 1) \tag{1}$$

Domestic social welfare is defined as the sum of consumer surplus (denoted by $CS$) and firm 0's profit. Since the private firm is foreign owned, his profit is excluded from social welfare. Therefore, social welfare is given by

$$W = CS + \pi_0 \tag{2}$$

$$\text{with } CS = \tfrac{1}{2}(q_0 + q_1)^2$$

Following Matsumura (1998), we assumed that the semi-public firm maximizes a convex linear combination of welfare and the firm's profits. If we denote $\alpha$, the share of the government's ownership in the semi-public firm, the objective function of this firm is given by:

$$V = \alpha W + (1 - \alpha)\pi_0 \tag{3}$$

where $\alpha \in [0, 1]$. If $\alpha = 0$, firm 0 maximizes profit, and if $\alpha = 1$ she maximizes welfare.

market where costs are linear, the public firm has to be less efficient to guarantee positive output for private firms. If there were any fixed costs, the public firm would be unable to cover them with a positive price-cost margin, and would incur losses (De Fraja and Delbono, 1989; Cremer *et al,* 1989). To avoid these situations of natural monopolies, a variety of researchers have assumed that firms have an identical quadratic cost function.

Furthermore, our paper focuses on the managerial aspect of the firms. We consider the situation where the owners of the firms may decide to delegate control to their managers. If they do this, they offer to their manager a linear combination of firm objective and a variable of interest for the manager. So the private manager and semi-public manager have different type of contract. Private owners offer their manager an incentive contract that is a linear combination of profit and sales revenue (VFJS contract):

$$M_1 = \lambda_1 \pi_1 + (1 - \lambda_1) p q_1 \tag{4}$$

where $\lambda_1$ is the incentive parameter that the owners of private firm choose to maximize their profit.

The semi-public owners offer its manager an incentive contract that is a linear combination of their objective ($V$) and sales revenue:

$$M_0 = \lambda_0 V + (1 - \lambda_0) p q_0 \tag{5}$$

Where $\lambda_0$ is the incentive parameter that the owners of semi-public firm choose to maximize their objective.

Note that if $\lambda_i = 1$, manager of firm $i$'s behavior coincides with owner $i$'s objective.

We propose a three-stage game with the following timing: in the first stage, the owners of the firms decide whether or not to hire a manager. Then in the second stage, if they have hired a manager, each owner sets the corresponding managerial incentives parameter $\lambda_i$. Finally, in the third stage, managers compete *a la* Cournot. We adopt a subgame perfect Nash equilibrium and thus, the game is solved backwards.

# 3 Results

We start the game by solving the third and second stage.

## 3.1 Manager's competition and optimal incentive schemes:

Given that the owner of each firm may hire a manager or not, we recognize a total of four cases: neither firm hires a manager *(*denoted by superscript $NN$*)*, only the semi-public firm hires a manager *(*denoted by superscript $DN$*)*, only the foreign private firm hires a manager *(*denoted by superscript $ND$*)* and both firms hire managers *(*denoted by superscript $DD$*).*

### 3.1.1 Neither firm hires a manager ($NN$)

This case corresponds to the equilibrium without any strategic contracts. In this situation, the semi-public and foreign private firms choose simultaneously their outputs to maximize their objective functions, given respectively by (3) and (1). Solving these problems, we obtain:

$$q_0^{NN} = \tfrac{3+\alpha}{3(5-\alpha)} \qquad q_1^{NN} = \tfrac{3-\alpha}{3(5-\alpha)} \qquad CS^{NN} = \tfrac{2}{(\alpha-5)^2}$$

$$\pi_0^{NN} = \tfrac{2(\alpha+3)(3-2\alpha)}{9(\alpha-5)^2} \qquad \pi_1^{NN} = \tfrac{2(\alpha-3)^2}{9(\alpha-5)^2}$$

$$W^{NN} = \tfrac{2(-3\alpha-2\alpha^2+18)}{9(\alpha-5)^2} \qquad V^{NN} = \tfrac{2(6\alpha-2\alpha^2+9)}{9(\alpha-5)^2}$$

When neither firm hires a manager, the semi-public firm has a higher output and a higher profit than the private firm. So, even though the semi-public firm objective function is not the maximization of its own profit, it makes more profit than private firm.

### 3.1.2 Only the foreign private firm hires a manager ($ND$)

In this case, only the foreign private firm faces an incentive contract. In the third stage, the foreign private firm's manager and the semi-public firm's owner choose their firm's output in order to maximize their objective function given respectively by (4) and (3). Solving these problems, we obtain:

$$q_0 = \frac{\alpha+2\lambda_1+1}{8\lambda_1-2\alpha\lambda_1-\alpha+7}, \qquad q_1 = \frac{3-\alpha}{8\lambda_1-2\alpha\lambda_1-\alpha+7}$$

Thus, in the second stage, the owner of the foreign private firm chooses $\lambda_1$ that maximizes (1). We find that the equilibrium in this case is as follows:

$$\lambda_1^{ND} = 1 - \frac{1-\alpha}{8-2\alpha}, \qquad q_0^{ND} = \frac{2\alpha-\alpha^2+11}{2(4-\alpha)(7-\alpha)}, \qquad q_1^{ND} = \frac{3-\alpha}{2(7-\alpha)}$$
$$CS^{ND} = \frac{1}{8}\frac{(5\alpha-23)^2}{(4-\alpha)^2(7-\alpha)^2} \qquad \pi_0^{ND} = \frac{\left(2\alpha-\alpha^2+11\right)(-19\alpha+3\alpha^2+22)}{4(7-\alpha)^2(4-\alpha)^2} \qquad \pi_1^{ND} = \frac{(3-\alpha)^2}{4(4-\alpha)(7-\alpha)}$$
$$W^{ND} = \frac{-560\alpha-29\alpha^2+50\alpha^3-6\alpha^4+1013}{8(7-\alpha)^2(4-\alpha)^2} \qquad V^{ND} = \frac{80\alpha-51\alpha^2+6\alpha^3+121}{8(4-\alpha)(7-\alpha)^2}$$

The private manager's contract term is less than one when $\alpha < 1$. In this case, the private firm manager moves away from strict profit-maximization and becomes more aggressive in the market. However, if $\alpha = 1$, the owner of foreign private firm choose $\lambda = 1$. In other words, in presence of fully public firm, the foreign private manager pursues the same goal as the owners. In fact, when $\alpha = 1$, public output is higher. Thus, by not hiring a manager ($\lambda = 1$), the foreign private firm obtains a better outcome (in term of price level and profit).

### 3.1.3 Only the semi-public firm hires a manager ($DN$)

In this case, only the semi-public firm faces an incentive contract. In the third stage, the semi-public firm's manager and the foreign private firm's owner choose their firm's output in order to maximize their objective function given respectively by (5) and (1). Solving these problems, we obtain:

$$q_0 = \frac{\alpha\lambda_0+3}{8\lambda_0-3\alpha\lambda_0+7}, \qquad q_1 = \frac{2\lambda_0-\alpha\lambda_0+1}{8\lambda_0-3\alpha\lambda_0+7}$$

Thus, in the second stage, the owner of the semi-public firm chooses $\lambda_1$ that maximizes (3). We find that the equilibrium in this case is as follows:

$$\lambda_0^{DN} = 1 - \frac{3-5\alpha}{24-17\alpha}, \qquad q_0^{DN} = \frac{3(\alpha+4)}{56-9\alpha}, \qquad q_1^{DN} = \frac{11-3\alpha}{56-9\alpha}$$
$$CS^{DN} = \frac{529}{2(56-9\alpha)^2} \qquad \pi_0^{DN} = \frac{9(\alpha+4)(7-4\alpha)}{(56-9\alpha)^2} \qquad \pi_1^{DN} = \frac{2(11-3\alpha)^2}{(56-9\alpha)^2}$$
$$W^{DN} = \frac{-162\alpha-72\alpha^2+1033}{2(56-9\alpha)^2} \qquad V^{DN} = \frac{8\alpha+9}{2(56-9\alpha)}$$

The incentive parameter of the manager of the semi-public firm is lower than one ($\lambda_0^{DN} < 1$) if and only if $\alpha < \frac{3}{5}$. When $\alpha > \frac{3}{5}$, the semi-public firms' owner encourages his manager to produce less ($\lambda_0^{DN} > 1$), compared to case $NN$. Moreover, $\lambda_0^{DN}$ is an increasing function of $\alpha$. This implies that when the degree of privatization decreases, the owner of semi-public firm incite their manager to attach more weight to $V$ than sales revenue.

### 3.1.4 Both firms hire managers ($DD$)

In this case, there is a manager at each firm. The semi-public firm's manager and the foreign private firm's manager choose in the third stage the output that maximizes respectively (5) and (4). Solving these problems, we obtain:

$$q_0 = \frac{2\lambda_1+\lambda_0\alpha+1}{4\lambda_0+4\lambda_1-\lambda_0\alpha+4\lambda_0\lambda_1-2\alpha\lambda_0\lambda_1+3}, \qquad q_1 = \frac{2\lambda_0-\lambda_0\alpha+1}{4\lambda_0+4\lambda_1-\lambda_0\alpha+4\lambda_0\lambda_1-2\alpha\lambda_0\lambda_1+3}$$

In the second stage, the owner of the foreign private firm and the owner of semi-public firm choose simultaneously $\lambda_1$ and $\lambda_0$ that maximize respectively (1) and (3). We obtain:

$$\lambda_0^{DD} = \frac{\varphi^{\frac{1}{3}}(2\varphi^{\frac{1}{3}} - 13\alpha^2 + 74\alpha - 88) - 2(4-\alpha)(7\alpha^3 - 66\alpha^2 + 180\alpha - 160)}{(2+\alpha)\left[\varphi^{\frac{1}{3}}(\varphi + 34\alpha - 61) - (4-\alpha)(7\alpha^3 - 66\alpha^2 + 180\alpha - 160)\right]},$$

$$\lambda_1^{DD} = \frac{\varphi^{\frac{1}{3}}(\varphi^{\frac{1}{3}} - 2\alpha^2 + 10\alpha - 8) - (4-\alpha)(7\alpha^3 - 66\alpha^2 + 180\alpha - 160)}{6\varphi^{\frac{1}{3}}(4-\alpha)(2-\alpha)}$$

with $\varphi = (4-\alpha)^2 \left[ \begin{array}{c} 2(\alpha-1)(5\alpha^3 - 129\alpha^2 + 450\alpha - 416) \\ -3(2-\alpha)\sqrt{\left(\frac{3(\alpha^7 - 110\alpha^6 - 420\alpha^5 + 7104\alpha^4 - 22908\alpha^3 + 23856\alpha^2 + 2560\alpha - 12288}{4-\alpha}\right)} \end{array} \right]$

For $\alpha \in ]0,1]$, we show that $\lambda_0^{DD} > \lambda_1^{DD}$.

All equilibria depend on $\alpha$. Since the expression of the equilibrium value of each variable is rather complicated, we abstain from presenting them here and adopt numerical simulation. Table 1 reports the equilibrium values of the main variables of the model.

**Table 1**: Equilibrium when both firms hire managers

| $\alpha$ | $\lambda_0^{DD}$ | $\lambda_1^{DD}$ | $q_0^{DD}$ | $q_1^{DD}$ | $p^{DD}$ | $\pi_0^{DD}$ | $\pi_1^{DD}$ | $W^{DD}$ | $V^{DD}$ |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.8660 | 0.8660 | 0.2113 | 0.2113 | 0.5773 | 0.0773 | 0.0773 | 0.1667 | 0.0778 |
| 0.1 | 0.8810 | 0.8758 | 0.2206 | 0.2077 | 0.5716 | 0.0774 | 0.0755 | 0.1691 | 0.0866 |
| 0.2 | 0.8982 | 0.8865 | 0.2302 | 0.2040 | 0.5657 | 0.0772 | 0.0738 | 0.1715 | 0.0961 |
| 0.3 | 0.9182 | 0.8982 | 0.2400 | 0.2001 | 0.5597 | 0.0767 | 0.0719 | 0.1736 | 0.1058 |
| 0.4 | 0.9417 | 0.9111 | 0.2503 | 0.1961 | 0.5535 | 0.0759 | 0.0701 | 0.1755 | 0.1157 |
| 0.5 | 0.9697 | 0.9254 | 0.2608 | 0.1919 | 0.5472 | 0.0746 | 0.0681 | 0.1772 | 0.1259 |
| 0.6 | 1.0036 | 0.9415 | 0.2717 | 0.1875 | 0.5406 | 0.0730 | 0.0662 | 0.1785 | 0.1363 |
| 0.7 | 1.0458 | 0.9601 | 0.2830 | 0.1828 | 0.5340 | 0.0710 | 0.0642 | 0.1795 | 0.1470 |
| 0.8 | 1.0994 | 0.9818 | 0.2948 | 0.1779 | 0.5272 | 0.0685 | 0.0621 | 0.1802 | 0.1579 |
| 0.9 | 1.1700 | 1.008 | 0.3070 | 0.1725 | 0.5204 | 0.0655 | 0.0600 | 0.1805 | 0.1690 |
| 1 | 1.2672 | 1.0408 | 0.3197 | 0.1666 | 0.5136 | 0.0620 | 0.0578 | 0.1803 | 0.1803 |

In equilibrium, we observe that $\lambda_0^{DD} \in [0.866, 1.2672]$ and $\lambda_1^{DD} \in [0.866, 1.0408]$. So the owner of the foreign private firm chooses an incentive parameter greater than one when the share of the government's ownership in the semi-public firm is very high. This is in contrast with the result obtained in domestic mixed oligopoly. This is explained by the aggressive behavior of the public firm owner when the competitor is foreign owned. If the parameter $\alpha$ is sufficiently high, the semi-public firm acts as a public firm. Thus, the owner of the foreign firm chooses an incentive parameter greater than one for its manager to reduce market competition.

## 3.2 Managerial game solution

In the first stage, the owner of each firm decides whether or not to hire a manager. From the results obtained in the four cases, we have the following proposition, where $\alpha^{**} = 0.5453$ and $\alpha^* = 0.8713$.

**Proposition 1** *In the international mixed duopoly with managerial delegation, the subgame perfect Nash equilibria are classified into three cases, depending on the value of the parameter* $\alpha$,

- *(DD) both the semi-public firm and the foreign private firm hire a manager, if* $\alpha \leq \alpha^{**}$,
- *(ND) only the foreign private firm hires a manager, if* $\alpha \in ]\alpha^{**}, \alpha^*]$
- *(ND) and (DN) only the foreign private firm and only the semi-public firm hire a manager, if* $\alpha \in ]\alpha^*, 1]$

Proof: see appendix

The proposition shows that the decision to hire managers depends on the share of the government's ownership in the semi-public firm ($\alpha$). When $\alpha$ is sufficiently low, $\alpha \in [0, 0.5453]$, there is a unique equilibrium in which both firm hire a manager. This is due to the fact that when $\alpha$ is sufficiently

low, it is a dominant strategy for both firms to hire a manager. For example in private duopoly ($\alpha = 0$), in line with the literature, delegation is a dominant strategy for the profit-maximizing firms. For intermediate value of state-ownership share ($\alpha \in ]0.5453, 0.8713]$), only the foreign private firm hires a manager. In this case, hiring a manager is a dominant strategy for the foreign private firm whereas the semi-public firm will always do the opposite of what the private firm does[5]. When $\alpha$ is sufficiently high ($\alpha \in ]0.8713, 1]$), there are two equilibria, $(ND)$ and $(DN)$. This latter result is different of that obtained by Fernandez-Ruiz (2009), who analyzed the case wherein both (foreign and fully public) firms provide to their managers a VFJS contract and shows that in equilibrium only the foreign private firm hires a manager. We can compare our results with that obtained in a domestic duopoly (Ouattara, 2013), in which private profit is integrated into the social welfare. In this context, it is showed that when $\alpha$ is high, only the semi-public firm hires a manager. The difference in results between the domestic duopoly and the international duopoly in the present paper is mainly explained by the optimal strategy of semi-public firm. In domestic duopoly, when $\alpha$ is sufficiently high, hiring a manager is a dominant strategy for semi-public firm; meanwhile, in international duopoly, the semi-public firm will always do the opposite of what the private firm does. Since in both cases (international and domestic) the optimal strategy of private firm is to do the opposite of what the semi-public firm does, the equilibrium in international duopoly also includes the case $(ND)$.

# 4 Conclusion

In this paper, we have studied a model of mixed duopoly where a profit-maximizing foreign firm competes against a semi-public firm. The firms may hire managers to make output decisions. We have formulated the semi-public firm manager incentives schemes such that these incentives take into account the social goals of public authority. We have found that in equilibrium, the decision to hire a manager depends on the state-ownership share in the semi-public firm. When the state-ownership share is sufficiently low, both firms hire managers; meanwhile, when the state-ownership share is high, the equilibrium is such that only a single firm hires a manager. This result is fairly remarkable in that it is different from that obtained by Fernandez-Ruiz (2009). He shows that in an international mixed duopoly with VFJS contracts, only the foreign private firm hires a manager. Yet we show that there exists an equilibrium in which only the semi-public firm hires a manager. This happens because, in contrast to VFJS contracts, the incentive schemes of semi-public firm that we propose provide a strategic advantage for the semi-public firm.

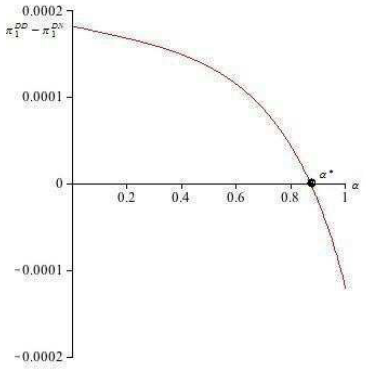
An avenue for future work is to study the effects of managerial delegation on the profitability of horizontal mergers in a mixed oligopoly.

## APPENDIX

**Proof of proposition 1**

- $\pi_1^{ND} - \pi_1^{NN} = (\alpha - 1)^2 \frac{(\alpha-3)^2}{(\alpha-4)(\alpha-7)(\alpha-5)^2} \geq 0$. This implies that when the semi-public firm does not hire a manager, the foreign private firm hires a manager.
- The difference $\pi_1^{DD} - \pi_1^{DN}$ is illustrated by figure 1. We see that when the semi-public firm hires a manager, the foreign private firm
  - hires a manager if $\alpha \leq \alpha^*$
  - does not hire a manager if $\alpha > \alpha^*$

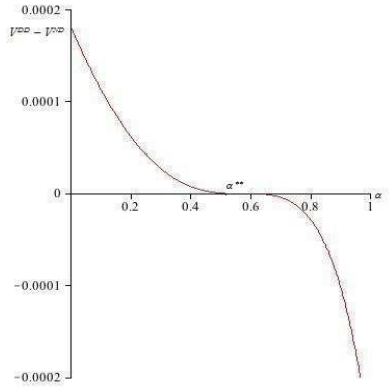
[5] The semi-public firm hires a manager if the foreign firm not hires one. The semi-public firm not hires manager if the foreign firm hires a manager.




$$\pi_1^{DD} - \pi_1^{DN} \begin{cases} < 0 & \text{if } \alpha > \alpha^* = 0.8713 \\ > 0 & \text{if } \alpha \leq \alpha^* = 0.8713 \end{cases}$$

Figure 1: $\pi_1^{DD} - \pi_1^{DN}$

- $V^{DN} - V^{NN} = -\frac{1}{18}\frac{(5\alpha-3)^2}{(9\alpha-56)(\alpha-5)^2} > 0$. This implies that when the foreign private firm does not hire a manager, the semi-public firm hires a manager.
- The difference $V^{DD} - V^{ND}$ is illustrated by figure 2. We see that when the foreign private firm hires a manager, the semi-public firm
  - hires a manager if $\alpha \leq \alpha^{**}$
  - does not hire a manager if $\alpha > \alpha^{**}$




$$V^{DD} - V^{ND} \begin{cases} < 0 & \text{if } \alpha > \alpha^{**} = 0.5453 \\ > 0 & \text{if } \alpha \leq \alpha^{**} = 0.5453 \end{cases}$$

Figure 2: $V^{DD} - V^{ND}$

with $\alpha^* > \alpha^{**}$

We have three different cases:

- If $\alpha \leq \alpha^{**}$,
  - Hiring manager is a dominant strategy for the foreign private firm
  - Hiring manager is a dominant strategy for the semi-public firm
  - So in equilibrium, both firms hire managers
- If $\alpha \in ]\alpha^{**}, \alpha^*]$,
  - Hiring manager is a dominant strategy for the foreign private firm
  - If private firm hires a manager, semi-public firm will not hire one
  - So in equilibrium, only the foreign private firm hires a manager
- If $\alpha \in ]\alpha^*, 1]$,

- Foreign private firm will always do the opposite of what the semi-public firm does
- The semi-public firm will always do the opposite of what the foreign private firm does
- So there are two equilibria: only the foreign private firm and only the semi-public firm hires a manager

# References


[1] Baker, G. (2002) "Distortion and risk in optimal incentive contracts" *Journal of Human Resources* **37** (4), 728-751

[2] Barcena-Ruiz J.C. (2009) "The decision to hire managers in mixed markets under bertrand competition" *The Japanese Economic Review* **60**, 3, 376-386.

[3] Barcena-Ruiz J.C. (2010) "Strategic delegation and semi-public firms" *Economics Bulletin* **30**, 744-750.

[4] Barros, F. (1995) "Incentive schemes as strategic variables: an application to a mixed duopoly" *International Journal of Industrial Organization* **13**, 373-386.

[5] Baumol, W. (1958) "On the theory of oligopoly" *Economica* **80**, 187-198.

[6] Cremer, H., M. Marchand and J.F. Thisse (1989) "The public firm as an instrument for regulating an oligopolistic market" *Oxford Economic Papers* **41**, 283-301.

[7] De Fraja, G. and F. Delbono (1989) "Alternative strategies of a public enterprise in oligopoly" *Oxford Economic Papers,* **41***,* 302-311.

[8] Fernandez-Ruiz, J. (2009) "Managerial delegation in a mixed duopoly with a foreign competitor" *Economics Bulletin* **29** (1), 90-99.

[9] Fershtman, C. and K.L. JUDD (1987) "Equilibrium incentives in oligopoly" *American Economic Review* **77**, 927-940.

[10] Hsin, L. and H. Ogawa (2005) "Cost reducing incentives in a mixed duopoly market" *Economics Bulletin* **12** (6), 1-6.

[11] Lu, Y. (2007) "Endogenous timing in a mixed oligopoly consisting of a single public firm and foreign competitors" *Economics Bulletin* **12** (2), 1-7.

[12] Matsumura, T. (1998) "Partial privatization in mixed duopoly" *Journal of Public Economics* **70**, 473-483.

[13] Megginson, W. and J. Netter (2001) "From state to market: A survey of empirical studies on privatization" *Journal of Economic Literature* **39**, 321-389.

[14] Ouattara, K.S. (2013) "Incitations managériales dans un duopole mixte: cas de la privatisation partielle de la firme publique" *Revue d'Economie Politique* **123** (4), 495-517.

[15] Sklivas, S. (1987) "The strategic choice of managerial incentives" *Rand Journal of Economics* **18**, 452-458.

[16] Vickers, J. (1985) "Delegation and the theory of the firm" *Economic Journal* **95**, 138-147.

[17] White, M.D. (2001) "Managerial incentives and the decision to hire managers in markets with public and private firms" *European Journal of political Economy* **17**, 877-896.