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Strategic Delegation and Semipublic Firms

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Abstract

By considering a mixed oligopoly and considering that public firms are less efficient than private firms, White (2001) shows that if private firms hire managers then the public firm does not do so. We show in this paper that if we consider that a private firm competes with a firm that is owned jointly by both the private and public sectors (a semipublic firm) and that all the firms are equally efficient, then in equilibrium both firms hire managers.

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1. Introduction

The literature on strategic delegation, which started with Vickers (1985), Fershtman and Judd (1987), and Sklivas (1987), analyzes the strategic value for shareholders of publicly observed irreversible incentive contracts based on sales and profits (not only profits). Basu (1995) shows that if all private firms are identical and all managers have the same reservation utility level all private firms hire managers.

Barros (1995) and White (2001) extend the above analysis, assuming Cournot competition, to markets in which private and public firms compete. Barros (1995) investigates the use of incentive contracts as strategic variables in a mixed duopoly. White (2001) extends the analysis of Barros (1995) considering a mixed oligopoly. He shows that when firms have the choice of whether or not to hire managers, in equilibrium only private firms do so. In this equilibrium, only private firms produce output, while a public firm exists only to impose discipline on private firms.[1]

We extend the model of White (2001) by considering a semipublic firm rather than a public firm. We consider an oligopoly containing one semipublic firm and one private firm that produce a homogeneous good. The semipublic firm maximizes the weighted average of the payoff of the government and its own profit. The private firm maximizes profits. These firms have identical constant marginal costs of production. The owners of the firms chose whether to delegate production decisions to managers or not. We obtain that in equilibrium it is a dominant strategy for the owners of both firms to hire managers. Therefore, in equilibrium they both do so. Thus we obtain a different result from White (2001), who finds that only the private firm hires a manager.

Our result differs from that of White (2001) due to two factors: first, we consider a semipublic firm (whose objective function is the weighted average of social welfare and its own profit) while White (2001) considers a public firm (that maximizes social welfare). Second, we assume that the constant marginal production costs of all firms are identical whereas White assumes that the public firm has a higher constant marginal cost than private firms. Both differences are necessary to obtain the contrasting result. If we consider that the semipublic firm has a greater marginal cost than the private firm then the semipublic firm does not hire a manager when the government owns a great enough percentage of the shares in this firm. In this case, the semipublic firm behaves in a similar way to a public firm and, thus, the same result is obtained as in White (2001). On the other hand, if we assume that all firms have the same marginal cost of production and that the private firm competes in the product market with a public firm instead of a semipublic firm we obtain that the private firm does not produce. Therefore, to obtain that it is a dominant strategy for the semipublic firm to hire a manager, it is necessary to assume that both firms are equally efficient.

The rest of the paper is organized as follows. Section 2 presents the model. Section 3 analyzes whether or not firms hire managers. Conclusions are drawn in section 4.

2. The model

We consider an economy made up of two firms that produce a homogeneous good. One firm is jointly owned by the public sector and private domestic shareholders (semipublic) and the other firm is privately owned. They are denoted by 0 and 1, respectively. The inverse demand

[1] Bárcena-Ruiz (2009) extends this analysis assuming a mixed duopoly and Bertrand competition with heterogeneous goods. He shows that both the public and private firms hire managers. This is in contrast with the result obtained under Cournot competition, where only the private firm hires a manager.

function is given by: $p = a - q_0 - q_1$, where p is the price of the good and q_i is the amount of the good produced by firm i. All firms have constant identical marginal costs of production of c, which means that they are equally efficient. Thus, the profit of firm i is given by:

$$\pi_i = (p - c)\, q_i,\ i = 0, 1. \tag{1}$$

As usual, social welfare comprises the consumer surplus, CS, and the producer surplus, PS. Thus, the social welfare function can be expressed as: $W=CS+PS$, where $CS=(q_0+q_1)^2/2$ and $PS=\pi_0+\pi_1$.

The government owns α percent of the shares in the semipublic firm, where $\alpha\in(0, 1)$. Following Matsumura (1998) and Bárcena-Ruiz and Garzón (2010), we consider that this firm chooses the output level, q_0, that maximizes the weighted average of the payoff of the government and its own profit (denoted as weighted welfare):

$$V = \alpha W + (1 - \alpha)\, \pi_0, \tag{2}$$

where π_0 is given by (1), for i=0. The private firm chooses the output level, q_1, that maximizes its profit given by (1), for i=1.

The owners of the firms may delegate price decisions to their managers. If they do this they offer linear incentive schemes to their managers. The incentive schemes are of the following type: the managers, who are risk neutral, are paid on the margin according to a linear combination of profits and sales revenue. Formally, the manager of firm i (manager i) has the following objective function:

$$O_i = \beta_i\, \pi_i + (1 - \beta_i)\, S_i,\ i = 0, 1, \tag{3}$$

where π_i and S_i are profits and sales revenue, respectively, and β_i is the incentive parameter chosen by the owner of firm i (owner i).[2] It has to be noted that the semipublic firm's manager is given the same type of contract as the private manager, one based on profit and sales revenue.

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. In the second stage, if they have hired a manager the owners of the firms choose the incentive parameters of their managers. Finally, in the third stage, the owners or the managers of the firms decide on production. To obtain a subgame perfect equilibrium, the game is solved backwards.

3. Results

Given that the owners of the firms may hire a manager or not, there are four possible cases: both firms hire managers, neither firm hires a manager, only the semipublic firm hires a manager and only the private firm hires a manager.

3.1 Both firms hire managers

In this case, in the third stage, manager i chooses the value of q_i, that maximizes his objective function, given by (3). Solving these problems we obtain:

$$q_1 = \frac{1}{3}(a - 2c\beta_1 + c\beta_0),\ q_0 = \frac{1}{3}(a - 2c\beta_0 + c\beta_1). \tag{4}$$

[2] As in Fershtman and Judd (1987), we assume that each owner offers its managers "take it or leave it" incentive schemes. Manager i receives a payoff $A_i+\gamma_i O_i$, where A_i and γ_i are constant, $\gamma_i>0$. Manager i is risk neutral and maximizes O_i; owner i chooses A_i and γ_i so that the manager gets only his opportunity cost, which is normalized to zero. We assume that owners can commit themselves to incentive schemes.

In the second stage, the owner of the semipublic firm chooses the incentive parameter β_0 that maximizes weighted welfare. Simultaneously, the owner of the private firm chooses the incentive parameter β_1 that maximizes its profit. The superscript *YY* denotes that both firms hire managers. Solving these problems, we obtain:

$$\beta_0^{YY} = 1 - \frac{a-c}{(5-4\alpha)c}, \ \beta_1^{YY} = 1 - \frac{(1-\alpha)(a-c)}{(5-4\alpha)c}, \ \beta_0^{YY} < \beta_1^{YY} < 1, \ q_0^{YY} = \frac{(2-\alpha)(a-c)}{5-4\alpha},$$

$$q_1^{YY} = \frac{2(1-\alpha)(a-c)}{5-4\alpha}, \ \pi_0^{YY} = \frac{(1-\alpha)(2-\alpha)(a-c)^2}{(5-4\alpha)^2}, \ \pi_1^{YY} = \frac{2(1-\alpha)^2(a-c)^2}{(5-4\alpha)^2},$$

$$CS^{YY} = \frac{(4-3\alpha)^2(a-c)^2}{2(5-4\alpha)^2}, \ V^{YY} = \frac{(4+14\alpha-30\alpha^2+13\alpha^3)(a-c)^2}{2(5-4\alpha)^2}.$$

As is well known(see Fershtman and Judd, 1987), the private firm chooses an incentive parameter lower than one to provide incentives to its manager to be aggressive in the product market (i.e. to produce more) in order to gain market share at the expense of the other firm. The owner of the semipublic firm provides incentives to its manager to be aggressive in the product market for two reasons. First, the owner of the semipublic firm takes consumer surplus into account and thus wants to produce more than a private firm. Second, quantities are strategic substitutes and thus the semipublic firm wants to gain market share at the expense of its rival. Therefore, the owner of the semipublic firm chooses an incentive parameter lower than that of the private firm ($\beta_0^{YY} < \beta_1^{YY}$).

3.2 Neither firm hires a manager

In the third stage, the private firm chooses the value of q_1 that maximizes its profit given by (1), for *i*=1. Simultaneously, the semipublic firm chooses the value of q_0 that maximizes its objective function, given by (2). The superscript *NN* denotes that neither firm hires a manager. Solving these problems, we obtain:

$$q_0^{NN} = \frac{a-c}{3-2\alpha}, \ q_1^{NN} = \frac{(1-\alpha)(a-c)}{3-2\alpha}, \ \pi_0^{NN} = \frac{(1-\alpha)(a-c)^2}{(3-2\alpha)^2}, \ \pi_1^{NN} = \frac{(1-\alpha)^2(a-c)^2}{(3-2\alpha)^2},$$

$$CS^{NN} = \frac{(2-\alpha)^2(a-c)^2}{2(3-2\alpha)^2}, \ V^{NN} = \frac{(2+4\alpha-8\alpha^2+3\alpha^3)(a-c)^2}{2(3-2\alpha)^2}.$$

3.3 Only the semipublic firm hires a manager

In the third stage, the manager of the semipublic firm and the owner of the private firm choose their firms' outputs to maximize their respective objective functions. Solving these problems we obtain expression (4) for β_1=1. In the second stage, the owner of the public firm chooses the incentive parameter β_0 that maximizes weighted welfare. The superscript *YN* denotes that the semipublic firm hires a manager when the other firm does not do so. Solving this problem, we obtain:

$$\beta_0^{YN} = 1 - \frac{(a-c)}{(4-3\alpha)c} < 1, \ q_0^{YN} = \frac{(2-\alpha)(a-c)}{4-3\alpha}, \ q_1^{YN} = \frac{(1-\alpha)(a-c)}{4-3\alpha}, \ \pi_1^{YN} = \frac{(1-\alpha)^2(a-c)^2}{(4-3\alpha)^2},$$

$$\pi_0^{YN} = \frac{(1-\alpha)(2-\alpha)(a-c)^2}{(4-3\alpha)^2}, \ CS^{YN} = \frac{(3-2\alpha)^2(a-c)^2}{2(4-3\alpha)^2}, \ V^{YN} = \frac{(1+2\alpha-2\alpha^2)(a-c)^2}{2(4-3\alpha)}.$$

3.4 Only the private firm hires a manager

In the third stage, the manager of the private firm and the owner of the semipublic firm choose their firms' quantities to maximize their objective functions. The superscript *NY* denotes that the semipublic firm does not hire a manager when the other firm hires a manager. Solving these problems we obtain:

$$q_1 = \frac{a(1-\alpha)+c-c\beta_1(2-\alpha)}{3-2\alpha},\ q_0 = \frac{a-2c+c\beta_1}{3-2\alpha}.$$

In the second stage, the owner of the private firm chooses the incentive parameter β_1 that maximizes its profit. Solving this problem, we get:

$$\beta_1^{NY} = 1-\frac{(a-c)}{2(2-\alpha)c} < 1,\ q_0^{NY} = \frac{a-c}{2(2-\alpha)},\ q_1^{NY} = \frac{a-c}{2},\ \pi_0^{NY} = \frac{(1-\alpha)(a-c)^2}{4(2-\alpha)^2},$$

$$\pi_1^{NY} = \frac{(1-\alpha)(a-c)^2}{4(2-\alpha)},\ CS^{NY} = \frac{(3-\alpha)^2(a-c)^2}{8(2-\alpha)^2},\ V^{NY} = \frac{(1+6\alpha-3\alpha^2)(a-c)^2}{8(2-\alpha)}.$$

3.5 Owners' decisions as to whether or not hire a manager

It remains to solve the first stage of the game. In this stage, the owners of the firms decide whether or not to hire managers. From the results obtained in the four cases considered, the following is obtained.

Proposition 1. *It is a dominant strategy for the private firm to hire a manager.*

It is easy to see that $\pi_1^{YY} > \pi_1^{YN}$ and $\pi_1^{NY} > \pi_1^{NN}$. Therefore, the owner of the private firm hires a manager independently of whether or not the semipublic firm does so.

When the semipublic firm does not hire a manager, the profit obtained by the private firm is greater if it hires a manager than if it does not do so ($\pi_1^{NY} > \pi_1^{NN}$). As reaction functions in quantities are downward sloping, if the semipublic firm does not hire a manager the private firm wants to hire a manager, thus becoming the leader in incentives; this permits the private firm to gain market share and profits at the expense of its rival.

When the semipublic firm hires a manager, the profit obtained by the private firm is greater if it hires a manager than if it does not do so ($\pi_1^{YY} > \pi_1^{YN}$), since in the latter case the private firm loses market share at the expense of the semipublic firm. As quantities are strategic substitutes, the leader firm in incentives is more aggressive in the product market than the follower firm; thus, the private firm wants to hire a manager to avoid becoming the follower in incentives.

Proposition 2. *It is a dominant strategy for the semipublic firm to hire a manager.*

It is easy to see that $V^{YN} > V^{NN}$ and $V^{YY} > V^{NY}$, therefore the semipublic firm hires a manager independently of whether the private firm hires a manager or not.

When the private firm does not hire a manager, the best response of the semipublic firm is to hire a manger ($V^{YN} > V^{NN}$). To explain this result all three components of the objective function of the semipublic firm have to be taken into account: the profit of the semipublic firm, the weighted profit of the private firm, and the weighted consumer surplus. Weighted welfare can be written as $V = \pi_0 + \alpha\pi_1 + \alpha CS$; therefore, $V^{YN} > V^{NN}$ if $\pi_0^{YN} + \alpha\pi_1^{YN} + \alpha CS^{YN} > \pi_0^{NN} + \alpha\pi_1^{NN} + \alpha CS^{NN}$. Moreover, it can be shown that $q_0^{YN} > q_0^{NN} > q_1^{YN} > q_1^{NN}$ and $q_0^{YN} + q_1^{YN} > q_0^{NN} + q_1^{NN}$. Therefore, the semipublic firm produces more than the private firm, and the highest output of the industry is obtained when the semipublic firm hires a manager. As a result: (i) $\pi_0^{YN} > \pi_0^{NN}$ if and only if $\alpha < \alpha_1 = \frac{1}{8}(7 - \sqrt{17}) \approx 0.3596$, (ii) $\alpha\pi_1^{YN} < \alpha\pi_1^{NN}$, and (iii) $\alpha CS^{YN} > \alpha CS^{NN}$. Then, if $\alpha < \alpha_1$, (i) and (iii) dominate (ii), implying that $V^{YN} > V^{NN}$; if $\alpha \geq \alpha_1$, (iii) has a greater effect than (i) and (ii), which means that $V^{YN} > V^{NN}$.

When the private firm hires a manager, the best response of the semipublic firm is to hire a manger ($V^{YY} > V^{NY}$). Therefore: $\pi_0^{YY} + \alpha\pi_1^{YY} + \alpha CS^{YY} > \pi_0^{NY} + \alpha\pi_1^{NY} + \alpha CS^{NY}$. It is easy to see that in this case: (i) $\pi_0^{YY} > \pi_0^{NY}$, (ii) $\alpha\pi_1^{YY} < \alpha\pi_1^{NY}$, and (iii) $\alpha CS^{YY} > \alpha CS^{NY}$ if and only if $\alpha < 1/2$. Then, if $\alpha < 1/2$, (i) and (iii) dominate (ii); if $\alpha > 1/2$, (i) dominates (ii) and (iii).

Proposition 3. *In equilibrium, both the private firm and the semipublic firm hire managers.*

We have seen in Propositions 1 and 2 that it is a dominant strategy for both firms to hire a manager. So in equilibrium both firms hire managers. Besides, it can be shown that $\pi_1^{NN} > \pi_1^{YY}$ if and only if $\alpha < 1 - \sqrt{1/8}$ and $V^{YY} > V^{NN}$. Therefore, if parameter α is low enough ($\alpha < 1 - \sqrt{1/8}$) there is a Prisoners' Dilemma and both firms would prefer not to hire a manager.

4. Conclusion

The literature that analyzes mixed oligopolies has dedicated little attention to investigating whether firms want to hire managers or not. However, this question has received great attention under private oligopolies. White (2001) extends this analysis considering a mixed oligopoly. He shows that when firms have the choice of whether or not to hire managers, in equilibrium only private firms do so. In this paper we consider a market in which a semipublic firm and a private firm compete. These firms have identical constant marginal costs of production. The owners of the firms chose whether to delegate production decisions to managers or not. We obtain that in equilibrium both firms hire managers.

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