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The decision to hire managers in the presence of public and CSR firms

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Abstract

The main aim of this paper is to study the endogenous choice of managerial incentives in a mixed duopoly of one public firm and one Corporate Social Responsibility (CSR) firm. The managerial delegation contract of the public firm includes social welfare and that of the CSR firm takes into account consumer surplus. We show that, in equilibrium, the government (as the owner of the public firm) should always hire a manager and delegate the production decision. However, the CSR firm hires a manager only if the degree of social concern is sufficiently high. Furthermore, adopting these delegation contracts is a better strategy from a social welfare viewpoint.

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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, in recent years, Corporate Social Responsibility (CSR) becomes much popular in the business economics, and an increasing number of private firms adopted a regime of CSR in any industry. For example, an international survey by the consulting firm KPMG in 2015 showed that nearly 92% of the Global Fortune 250 firms issued CSR reports in 2015, up from 82% in 2008 and 35% in 1999 (Ouattara, 2017). Furthermore, 90% of CEOs indicated that customers and clients have a high or very high impact on their business strategy (PriceWaterhouseCoopers, 2016).

While there is a growing literature that analyses the competition between a private firm (pure profit-maximizing firm) and a CSR firm¹ (firm that follows rules of CSR), there is a little model that studies the competition between a CSR firm and a public firm. Yet in many countries, public firm competes with a firm that follows rules of CSR in sectors like telecommunications, education, health, oil and transportation industries. Since the public firms are active in the same markets as the CSR firms, it is of considerable interest to analyze the competition between these two types of firms. Following Goering (2007; 2008), Lambertini and Tampieri (2012) and Bian *et al.* (2016), we adopt, consumer surplus as a proxy of the firm's CSR concerns.

The aim of this paper is to study a mixed oligopoly with separation between ownership and management. The literature on strategic delegation, which started with Fershtman and Judd (1987), and Sklivas (1987), supposes that profit maximizing-firms provide a delegation contract for their manager, which is a linear combination of profits and revenues. In a managerial mixed oligopoly with public and private firms, previous studies suppose that both the private and public firm's managerial contracts combine profits and revenues (Barros [1995]; White [2001]; Fernandez-Ruiz [2009]). With regard to previous work on managerial CSR firm, Goering (2007) and Kopel and Brand (2012) examined mixed duopoly where the owner of CSR firm designs its managerial incentive based on consumer surplus. They show that the CSR firm has an incentive to make the manager more aggressive.

The originality of the paper is that, to our knowledge, no theoretical study deals with competition between a managerial CSR firm and a managerial public firm in a context where both firm's incentive contracts take into account the objective of the owners of the firms. Although Ouattara (2017) and Kim *et al.* (2019) discussed the issue of competition between the public and CSR firms, they don't consider the strategic delegation. As for studies with motivation similar to ours, we have the models of managerial contracts of Kopel and Brand (2012) and Nakamura (2015, 2019). However, Kopel and Brand (2012) analyze the competition between a private firm and a CSR firm. In addition, Nakamura (2015, 2019) considers the endogenous choice of the strategic contracts in a market with one public firm and one private firm. Our research differs from that of the above works in that we rather consider the competition between a CSR firm and a public firm. In this context, we pose the following research questions: How does the degree of CSR considerations affects the endogenous decision of hiring managers? What is the impact of these delegation contracts on the social welfare?

We show that the degree of CSR considerations affects the incentive parameters of firms' managers. If the CSR firm's weight on the consumer surplus is sufficiently low (high),

¹See for example Kopel and Brand (2012), Lambertini and Tampieri (2012), Bian *et al.* (2016).

the public (CSR) firm's owner provides disincentives to the manager's choice of output. In addition, the endogenous choice of strategic incentive depends on the degree of CSR considerations. In contrast with the results by Kopel and Brand (2012) - where in equilibrium both firm's dominant strategy is to hire manager - we show that both the public and the CSR firms hire a manager only if the weight of CSR considerations is sufficiently high. If this weight on the consumer surplus is low, only the public firm hires a manager. Moreover, we find that social welfare is higher in the case where firms delegate.

2 The model

We consider an industry consisting of two firms with a single homogeneous output. One of the firm (firm 0) is a public firm, i.e. owned by the government, and the other firm (firm 1) is a CSR firm.

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 firm i is:

$$\pi_i = pq_i - q_i^2 \quad (i = 0, 1)$$

Following the recent established literature², we assume that the owner of CSR firm maximizes profits plus a fraction of consumer surplus. Thus, the objective function of a CSR firm is:

$$V = \pi_1 + \theta CS \quad (1)$$

where consumer surplus, denoted by CS, is given by $CS = \frac{Q^2}{2}$. The parameter $\theta \in [0, 1]$ measures the degree of concern for consumers that the CSR firm has.

The public firm's owners aim to maximize social welfare, defined as the sum of the consumer surplus and the producer surplus. Therefore social welfare is given by

$$W = CS + \pi_0 + \pi_1 \quad (2)$$

Furthermore, our paper focuses on the managerial aspect of the firms. Owners of firm i can hire a manager to make his firm's production decisions. Following Ouattara (2013) and Nakamura (2015, 2019), we suppose that the incentive contract takes into account the objective of the firm's owners. The owner of each firm provides to his manager a strategic delegation contract that is based upon a combination of the owner's objective function and output. Thus, the manager of CSR firm and public firm maximize respectively M_1 and M_0 :

$$M_1 = V + \lambda_1 q_1 \quad (3)$$

$$M_0 = W + \lambda_0 q_0 \quad (4)$$

²See for example Goering (2007, 2008), Lambertini and Tampieri (2012), Ouattara (2017).

where parameter λ_i is the incentive parameter that the owner of firm i chooses to maximize his objective. The case in which $\lambda_i = 0$, portrays a situation in which the behavior of firm i 's manager coincides with owner i 's objective.

The game has a three-stage structure. 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, each owner sets the corresponding managerial incentives parameter λ_i . In the third stage, managers compete *a la* Cournot. We adopt a subgame perfect Nash equilibrium.

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, there are four different subgames of the delegation game: neither firm hires a manager (denoted by superscript NN), both firms hire managers (denoted by superscript DD), only the CSR firm hires a manager (denoted by superscript ND) and only the public firm hires a manager (denoted by superscript DN). We solve the game by backward induction and analyze the decision taken by each firm at the delegation stage.

3.1.1 Neither firm hires a manager (NN)

In the third stage, the public and the CSR firms choose simultaneously their outputs to maximize their objective functions, given respectively by (2) and (1). Solving these problems, we obtain:

$$\begin{aligned}
 q_0^{NN} &= \frac{3 - \theta}{11 - 2\theta} & q_1^{NN} &= \frac{\theta + 2}{11 - 2\theta} \\
 \pi_0^{NN} &= \frac{(3 - \theta)^2}{(11 - 2\theta)^2} & \pi_1^{NN} &= \frac{(\theta + 2)(4 - 3\theta)}{(11 - 2\theta)^2} \\
 W^{NN} &= \frac{-16\theta - 4\theta^2 + 59}{2(11 - 2\theta)^2} & V^{NN} &= \frac{21\theta - 6\theta^2 + 16}{2(11 - 2\theta)^2}
 \end{aligned}$$

When neither firm hires a manager, the public firm's output is not always higher than that of the CSR firm ($q_0^{NN} > (<) q_1^{NN}$ if $\theta < (>) \frac{1}{2}$). Furthermore, the profit of the public firm is never less than that of the CSR firm. We observe that the public firm's output decreases with θ and the CSR firm's output increases with θ . Nevertheless, increasing θ leads to a decrease of both firms' profits and an increase of consumer surplus. If θ is low ($\theta < \frac{1}{2}$), social welfare strictly increases with θ , because the decrease in the producer surplus is compensated by the increase in consumer surplus. When θ is high, the opposite effect occurs and social welfare decreases with θ .

3.1.2 Both firms hire managers (DD)

In this case, there is a manager at each firm. In the third stage, the public firm's manager and the CSR firm's manager choose the output that maximizes respectively (4) and (3). Solving these problems, we obtain:

$$q_0 = \frac{-\theta + 4\lambda_0 - \lambda_1 - \theta\lambda_0 + 3}{11 - 2\theta} \quad q_1 = \frac{\theta - \lambda_0 + 3\lambda_1 + \theta\lambda_0 + 2}{11 - 2\theta}$$

At stage two, the owners of the CSR firm and the owners of public firm choose simultaneously λ_1 and λ_0 that maximize respectively (1) and (2). We find that the equilibrium in this case is as follows:

$$\lambda_0^{DD} = \frac{2(2\theta - 1)(1 - \theta)}{59 - 4\theta(6 - \theta)} \quad \lambda_1^{DD} = \frac{(1 - 2\theta)(4 - \theta)}{59 - 4\theta(6 - \theta)}$$

$$q_0^{DD} = \frac{3(5 - 2\theta)}{59 - 4\theta(6 - \theta)} \quad q_1^{DD} = \frac{12}{59 - 4\theta(6 - \theta)}$$

$$\pi_0^{DD} = \frac{3(5 - 2\theta)(-12\theta + 4\theta^2 + 17)}{(59 - 4\theta(6 - \theta))^2} \quad \pi_1^{DD} = \frac{24(5 - 2\theta)(2 - \theta)}{(59 - 4\theta(6 - \theta))^2}$$

$$W^{DD} = \frac{3(-440\theta + 132\theta^2 - 16\theta^3 + 573)}{2(59 - 4\theta(6 - \theta))^2} \quad V^{DD} = \frac{3(99\theta - 76\theta^2 + 12\theta^3 + 160)}{2(59 - 4\theta(6 - \theta))^2}$$

The equilibrium incentive parameter of both firms can be either positive or negative. Particularly, $\lambda_0^{DD} < 0$ if $\theta < \frac{1}{2}$ and $\lambda_1^{DD} < 0$ if $\theta > \frac{1}{2}$. In other words, the public (CSR) firm's owner provides disincentives to the manager's choice of output if the level of CSR is less (high) than $\frac{1}{2}$. This result is in contrast with the standard managerial delegation literature where the incentive parameters are positive. This difference in results is due to the fact that in our model both firms take into account consumer surplus in their objective.

Note that if $\theta = \frac{1}{2}$, $\lambda_i^{DD} = 0$ ($i = 0, 1$). This means that both firms have no incentive to hire manager when the degree of CSR considerations is $\theta = \frac{1}{2}$. In fact, when θ increases, the output of public firm decreases, the output of CSR firm and consumer surplus increase. Nevertheless, both firm's profits decrease. We show that social welfare is maximized when $\theta = \frac{1}{2}$ because the decrease in the aggregated profit of both firms is equal to the increase in consumer surplus at this point.

Furthermore, only the CSR firm engages a manager when $\theta = 1$. This mean that in an economy where a public firm compete with a CSR firm which take into account all the consumer surplus, the public firm must stick to a pure welfare maximization behavior. This is because, in this case, a further increase in production would lead to decrease both firms profits since the market price is equal to the marginal cost of production when $\theta = 1$.

We observe that the public firm's profit is at least higher than that of the CSR firm ($\pi_0^{DD} \geq \pi_1^{DD}$).

3.1.3 Only the CSR firm hires a manager (ND)

In the third stage, the manager of the CSR firm and the owner of the public firm choose their firm's output in order to maximize their objective function given respectively by (3) and (2). Solving these problems, we obtain:

$$q_0 = \frac{3 - \theta - \lambda_1}{11 - 2\theta} \quad q_1 = \frac{2 + \theta + 3\lambda_1}{11 - 2\theta}$$

At the second stage, the owners of the CSR firm choose λ_1 that maximizes (1). We find that the equilibrium in this case is as follows:

$$\lambda_1^{ND} = \frac{1 - 2\theta}{15 - 2\theta} \quad q_0^{ND} = \frac{4 - \theta}{15 - 2\theta} \quad q_1^{ND} = \frac{\theta + 3}{15 - 2\theta}$$

$$\pi_0^{ND} = \frac{(\theta - 4)^2}{(15 - 2\theta)^2} \quad \pi_1^{ND} = \frac{(\theta + 3)(5 - 3\theta)}{(15 - 2\theta)^2}$$

$$W^{ND} = \frac{111 - 24\theta - 4\theta^2}{2(15 - 2\theta)^2} \quad V^{ND} = \frac{3\theta + 2}{2(15 - 2\theta)}$$

The CSR manager's contract term is positive (negative) if the level of CSR is lower (higher) than $\frac{1}{2}$. In other words, the CSR firm becomes more aggressive in the market only if the level of CSR is low ($\theta < \frac{1}{2}$). In fact, when θ is low, the public firm's output is high. Thus, by giving his owner an incentive to become more aggressive, the CSR firm forced firm 0 to reduce its production and thus obtains a better outcome.

3.1.4 Only the public firm hires a manager (DN)

In the third stage, the manager of the public firm and the owners of the CSR firm choose their firm's output in order to maximize their objective function given respectively by (4) and (1). Solving these problems, we obtain:

$$q_0 = \frac{3 - \theta + 4\lambda_0 - \theta\lambda_0}{11 - 2\theta} \quad q_1 = \frac{2 + \theta - \lambda_0 + \theta\lambda_0}{11 - 2\theta}$$

At the second stage, the owner of the public firm chooses λ_0 that maximizes (3). We obtain:

$$\lambda_0^{DN} = \frac{2(2\theta - 1)(1 - \theta)}{43 - 4\theta(5 - \theta)} \quad q_0^{DN} = \frac{11 - 5\theta}{43 - 4\theta(5 - \theta)} \quad q_1^{DN} = \frac{\theta + 8}{43 - 4\theta(5 - \theta)}$$

$$\pi_0^{DN} = \frac{(11 - 5\theta)(-11\theta + 4\theta^2 + 13)}{(43 - 4\theta(5 - \theta))^2} \quad \pi_1^{DN} = \frac{(\theta + 8)(-17\theta + 4\theta^2 + 16)}{(43 - 4\theta(5 - \theta))^2}$$

$$W^{DN} = \frac{21 - 8\theta}{2(43 - 4\theta(5 - \theta))} \quad V^{DN} = \frac{121\theta - 122\theta^2 + 24\theta^3 + 256}{2(43 - 4\theta(5 - \theta))^2}$$

The public firm manager's contract term is positive (negative) if the level of CSR is higher (lower) than $\frac{1}{2}$. In other words, the public firm behaves less aggressively (by choosing negative λ_0) when the CSR firm's weight on the consumer surplus is low. Interestingly, Matsumura (1998) shows that a similar effect occurs when the public firm is partially privatized. Furthermore, in our model, delegation can make the public firm more aggressive in the market. In fact, when θ is high, the CSR firm's output is high. Thus, by giving his owner an incentive to become more aggressive, the public firm forced firm 1 to reduce its production and thus obtains a better outcome³. This last result highlights the advantage of our approach over the partial privatization approach by Matsumura (1998). Indeed, while partial privatization can only make the public firm less aggressive, our model shows that the delegation can make the public firm more (or less) aggressive.

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

In this subsection, we investigate the owners' decision of whether or not to hire managers. The relevant reduced form game played by owners at the first stage takes the form depicted in this Matrix:

		<i>CSR Firm</i>	
		(D)	(N)
<i>Public Firm</i>	(D)	W^{DD}, V^{DD}	W^{DN}, V^{DN}
	(N)	W^{ND}, V^{ND}	W^{NN}, V^{NN}

From the results obtained in the four cases, we have the following proposition.

Proposition 1 *The subgame perfect Nash equilibria are classified into two cases, depending on the value of θ ,*

- *both the public firm and the CSR firm hire a manager, if $\theta > \tilde{\theta}$ (with $\tilde{\theta} = 0.38$),*
- *only the public firm hires a manager, if $\theta < \tilde{\theta}$*

³In fact, the public firm uses the manager's contract term to adjust production allocation in the market.

Proof: see appendix 1

The above result shows that in equilibrium the decision to hire managers depends on the degree of CSR considerations (θ). In fact, it is a dominant strategy for the public firm to hire a manager ($W^{DD} > W^{ND}$; $W^{DN} > W^{NN}$). Independently of whether the CSR firm hires a manager or not, the public firm hires a manager because the decrease in the consumer surplus has a lower effect on welfare than the increase in producer surplus.

When the public firm hires a manager, the CSR firm does not hire a manager if the degree of CSR considerations is low enough. In other words, in an industry where a public firm hires a manager, it is not optimal for the owner of the CSR firm to engage a manager when the weight of CSR considerations is sufficiently low. In this case, a lower concern for consumer surplus results in a decrease of CSR firm's profit ($\pi_1^{DD} < \pi_1^{DN}$) and an increase in the consumer surplus ($CS^{DD} > CS^{DN}$). Finally the CSR firm payoff is low ($V^{DD} < V^{DN}$) when $\theta < \tilde{\theta}$.

Next, we compare the equilibrium social welfare values with a situation in which neither firm hires a manager.

Proposition 2 *In equilibrium, delegation always increases social welfare.*

Proof: see appendix 2

This proposition shows that in a mixed duopoly equilibrium, delegation contract is a better strategy from a social welfare viewpoint. First, in equilibrium DD ⁴, while the output and profit of the CSR firm increase ($q_1^D D > q_1^N N$; $\pi_1^D D > \pi_1^N N$), those of the public firm decrease ($q_0^D D < q_0^N N$; $\pi_0^D D < \pi_0^N N$). In equilibrium DN ⁵, it is the opposite which occurs ($q_1^D N < q_1^N N$; $q_0^D N > q_0^N N$) and both firms' profits decrease ($\pi_0^D D < \pi_0^N N$; $\pi_0^D N < \pi_0^N N$). However, in both cases, total output and consumer's surplus increase ($CS^D D > CS^N N$; $CS^D N > CS^N N$). Since the loss in producer surplus is offset by the increase of consumer surplus, social welfare increases.

4 Conclusion

In this paper, we provide the first formal model of competition between a managerial public firm and a managerial CSR firm. Compared to the result of existing literature (where CSR firm competes with a pure profit-maximizing firm), we highlight the sensitivity of managerial incentives to the degree of CSR considerations.

We show that the government (as the owner of the public firm) should always hire a manager and delegate the production decision. We also show that in organizational structures in which public and CSR firms compete, the use of incentive contracts of the type considered in this paper should be encouraged because it increases the consumer surplus and the social welfare.

⁴Note that for this equilibrium $\theta < \frac{1}{2}$.

⁵Note that for this equilibrium $\theta > \frac{1}{2}$.

Three interesting extensions of our model remain. One is to study a model of price competition between public and CSR firms in the context where managerial contracts take into account the firm's objectives. The second extension is to check the robustness of our result under an alternative assumption of cost. Matsumura and Okamura (2015) show that in a mixed oligopoly market, the constant marginal cost model and the quadratic cost model can yield contrasting results in terms of privatization policies. The introduction of constant marginal cost in our model would have an impact on a firm's decision to hire a manager. Finally, we supposed a mixed duopoly with one public firm and one CSR private firm. However, Kim *et al.* (2019) analyzed the optimal privatization policy when two CSR private firms compete with one public firm. They showed that heterogeneity among CSR private firms affects the optimal privatization policy. An extension of our study to the analysis of an oligopoly would have interesting implications.

Appendix

Appendix 1

- Hiring manager is a dominant strategy for the public firm because:

- When the CSR firm does not hire a manager, the public firm hires a manager:

$$W^{DN} - W^{NN} = \frac{2(2\theta-1)^2(\theta-1)^2}{(-20\theta+4\theta^2+43)(2\theta-11)^2} \geq 0$$

- When the CSR firm hires a manager, the public firm does not hire a manager:

$$W^{DD} - W^{ND} = \frac{2(1-\theta)(-81\theta+28\theta^2-4\theta^3+96)(2\theta-1)^2}{(2\theta-15)^2(-24\theta+4\theta^2+59)^2} \geq 0$$

- If the public firm hires a manager, the CSR firm compares V^{DD} and V^{DN} . This difference is equal to $V^{DD} - V^{DN} = \frac{(346\theta-140\theta^2+24\theta^3-113)(2\theta-1)^2(\theta-4)^2}{(-20\theta+4\theta^2+43)^2(-24\theta+4\theta^2+59)^2}$. The sign of this expression depends of that of $(346\theta - 140\theta^2 + 24\theta^3 - 113)$. Since $346\theta - 140\theta^2 + 24\theta^3 - 113$ is equal to zero when $\theta = \tilde{\theta}$ (with $\tilde{\theta} = 0.38$), therefore $V^{DD} - V^{DN} > 0$ if and only if $\theta > \tilde{\theta}$.

Appendix 2

- When both firms hire a manager, $W^{DD} - W^{NN} = \frac{2(-523\theta+201\theta^2-40\theta^3+4\theta^4+655)(2\theta-1)^2}{(2\theta-11)^2(-24\theta+4\theta^2+59)^2} > 0$ for all $0 \leq \theta \leq 1$.
- When only the public firm hires a manager, $W^{DN} - W^{NN} = \frac{2(2\theta-1)^2(\theta-1)^2}{(-20\theta+4\theta^2+43)(2\theta-11)^2} > 0$ for all $0 \leq \theta \leq 1$.

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