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Strategic privatization in a mixed duopoly with a socially responsible firm

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Abstract

This paper examines the impact of Corporate Social Responsibility (CSR) on privatization in a mixed duopoly consisting of one public firm and one Socially Responsible firm (SR firm). Two types of ownership of the SR firm are considered: (D) the SR firm is owned by domestic private investors and (F) it is owned by foreign private investors. Our model suggests that when considering the extent of privatization, the policy makers should account for two influences: the level of CSR and the nationality of the SR firm. Our results show that government should decrease the degree of privatization if the level of CSR increases. Furthermore, if the level of CSR is high enough, the optimal degree of privatization in an international mixed duopoly is higher than that obtained in a domestic mixed duopoly. This is in contrast to the standard mixed duopoly without CSR activities.

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1 Introduction

Corporate social responsibility (CSR) has become a major concern for a large number of companies. An international survey by 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. Furthermore, 90% of CEOs indicated that customers and clients have a high or very high impact on their business strategy (PriceWaterhouseCoopers, 2016).

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 concerns¹. Many recent studies have considered competition between a socially responsible firm (*SR* firm) and a pure profit-maximizing firm (Kopel and Brand, 2012; Lambertini and Tampieri, 2015). In this paper, we consider a mixed duopoly market where an *SR* firm competes with a partially privatized firm. In many countries (France, China, Italy), privatization of public firms has spread across several sectors such as gas, electricity, but also transport and telecommunications. The theoretical literature on the privatization policy has investigated mixed oligopolies in which pure profit-maximizing firms compete with a public firm which maximizes social welfare. In this context, Matsumura (1998) shows that partial privatization is socially optimal. Furthermore, the optimal degree of privatization can be affected by the number of firms (De Fraja and Delbono, 1989; Matsumura and Okamura, 2015)², the substitutability of the products (Fujiwara, 2007), or the share of foreign ownership of the private firms (Cato and Matsumura, 2012).

The aim of this paper is to study the relationship between a public firm's privatization and the level of CSR by considering two types of Cournot mixed duopoly. The first type is that an *SR* firm is perfectly owned by domestic private investors. The second type is that a *SR* firm is perfectly owned by foreign private investors. The introduction of a foreign *SR* firm in the analysis is clearly relevant because in many industries, such as airlines or tobacco, semi-public firms compete with foreign firms. Moreover, the presence of a foreign firm in the market changes the welfare function and therefore the goal of the semi-public firm. In this context, we pose the following research questions: What is the impact of increasing the CSR level on the degree of public firm's privatization? How does the *SR* firm's nationality affect the optimal degree of privatization?

We show that the degree of privatization of a public firm critically depends on the level of CSR and the *SR* firm's nationality. If the level of CSR is low enough, partial privatization is socially optimal. However, full nationalization is optimal if the level of CSR is high enough. This last result is in contrast to that obtained when a public firm competes with a pure

¹For an analysis of an environmental CSR, see Liu et al. (2015), Lambertini and Tampieri (2015) or Hirose et al. (2017).

²Strictly speaking, De Fraja and Delbono (1989) compared full nationalization and full privatization and showed that full privatization is more likely to be better when the number of private firms is larger. For discussion of the relationship between the optimal degree of privatization and the number of firms, see Matsumura and Okamura (2015).

profit-maximizing firm, where full state ownership is never optimal (Matsumura, 1998; Lee and Hwang, 2003). In addition, we show that if the level of CSR increases, the degree of privatization decreases. This is due to the fact that CSR and privatization have similar competitive effects. Nevertheless, we find that the optimal degree of privatization in a domestic mixed duopoly is not always higher than that obtained in an international mixed duopoly.

The paper is organized as follows. Section 2 sets up the model. In sections 3 and 4, we present respectively the equilibriums of domestic and international competition. Finally, section 4 offers some concluding remarks.

2 The model

We consider an industry consisting of two firms, firm 0 and firm 1, producing a homogeneous good. Firms are engaged in Cournot-type quantity competition.

Let $q_i \geq 0$ denotes the quantities produce by firm i ($i = 0, 1$). Then, the inverse demand function is given by:

$$p = 1 - q_0 - q_1 \quad (1)$$

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

The profit function of firm i is given as:

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

We assume that firm 0 is a public firm, i.e. owned by the government, and firm 1 is a socially responsible firm (*SR*). The objective function of an *SR* firm is to maximize the sum of its profit and a share of consumer surplus (Goering, 2007)

$$V_1 = \pi_1 + \theta CS \quad (3)$$

where consumer surplus, denoted by CS , is given by

$$CS = \frac{1}{2}(q_0 + q_1)^2 \quad (4)$$

The parameter $\theta \in [0, 1]$ represents the weight an *SR* firm gives to the consumer surplus.

The government's objective is to maximize social welfare. If the *SR* firm is a domestic firm, its profit should be involved in the social welfare. However, π_1 will be eliminated from social welfare if the *SR* firm is owned by foreign investors. Social welfare is given by

$$W = \begin{cases} CS + \pi_0 + \pi_1 & \text{if the } SR \text{ firm is a domestic firm} \\ CS + \pi_0 & \text{if the } SR \text{ firm is a foreign firm} \end{cases} \quad (5)$$

The government decides on the level of privatization α ($0 \leq \alpha \leq 1$) of the public firm in order to maximize social welfare. Following Matsumura (1998), we assumed that firm 0 maximizes a convex linear combination of social welfare and the firm's profit.

$$V_0 = (1 - \alpha)W + \alpha\pi_0 \quad (6)$$

If $\alpha = 0$, firm 0 is a fully nationalized firm and maximizes welfare, and if $\alpha = 1$ it is a fully privatized firm and maximizes profit. The higher value of α denotes a higher level of privatization.

We propose a two-stage game. In the first stage, the government maximizes welfare (5) to decide on the level of privatization. In the second stage, observing α , firm 0 and the *SR* firm simultaneously and independently choose their outputs respectively to maximize (6) and (3). To obtain a subgame perfect equilibrium, the game is solved by backwards induction.

3 Domestic competition

In this section, firm 0 competes with a domestic *SR* firm. Firm 0 and firm 1 choose respectively q_0 and q_1 to maximize (6) and (3). For given θ , the standard Cournot-Nash equilibrium in the second stage can be derived as:

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

$$CS = \frac{(\alpha+5)^2}{2(-2\theta+4\alpha-\theta\alpha+11)^2} \quad (7)$$

$$\pi_0 = \frac{(\theta-3)^2(\alpha+1)}{(-2\theta+4\alpha-\theta\alpha+11)^2}, \quad \pi_1 = \frac{(-3\theta+2\alpha-\theta\alpha+4)(\theta+\alpha+2)}{(-2\theta+4\alpha-\theta\alpha+11)^2}$$

$$W = \frac{-16\theta + 44\alpha - 4\theta^2 + 5\alpha^2 - 18\theta\alpha - 2\theta\alpha^2 + 59}{2(2 - 2\theta + 4\alpha - \theta\alpha + 11)^2} \quad (8)$$

We can see that the private firm's CSR activities always decrease firm 0 profit but it is profitable for the *SR* firm if and only if the level of CSR is relatively low (see appendix 1).

In the first stage, the government chooses α to maximize (8). We obtain:

$$\alpha^D = \begin{cases} \frac{2(2\theta-1)(\theta-1)}{11-5\theta} & \text{if } \theta \leq \frac{1}{2} \\ 0 & \text{if } \theta \geq \frac{1}{2} \end{cases} \quad (9)$$

where the superscript D denotes the equilibrium outcome in the first stage.

Proposition 1 *In a domestic mixed duopoly,*

- *The degree of privatization decreases if the level of CSR increases*
- *Partial privatization (full nationalization) is socially optimal if the level of CSR is low (high)*

Proof: $\frac{\partial(\alpha^D)}{\partial\theta} = \frac{4(-5\theta^2+22\theta-14)}{(5\theta-11)^2} < 0$ for $\theta \leq \frac{1}{2}$. Furthermore, $\alpha^D > 0$ for $\theta < \frac{1}{2}$.

This proposition shows how the level of CSR affects the degree of the public firm's privatization. By considering a mixed oligopoly and considering that private firms focus on their own profits and their rivals' profits, Matsumura and Okamura (2015) show that the optimal degree of privatization decreases with the weight given to rivals' profit. We show in this paper that when a private firm takes into account a CSR activities, the optimal degree of privatization decreases ($\alpha^D|_{\theta=0} > \alpha^D|_{\theta>0}$). So, including non-profit motives in the objective function of a pure private firm decreases the level of public firm privatization.

In a standard mixed oligopoly (without CSR), privatization is socially optimal because it has a beneficial effect due to substitution between public and private firms' output. When a public firm competes with an SR firm, there also exists an output substitution effect because the SR firm increases its output (at lower costs) and the public firm reduces its output. So, privatization and CSR activities have similar competitive effects.

We show that full nationalization is optimal if the level of CSR is high ($\theta \geq \frac{1}{2}$). When $\theta \geq \frac{1}{2}$, the marginal increase in α decreases q_0 , increases q_1 and decreases the consumer surplus. This decrease in consumer surplus outweighs the increase of producer surplus, and then, $\frac{\partial W}{\partial \alpha}|_{\alpha=0} < 0$ (when $\theta > \frac{1}{2}$). This result is in contrast with that obtained when a public firm competes with a pure profit-maximizing firm, where full state ownership is never optimal (Matsumura, 1998). Otherwise, Matsumura and Kanda (2005) show that in some circumstances (free entry markets, strategic complements), full nationalization is optimal. In this paper, we find a new case in which full nationalization can be optimal.

We also show that full privatization is never desirable. The marginal decrease in α at $\alpha = 1$, increases the consumer surplus and decreases the producer surplus. Since the increase of consumer surplus outweighs the decrease in the producer surplus, $\frac{\partial W}{\partial \alpha}|_{\alpha=1} < 0$.

By considering a mixed duopoly where the public firm competes with a pure profit-maximizing firm ($\theta = 0$ in our model), Matsumura (1998) and Lee and Hwang (2003) show that partial privatization is the optimum solution. In our model, this result also holds when the level of CSR is low ($\theta < \frac{1}{2}$). However, when the level of CSR is high ($\theta \geq \frac{1}{2}$), full state ownership is optimal.

Substituting α^D into (7)-(8), we obtain:

$$\begin{aligned} q_0^D &= \frac{11-5\theta}{-20\theta+4\theta^2+43}, & q_1^D &= \frac{\theta+8}{-20\theta+4\theta^2+43} \\ \pi_0^D &= \frac{(11-5\theta)(-11\theta+4\theta^2+13)}{(-20\theta+4\theta^2+43)^2}, & \pi_1^D &= \frac{(\theta+8)(-17\theta+4\theta^2+16)}{(-20\theta+4\theta^2+43)^2} \\ CS^D &= \frac{(4\theta-19)^2}{2(-20\theta+4\theta^2+43)^2}, & W^D &= \frac{21-8\theta}{2(-20\theta+4\theta^2+43)} \end{aligned} \quad (10)$$

Firm 0's output is not always higher than that of an SR firm. Furthermore, the profit of firm 0 is never less than that of the SR firm. When θ increases, q_0^D decreases, q_1^D and consumer surplus increase. Nevertheless both firms' profits decrease. If θ is low ($\theta < \frac{1}{2}$), social welfare strictly increases³ with θ , because the decrease in the aggregated profit of both firms is compensated by the increase in consumer surplus. When θ is high, the opposite effect occurs and social welfare decreases with θ .

³ $\frac{\partial}{\partial \theta}(W^D) = \frac{2(2\theta-1)(4\theta-19)}{(4\theta^2-20\theta+43)^2} > (<)0$ if $\theta < (>)\frac{1}{2}$

4 Foreign competition

In this section, firm 0 competes with a foreign SR firm. In the second stage firm 0 and the foreign SR firm simultaneously choose their outputs to maximize respectively (6) and (3). We obtain:

$$q_0 = \frac{-\theta - \alpha + 4}{3(-\theta + \alpha + 4)}, \quad q_1 = \frac{\theta + \alpha + 2}{3(-\theta + \alpha + 4)}$$

$$CS = \frac{2}{(-\theta + \alpha + 4)^2} \quad (11)$$

$$\pi_0 = \frac{2(\theta - 2\alpha - 1)(\theta + \alpha - 4)}{9(-\theta + \alpha + 4)^2}, \quad \pi_1 = \frac{2(-2\theta + \alpha + 2)(\theta + \alpha + 2)}{9(-\theta + \alpha + 4)^2}$$

$$W = \frac{2}{9} \frac{-5\theta + 7\alpha + \theta^2 - 2\alpha^2 - \theta\alpha + 13}{(-\theta + \alpha + 4)^2} \quad (12)$$

We can see that the private firm's CSR activities always decrease firm 0's profit but it is profitable for the SR firm if and only if the level of CSR is relatively low (see appendix 2).

In the first stage, the government chooses α to maximize (12). We obtain:

$$\alpha^F = \frac{(\theta + 2)(1 - \theta)}{23 - 5\theta} \quad (13)$$

where the superscript F denotes the equilibrium outcome in the first stage

Proposition 2 *In an international mixed duopoly,*

- *The degree of privatization decreases if the level of CSR increases*
- *Partial privatization is socially optimal if $\theta \neq 1$. If $\theta = 1$, nationalization is the optimal policy.*

Proof $\frac{\partial}{\partial \theta}(\alpha^F) = \frac{5\theta^2 - 46\theta - 13}{(5\theta - 23)^2} < 0$. Furthermore, $\alpha^F|_{\theta < 1} > 0$ and $\alpha^F|_{\theta = 1} = 0$.

First, we show that full privatization is never desirable. The marginal decrease in α at $\alpha = 1$, increases the consumer surplus and decreases firm 0's profit. This increase in consumer surplus outweighs the decrease in firm 0's profit, and then, $\frac{\partial W}{\partial \alpha}|_{\alpha=1} < 0$.

Next, we show that full nationalization is optimal only if the foreign SR firm takes into account the whole consumer surplus ($\theta = 1$). When $\theta = 1$, the marginal increase in α decreases the consumer surplus and increases firm 0's profit. The marginal change in the consumer surplus is equal to the marginal change in firm 0's profit when $\theta = 1$. So $\frac{\partial W}{\partial \alpha}|_{\alpha=0} = 0$ (when $\theta = 1$).

Substituting α^F into (11)-(12), we obtain:

$$\begin{aligned}
q_0^F &= \frac{-7\theta + \theta^2 + 15}{-22\theta + 2\theta^2 + 47}, & q_1^F &= \frac{(\theta+2)(4-\theta)}{-22\theta + 2\theta^2 + 47} \\
\pi_0^F &= \frac{(-7\theta + \theta^2 + 15)(1-\theta)(9-\theta)}{(-22\theta + 2\theta^2 + 47)^2}, & \pi_1^F &= \frac{(\theta+2)(4-\theta)(\theta-1)(3\theta-16)}{(-22\theta + 2\theta^2 + 47)^2} \\
CS^F &= \frac{(5\theta-23)^2}{2(-22\theta + 2\theta^2 + 47)^2}, & W^F &= \frac{-6\theta + \theta^2 + 17}{2(-22\theta + 2\theta^2 + 47)}
\end{aligned} \tag{14}$$

Firm 0's output is higher than that of the foreign *SR* firm. Moreover, the profit of firm 0 is higher (lower) than that of the *SR* firm if $\theta < (>)0.084$. Contrary to the domestic mixed duopoly where the effect of the CSR level in welfare is ambiguous, we show that in an international mixed duopoly, welfare increases⁴ with θ . The higher level of CSR increases both firms' outputs and consumer surplus. Despite a decrease in firm 0's profit, social welfare increases because the gain in the consumer surplus compensates the loss of firm 0's profit.

5 Comparison

Proposition 3 *A domestic mixed duopoly leads to a higher (lower) degree of privatization than an international mixed duopoly when the level of CSR is low (high) enough.*

Proof: $\alpha^D - \alpha^F = \frac{(1-\theta)(-103\theta + 25\theta^2 + 24)}{(11-5\theta)(23-5\theta)} > 0$ when $\theta < 0.247$.

The optimal degree of privatization in a domestic mixed duopoly is not always higher than that obtained in an international mixed duopoly. This result is partly in contrast to that obtained by Heywood and Ye (2010), who show that the optimal degree of privatization with a domestic pure profit-maximizing firm exceeds that with a foreign pure profit-maximizing firm. This is due to the fact that the output substitution effect between the public and private firms is socially beneficial in a domestic mixed duopoly and not beneficial in an international mixed duopoly (because the domestic social welfare does not include the foreign firm's profit). This result also holds in our model only if the level of CSR is low ($\theta < 0.247$). However, when the level of CSR is high enough ($\theta \in]0.247, 1[$), the optimal degree of privatization is higher in the presence of the foreign *SR* firm. The intuition behind this result is as follows. When θ is high, the increased output of the *SR* firm will decrease its profits. Under these conditions, the state can correct this negative effect by reducing the degree of privatization. However, in the presence of a foreign *SR* firm, this negative effect has no impact on domestic welfare, which does not include the profit of the foreign firm. Then, in an international mixed duopoly, privatization policy should be more restricted.

6 Conclusion

The model presented here serves to illustrate the sensitivity of privatization policy to the level of CSR and the *SR* firm's nationality. We have found that when the level of CSR is sufficiently low, partial privatization is socially optimal; meanwhile, when the level of CSR is high enough, it is optimal to completely nationalize the public firm. This result is fairly

⁴ $\frac{\partial}{\partial \theta}(W^F) = \frac{-5\theta^2 + 13\theta + 46}{(2\theta^2 - 22\theta + 47)^2} > 0$

remarkable in that it is different to that obtained by Matsumura (1998) and Lee and Hwang (2003) who show that when a public firm competes with a pure profit-maximizing firm, full state ownership is never optimal. Yet we show that privatization and CSR activities have similar competitive effects. Furthermore, an increase in the CSR level, always increases social welfare in the presence of a foreign *SR* firm, while it may either increase or decrease social welfare in the presence of a domestic *SR* firm.

We conclude this paper by providing an avenue for future research. We supposed that the private firm is either totally owned by domestic investors, or totally owned by foreign investors. However researchers such as Lin and Matsumura (2012) or Ouattara (2016) consider the intermediate situations between cases of full domestic ownership of the private firm and full foreign ownership of the private firm. The introduction of a partial foreign *SR* firm will allow more general cases to be discussed, including the two cases above as special cases.

APPENDIX

Appendix1: CSR profitability in a domestic mixed duopoly

Let $\Delta\pi_1 = \pi_1 - \pi_1|_{\theta=0}$

$$\Delta\pi_1 = \theta(\alpha + 5) \frac{-79\theta + 19\alpha + 4\alpha^2 - 74\theta\alpha - 22\theta\alpha^2 - 2\theta\alpha^3 + 22}{(4\alpha + 11)^2(2\theta - 4\alpha + \theta\alpha - 11)^2}$$

If we denote $\widetilde{\theta}^D$ the value of parameter θ such that $\Delta\pi_1 = 0$:

$$\widetilde{\theta}^D = \frac{(4\alpha + 11)(\alpha + 2)}{74\alpha + 22\alpha^2 + 2\alpha^3 + 79}$$

The sign of $\Delta\pi_1$ depends on that of expression $(-79\theta + 19\alpha + 4\alpha^2 - 74\theta\alpha - 22\theta\alpha^2 - 2\theta\alpha^3 + 22)$. Since this expression is a decreasing function⁵ of θ and is equal to zero when $\theta = \widetilde{\theta}^D$, therefore $\Delta\pi_1 > 0$ if and only if $\theta < \widetilde{\theta}^D$.

Let $\Delta\pi_0 = \pi_0 - \pi_0|_{\theta=0}$

$$\Delta\pi_0 = \theta(\alpha + 5)(\alpha + 1) \frac{17\theta - 24\alpha + 7\theta\alpha - 66}{(4\alpha + 11)^2(2\theta - 4\alpha + \theta\alpha - 11)^2} < 0$$

Appendix2: CSR profitability in an international mixed duopoly

Let $\Delta\pi_1 = \pi_1 - \pi_1|_{\theta=0}$

$$\Delta\pi_1 = \frac{2}{9}\theta \frac{-36\theta + 8\alpha + 6\alpha^2 + \alpha^3 - 20\theta\alpha - 3\theta\alpha^2}{(\alpha + 4)^2(\theta - \alpha - 4)^2}$$

If we denote $\widetilde{\theta}^D$ the value of parameter θ such that $\Delta\pi_1 = 0$:

$$\widetilde{\theta}^F = \alpha(\alpha + 4) \frac{\alpha + 2}{20\alpha + 3\alpha^2 + 36}$$

The sign of $\Delta\pi_1$ depends on that of expression $(-36\theta + 8\alpha + 6\alpha^2 + \alpha^3 - 20\theta\alpha - 3\theta\alpha^2)$. Since this expression is a decreasing function⁶ of θ and is equal to zero when $\theta = \widetilde{\theta}^F$, therefore $\Delta\pi_1 > 0$ if and only if $\theta < \widetilde{\theta}^F$.

Let $\Delta\pi_0 = \pi_0 - \pi_0|_{\theta=0}$

$$\Delta\pi_0 = \frac{2}{9}\theta \frac{12\theta + 8\alpha - 15\alpha^2 - 5\alpha^3 + \theta\alpha + 3\theta\alpha^2 - 48}{(\alpha + 4)^2(\theta - \alpha - 4)^2} < 0$$

⁵ $\frac{\partial}{\partial\theta}(-79\theta + 19\alpha + 4\alpha^2 - 74\theta\alpha - 22\theta\alpha^2 - 2\theta\alpha^3 + 22) = -2\alpha^3 - 22\alpha^2 - 74\alpha - 79 < 0$

⁶ $\frac{\partial}{\partial\theta}(-36\theta - 8\alpha - 6\alpha^2 - \alpha^3 + 20\theta\alpha + 3\theta\alpha^2) = -23\alpha - 36 < 0$

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