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any room for Regulation?**

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Private CSR Activities in Oligopolistic Markets: Is there any room for Regulation?

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Abstract

The present paper examines the conditions under which the regulator can complement the provision of Corporate Social Responsibility (CSR) activities by private firms in an oligopolistic market. Our main finding is that if there is no credible information disclosure about SR characteristics of the firms' products to consumers, no firm will have incentives to undertake CSR effort in equilibrium. However, if the necessary information about the CSR aspects of each firm's product, otherwise unobservable, is made available to consumers through certification provided either by a profit-maximizing certifier or by the regulator, then both firms will have incentives to engage in CSR activities. Hence in equilibrium, consumers' surplus, firms profits and total welfare increase comparing to the benchmark case without CSR activities.

JEL Classification: M14, L13, L5.

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1 Introduction

The large publicity on Corporate Social Responsibility (CSR hereafter) over the last few years has led many companies to account for the social consequences of their activities. As a result,

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CSR has emerged as a prime issue among firms, seeking ways to benefit society and at the same time, receive a benefit from this new challenge.¹ Following the terminology of Porter & Kramer (2006), potential firms' benefits from engaging in CSR actions may be moral obligation, sustainability, "license to operate" and reputation.² For these benefits to be effective, firms have to convince potential consumers about their social orientation.

However, CSR effort by firms may involve cost increasing actions within their value chain, which are difficult - if not impossible - to be observed by a large scope of consumers, even after consumption. For instance, the firm may operate with respect to the interests of its stakeholders such as its employees (investing in workplace safety), suppliers (by supporting local suppliers rather than cheaper alternative sources in order to support the local economy), and the environment (by reducing emissions of pollutants).³ Therefore, the SR attribute of a product can be characterized as a credence good. It becomes obvious that, in the absence of a credible information disclosure system, firms may fail to persuade socially conscious consumers about their true commitment to social values, hence they will have no incentives to undertake any costly CSR activity.

Given this evidence, the following question arises: *"Which are the policy instruments that a regulator can employ in order to promote firms' engagement in CSR activities, and what are their effects on market outcomes and social welfare?"* The present paper addresses and formalizes this question in an oligopolistic market for a final good, where consumers differ with respect to their valuation towards CSR activities.

The basic idea behind our model is that firms strategically engage in CSR activities in order to create a *"socially friendly image"* for their product. We consider that consumers are homogeneous regarding the physical characteristics of the goods, but heterogeneous towards the valuation of the CSR aspects of each product. More socially conscious consumers have a higher valuation for the product of the firm that engages in CSR activities, hence, they are willing to pay a higher price for the *"socially friendly"* good.⁴

¹More than half of the top 100 corporations that are based in the 16 more industrialized countries published a CSR report in the year 2005 (Becchetti et al., 2006).

²For instance, Baron (2001, 2003), Bagnoli and Watts (2003), Manasakis et. al (2006) and Garcia-Gallego and Georgantzis (2008) under the scope of strategic CSR, formalize situations where firms create a socially friendly image in order to obtain a competitive advantage in the market in which they operate.

³See for example Mayer (1999) and Bris & Brisley (2006).

⁴Becchetti et al. (2005) quote the "2003 Corporate Social Responsibility Survey". The main finding of this survey is that the amount of consumers that are socially concerned about their purchasing choices was 62% in 2001 in Europe.

Since CSR is defined as: “*firms’ commitment to social and ecological considerations, beyond the law requirements*” there cannot be any “*command and control*” measures, such as compulsory CSR standards, in order to impose socially conscious behavior by firms. We thus consider certification as a policy instrument, i.e. the regulator sets certain social and environmental criteria that should be respected during the firm’s operational activities and then provides a certification to any firm that fulfills those criteria.⁵ Following Bottega & De Freitas (2006) we consider that certification from, either a profit-maximizing private organization or the regulator, is an effective system of information disclosure that allows consumers to distinguish the social characteristics of the products they purchase.⁶

We investigate two possible scenarios. The first one is the "Certification by a private organization", which assumes that a voluntary certificate, provided by a private profit maximizing organization, is an appropriate system of information disclosure that allows consumers to distinguish the social characteristics of the products they purchase, without the need for a policy intervention. We find that in this case, both firms’ endogenous choice will be to engage in CSR, seeking for a competitive advantage at the market competition stage via an increase of consumers’ willingness to pay for their final product. The above interaction between competing firms, increases the consumers’ surplus and total welfare comparing to the benchmark case without CSR activities.

The second scenario refers to the case in which the regulator intervenes in order to solve the ensuing “market of lemons” problem, by proposing a certain standard of CSR effort to the firms, and providing a certification to the firms that comply with the standard voluntary. Similar to the previous scenario, this certification endows consumers with credible information

⁵For example, the certification SA8000 (2006) is specialized in the workers’ human rights in developing countries and it is developed and overseen by the Social Accountability International (SAI) (<http://www.sai-intl.org/>. Date last visited: May 24, 2008).

Additionally, an example of a public certifier is ISO 26000 which will certify SR activities by firms starting from 2008. (<http://isotc.iso.org/livelink/livelink/fetch/2000/2122/830949/3934883/3935096/home.html>. Date last visited: May 24, 2008).

According to Bottega & De Freitas (2006), an example of for profit organizations that provides certification is Ecocert (see <http://www.ecocert.com>. Date last visited May 24, 2008). Another example is the Scientific Certification Systems (SCS), which certifies environmental consciousness in product manufacturing and natural resource extraction.

⁶This assumption is in line with recent empirical evidence, according to which, EU citizens trust better a certification labeled on the product, comparing with other forms of information about the social characteristics of the products they purchase (see Fliess et al., 2007). It is assumed here, that the certifier spends an amount from the certification fees that collects on informative advertising, in order to inform consumers about the CSR characteristics of the certification that provides.

about the CSR aspects of each firm's product, otherwise unobservable. Our main finding is that the regulator will set a standard of positive CSR effort up to a level, at which both firms will have incentives to comply. This standard will be higher than the one set by the private certifier. Hence, in equilibrium, consumers surplus and total welfare increase comparing with the benchmark case without CSR activities and the "certification by a private organization" configuration.

Unlike the present paper, the vast majority of the literature on quality certification is based on the seminal paper of Gabszewich and Thisse (1979) and concentrates on oligopolistic models in which firms' products differ only in their vertical quality characteristics, which are observable by consumers.⁷ Moreover, in the aforementioned literature, the cost to increase quality is assumed to be zero, or fixed. Our duopolistic market is based on Häckner (2000) along with Garella and Petrakis (2008), therefore assumes a utility function that combines horizontal and vertical differentiation aspects of the products of the firms. The vertical differentiation represents the CSR aspects of the production process that are perceived as a quality improvement of the final product by socially conscious consumers. The present paper contributes to this branch of the literature assuming that, since CSR is considered as a credence good, there is no ex ante mechanism that can credibly inform consumers about the CSR characteristics of each product. Hence, in the absence of such an information disclosure mechanism, firms will fail to persuade consumers about their true commitment to social values, thus, a "market of lemons" problem arises.⁸ Additionally we assume that engaging in CSR increases variable costs, also.

This paper also built on a recent branch of the certification literature, that examines the effects of alternative certification regimes, considering that the true quality of the final products is difficult to be observed by consumers. Bottega and De Freitas (2006) examine the welfare implications of the coexistence of public and private environmental quality certification schemes, in a monopolistic context. Our work is closer to the work of Bonroy and Constantatos (2008), in the sense that an oligopolistic market for final products is assumed, in which the strategic interactions between the competing firms are investigated. They examine the certification of credence goods' quality, in a Bertrand competition context, focusing on the difference

⁷See for instance Daughety and Reinganum, (2005), Garella and Fluet, (2002).

⁸More specifically, once consumers have been convinced that one firm has undertaken a positive CSR effort they increase their willingness to pay for the firm's good. The firm has no incentives to spend on CSR activities, as these are costly for the firm. Consumers realize the firm's incentives and thus rationally believe that there will be zero CSR activity. The firm, in turn, spends zero on CSR activities, in equilibrium.

between mandatory and voluntary certification, where labelling does not always reveal perfect information. Conversely, in our work we examine firms' incentives for engaging in CSR (hence providing a credence attribute of a higher quality to their final product), focusing on different sources of certification (public or private) and assuming that certification is always voluntary and reveals perfect information.

Our work also contributes to the existing literature on "strategic CSR", a term that was introduced by Baron (2001) and refers to the case where firms are assumed to be socially responsible because they anticipate a benefit from such a behavior. Baron (2001, 2003) examines CSR under the prism of a strategic choice between public and private politics. His main finding is that private politics and CSR affect the strategic position of a firm in an industry under the existence of activist consumers, who can boycott firms with non-socially friendly behavior. In the same vein, Calveras et al. (2006), assuming a perfectly competitive supply of inputs, compare the effects of formal regulation to firms' incentives to provide socially friendly goods as a response to increased activism from the consumers. They argue that the substitution of the formal regulation with firms CSR actions may cause inefficiency, in which non activist consumers free-ride the willingness to pay of activist consumers, because of a lower formal regulation. Nevertheless, the above literature focuses on the difference between the provision of CSR by private firms and by the regulator. The main difference between the present work and the above literature is that the our paper examines the conditions under which the regulator can complement the provision of CSR by private firms, via the provision of certification to the firms that engage in CSR.

The rest of this paper is organized as follows: Section 2 presents the model. In Section 3 the different scenarios are solved and a detailed equilibrium analysis is conducted, whereas Section 4 provides some concluding remarks.

2 The Model

We examine a market, where in the production side there are two firms, denoted by $i, j = 1, 2$, $i \neq j$. Each firm produces one brand of a differentiated good. On the demand side, there is a *unit mass* of consumers composed by individuals who have homogeneous preferences regarding the physical characteristics of the goods. They are, however, heterogeneous regarding their valuation of the CSR activities that are undertaken by the firm that produces the good. In

particular, following Häckner (2000), the utility function of the θ -type consumer is given by:

$$U = (a + \theta s_i)x_i(\theta) + (a + \theta s_j)x_j(\theta) - [x_i^2(\theta) + x_j^2(\theta) + 2\gamma x_i(\theta)x_j(\theta)]/2 + m(\theta) \quad (1)$$

where $x_i(\theta)$, $i = 1, 2$, represents the quantity of good i bought by the consumer of type θ , and $m(\theta)$ is the respective quantity of the “composite good”. The parameter $\gamma \in [0, 1]$ is a measure of the degree of substitutability among goods, with $\gamma = 0$ corresponding to the case of independent goods and $\gamma = 1$ to that of homogeneous goods. Further, $s_i \geq 0$ represents the CSR effort that firm i undertakes, which, in turn, increases the θ -type consumer’s valuation for its good by θs_i . In other words, θ represents the increase of the θ -type consumer’s willingness to pay for the firm i ’s good per unit of CSR effort undertaken by firm i . Thus, the more socially conscious a consumer is, the higher is its θ , while a consumer who does not value the firms’ CSR activities at all is of type $\theta = 0$. We assume that θ is distributed uniformly where $\theta \in [0, 1]$. Thus, $\bar{\theta} = 1/2$ represents the average type of consumer in the population.

Maximization of utility (1) with respect to $x_i(\theta)$ and $x_j(\theta)$ gives the (inverse) demand functions for the θ -type consumer:

$$p_i = a + \theta s_i - x_i(\theta) - \gamma x_j(\theta), \quad i = 1, 2 \quad (2)$$

where p_i and p_j are the firms’ unit prices, while the price of the composite good has been normalized to unity. By inverting (2) we obtain the θ -type consumer’s demand for good i :

$$x_i(\theta) = \frac{a(1 - \gamma) + \theta(s_i - \gamma s_j) - p_i + \gamma p_j}{1 - \gamma^2} \quad (3)$$

By integrating (3) with respect to θ , we get firm i ’s aggregate demand function:

$$q_i(p_i, p_j) = \int_0^1 x_i(\theta) \frac{1}{2} d\theta = \frac{a(1 - \gamma) + \bar{\theta}(s_i - \gamma s_j) - p_i + \gamma p_j}{1 - \gamma^2} \quad (4)$$

Finally, by inverting (4), we obtain the firm i ’s (inverse) aggregate demand function:

$$p_i(q_i, q_j) = a + \bar{\theta} s_i - q_i - \gamma q_j, \quad i = 1, 2, i \neq j \quad (5)$$

Observe that the aggregate demand function corresponds to the demand function of an average type consumer, $\bar{\theta}$.

We assume that both firms are endowed with identical constant returns to scale production technologies. Firm i 's total cost function is given by $C_i(q_i, s_i) = c(1 + s_i^2)q_i$. This implies that, for a given CSR effort s_i , the firm i 's marginal (and average) production cost is constant and equal to $c(1 + s_i^2)$. Yet, a higher CSR effort increases, at an increasing rate, firm i 's unit production costs. This can be justified on the grounds that an individual firm's level of CSR activities, such as improving working conditions for employees, buying more expensive inputs from local suppliers, financing recycling and other SR campaigns or introducing "green" technologies, has an increasingly negative impact on the firm's unit production costs.

Firm i 's profits can then be expressed as:

$$\Pi_i = (a + \bar{\theta}s_i - q_i - \gamma q_j)q_i - c(1 + s_i^2)q_i \quad (6)$$

Therefore, CSR activities by firm i lead to a higher consumers' valuation for its product and thus to a higher aggregate demand for the firm but, at the same time, they increase firm i 's unit and total production costs. Note however that the CSR effort of the firms may not be observable by the consumers even after consumption. Thus, the SR quality of a product can be categorized as a credence good and a "lemons' problem" arises in our setup. Once consumers have been convinced that firm i has undertaken a CSR effort s_i , and have thus increased their willingness to pay for the firm's good, the firm has no incentives to spend on CSR activities, as these are costly for the firm. Consumers realize the firm's intentions and thus rationally believe that there will be zero CSR activity. The firm, in turn, spends zero on CSR activities in equilibrium.

To resolve the ensuing lemons problem, we evoke the literature on certification. More specifically, we consider two alternative scenarios: The first one refers to the case in which a profit-maximizing organization provides firms with a credible certificate about their SR activities, while the second one considers the case in which the regulator intervenes, by providing the certification himself with respect to total welfare.

3 Equilibrium Analysis.

3.1 The Benchmark case without CSR activities.

Before proceeding to the examination of the alternative certification scenarios, we briefly discuss the benchmark case where no owner engages in CSR and thus $s_1 = s_2 = 0$.⁹ In this scenario, the market outcomes coincide with the standard Cournot game with differentiated goods, where each owner chooses his firm's output to maximize his profits, $\Pi_i = (a - q_i - \gamma q_j)q_i - cq_i$. From the first order condition, the reaction function of owner i is,

$$q_i = R_i^C(q_j) = \frac{a - \gamma q_j - c}{2} \quad (7)$$

By symmetry, the equilibrium output, price and profits are, respectively,

$$q^C = \frac{a - c}{2 + \gamma}; \quad p^C = \frac{a + (1 + \gamma)c}{2 + \gamma}; \quad \pi^C = \frac{(a - c)^2}{(2 + \gamma)^2} \quad (8)$$

Finally, since all consumers have identical preferences over the physical characteristics of the two goods and there is a unit mass of them in the population, it turns out that each consumer buys a quantity $x^C = q^C$ of each good. Using (1) and (8), it can be checked that the consumers surplus and total welfare are given by $CS^C = (q^C)^2(1 + \gamma)$ and $TW^C = (q^C)^2(3 + \gamma)$ respectively.

3.2 Certification by a private organization.

In this section we begin our analysis by assuming that the only credible information disclosure system from firms to consumers regarding the CSR attribute of the products can only be provided through a certification by a private, profit maximizing organization.¹⁰ Following Bottega and De Freitas (2006) along with Hardling and Alexander (2003), we assume that the private certifier has all the bargaining power, hence, he is in position to extract all the extra profits from the CSR activities of the firms. Each firm's owner can set the CSR effort proposed

⁹This configuration also reflects the case where a firm that engages in CSR does not have any credible way to persuade consumers about its social orientation. In this case, the results coincide with the ones obtained in this subsection.

¹⁰Following the terminology of Bonroy and Constantatos (2008), we assume that this certification is perfect. Hence, if consumers see the CSR certification of a product, they are aware that the firm producing it is socially responsible.

by the private certifier or not engage in CSR activities at all. Each owner may make lower CSR effort than the proposed standard and claim not to have done so. Therefore, the private certifier has to monitor and certify CSR effort made by firms, assuming that, the probability the certifier tracing an owner that reveals untruthful information is almost unity. The cost of monitoring is paid by each firm that wishes to be certified. More specifically, each firm will be willing to get the certification from the private certifier and engage in CSR only if the profits of engaging in CSR are higher, or equal than if firm acts in the opposite manner. Hence, the profits of the private certifier will be equal to a fee given by:

$$F = \Pi_{gross}^{pc} - \pi^C \quad (9)$$

where Π_{gross}^{pc} stands for the gross firm's profits from engaging in CSR, before the payment of the fee, and π^C represents firm's profits in the case no firm engages in CSR. The fee cannot be higher than $\Pi_{gross}^{pc} - \pi^C$, because then the firm will not have incentives to engage in CSR and to eventually seek for certification. Thus, the objective of the private certifier coincides with the firms extra profits from CSR effort.¹¹

We consider a three stage game. At the first stage, the private certifier sets the CSR effort standard and the fee for certification in order to maximize his profits. At the second stage, both firms' owners decide whether or not they will engage in CSR. If they do so, they have to comply with the standard and pay the fee in order to be certified. At the last stage, firms compete in the market a lá Cournot. We solve the game backwards.

At the last stage of the game, owner i sets q_i to maximize his firm's profits (6), taking as given the output q_j of his rival, along with the CSR efforts, (s_i, s_j) , chosen at the previous stages.

The first order condition (foc) of (6) leads to firm i 's reaction function:

$$q_i = R_i^{pc}(q_j) = \frac{a - c - \gamma q_j}{2} + \frac{\bar{\theta} s_i - c s_i^2}{2} \quad (10)$$

Comparing $R_i^{pc}(q_j)$ with the benchmark case with no CSR activities $R_i^C(q_j)$, in which only the first term of the RHS of (10) appears, we observe that CSR effort has two opposing effects on owner i 's output decision. On the one hand, CSR effort s_i augments the demand for the

¹¹We assume that the private certifier spends a part of F on monitoring and informative advertising in order to provide information about the SR characteristics of the product to consumers.

firm i 's good and thus tends to increase equilibrium output. However, it increases firm i 's unit costs as well, tending to decrease equilibrium output. If $0 < s_i < \bar{\theta}/c$ the first effect is dominant and the CSR effort undertaken by firm i shifts its reaction function outwards.¹² If $s_i > \bar{\theta}/c$, the opposite holds.

Solving the system of focs (10), we obtain the equilibrium output:

$$q_i^{pc}(s_i, s_j) = \frac{a(2 - \gamma) + \bar{\theta}(2s_i - \gamma s_j) - c[2(1 + s_i^2) - \gamma(1 + s_j^2)]}{(4 - \gamma^2)} \quad (11)$$

Observe that firm i 's equilibrium output increases with s_i , while it decreases with s_j .¹³ The higher the firm i 's CSR effort s_i is, the higher the firm i 's output will be. This occurs because the owner then obtains higher profits per unit of output produced by firm i . On the other hand, when the rival owner sets a higher output for firm j , firm i 's owner optimally reacts by reducing his firm's output (due to the strategic substitutability of the decision variables). A similar reasoning applies when firm j 's CSR effort becomes higher, in which case its owner has incentives to increase firm j 's output, since he earns higher profits per unit of output produced.

At the second stage, both firms decide whether they will engage in CSR or not, given the level of CSR set by the certifier. By assumption, firms will engage in CSR only if the net profits are equal or higher to the ones obtained under the benchmark regime without CSR activities. That is only if: $\Pi_{net}^{pc} \geq \pi^C$.

At the first stage, the private certifier chooses CSR effort s_i to maximize firm i 's gross profits, which from the focs of (6) is given as $PR_i^{pc}(s_i, s_j) = [q_i^{pc}(s_i, s_j)]^2$. The foc of the latter is equivalent to $\partial q_i^{pc}(\cdot)/\partial s_i = 0$. Due to symmetry, the equilibrium CSR effort is given by:

$$s^{pc} = s_i^{pc} = s_j^{pc} = \frac{\bar{\theta}}{2c} > 0 \quad (12)$$

Plugging s^{pc} into eq.(11), (4) and (6), for $\bar{\theta} = 1/2$, we obtain the equilibrium values for output, price and gross profits, respectively,

$$q^{pc} = \frac{1 + 16c(a - c)}{16c(2 + \gamma)} \quad (13)$$

¹²This is in fact the case in equilibrium - see below.

¹³Provided that $s_i, s_j < \frac{\bar{\theta}}{c}$ - see our discussion above.

$$p^{pc} = \frac{a + (1 + \gamma)c}{2 + \gamma} + \frac{(3 + \gamma)}{16c(2 + \gamma)}$$

$$\Pi_{gross}^{pc} = \left(\frac{1 + 16(a - c)c}{16c(2 + \gamma)} \right)^2 \quad (14)$$

Hence, with respect to (9), the net profits for the private certifier and firm i are given by

$$\Pi_{gross}^{pc} - \pi^C = F = \frac{1 + 32(a - c)c}{128c^2(2 + \gamma)^2}, \text{ and } \Pi_{net}^{pc} = \pi^C = \frac{(a - c)^2}{(2 + \gamma)^2} \quad (15)$$

Clearly, from (12), the CSR effort increases with the social consciousness of the average consumer type $\bar{\theta}$, while it decreases with the degree of inefficiency of the CSR “production technology” (as captured by a higher c). Finally, in equilibrium, both firms’ owners’ endogenous choice is to engage in CSR activities when the private certifier sets a positive CSR effort $s^{pc} = \frac{\bar{\theta}}{2c} > 0$. The intuition behind this is that the private certifier optimally sets a positive level of CSR effort s^{pc} up to the point that the certified firm will maximize its gross profits, and thus the fees that he collects. Since each firm obtains profits equal to its previous status $\Pi_{net}^{pc} = \pi^C$, for s^{pc} then the endogenous choice of both firms is to engage in CSR. Furthermore, if one firm does not engage in CSR then the rival firm obtains a competitive advantage in the market and it ends up with lower profit levels than its previous status. The following Proposition summarizes:

Proposition 1: *In the "certification by a private organization" scenario, assuming that firms' certification by a private organization is a credible system of information provision to consumers about the CSR characteristics of the products they purchase, there exists a level of positive CSR effort, such that both firms' owners' endogenous choice is to engage in CSR activities.*

Let us now consider the societal effects of owners decision to engage in CSR.

Total welfare is defined as:

$$TW = CS_{net}^{pc} + 2\Pi_{net}^{pc} + F \quad (16)$$

with $2\Pi_{net}^{pc} + F$ and CS_{net}^{pc} being the overall market profits and net consumers' surplus respectively.

More specifically, the net consumer surplus of a θ -type consumer is given by the following expression:

$$CS(\theta) = (a + \theta s_i)x_i(\theta) + (a + \theta s_j)x_j(\theta) - [x_i^2(\theta) + x_j^2(\theta) + 2\gamma x_i(\theta)x_j(\theta)]/2 - p_i x_i(\theta) - p_j x_j(\theta) \quad (17)$$

In equilibrium, due to symmetry, we have $s_i^* = s_j^* = s^{pc}$ and $p_i^* = p_j^* = p^{pc}$. Thus, after some manipulations, eq.(17) and (3) become:

$$CS(\theta) = (1 + \gamma)[x^*(\theta)]^2 \quad (18)$$

$$x^*(\theta) = \frac{a + \theta s^{SR} - p^{SR}}{1 + \gamma} \quad (19)$$

From eq.(18), the total net consumers' surplus is given by:

$$CS_{net}^{SR} = (1 + \gamma) \int_0^1 [x^*(\theta)]^2 d\theta \quad (20)$$

Substituting eq.(19) into (20) and solving gives:

$$CS_{net}^{pc} = \frac{3(a - p^{pc})^2 + 3s^{pc}(a - p^{pc}) + s^{pc^2}}{3(1 + \gamma)} \quad (21)$$

Therefore, with respect to eq.(16) and (17) the total welfare is now given by:

$$TW^{pc} = \frac{3(a - p^{pc})^2 + 3s^{pc}(a - p^{pc}) + s^{pc^2}}{3(1 + \gamma)} + 2\left(\frac{a - c}{2 + \gamma}\right)^2 + \frac{1 + 32(a - c)c}{128c^2(2 + \gamma)^2} \quad (22)$$

By comparing the equilibrium values of output, profits, consumers surplus, and total welfare obtained in the "certification by a private organization" scenario to the corresponding values in the benchmark case we find that $q^{pc} > q^C$, $\Pi_{gross}^{pc} > \Pi_{net}^{pc} = \pi^C$, $CS_{net}^{pc} > CS^C$ and $TW^{SR} > TW^C$ always. Hence, the following Proposition holds:¹⁴

¹⁴However, the above results are valid only under the assumption that the certification by a private organization is a credible mechanism of information provision to consumers about the CSR characteristics of the products they purchase. If one loosens this assumption, firms will fail to persuade consumers about their true commitment to social values, thus a "market of lemons" problem arises. In this case, no firm will have incentives to undertake CSR effort in equilibrium, and the equilibrium outcomes will coincide with the ones observed in the benchmark case without CSR activities.

Proposition 2: *In the "certification by a private organization" scenario, equilibrium output, gross profits, consumers' surplus and total welfare are always higher comparing with the ones obtained in the benchmark case without CSR activities.*

For proof see Appendix

It is easy to understand the reason behind output levels by considering the arguments about both firms' reaction functions after eq.(10). Since $s^{pc} < \bar{\theta}/c$, then output will be higher in the "certification by a private organization" scenario. Let us now consider firms' profits. We obtain $\Pi_{net}^{pc} = \pi^C$, since the private certifier extracts all extra profits by assumption. Also the total profitability in this market represented by Π_{gross}^{pc} is equal or higher than the benchmark. Regarding consumers' surplus it is increasing in CSR effort. Hence, since $s^{pc} \geq 0$ then consumers surplus in the "certification by a private organization" scenario is equal or higher comparing with the benchmark one. Regarding total welfare, according to proposition 1 it has already been clear that in equilibrium, each firm's owner will engage in CSR. This interaction among competing firms has a positive effect on total welfare, since it increases output, gross profits and consumers' surplus as well. On the other hand, engaging in CSR increases variable cost of production, which decreases total welfare. It is found that the positive effect of increased profits and consumers' surplus on total welfare dominates over the negative effect of increased costs and thus, $TW^{SR} > TW^C$ always.¹⁵

3.3 Certification by the regulator.

In this subsection, assuming there is no other appropriate system of information disclosure endowing consumers with the necessary information about the CSR characteristics of the products they purchase, we consider that the regulator proposes a certain standard of CSR effort to the firms, denoted by s^R , and provides a certification to the firms that comply with the standard.¹⁶ We assume that now this kind of certification is credible to consumers. Similar

¹⁵ Anecdotal evidence regarding the CSR practices of some corporations reveal that in some cases engaging in CSR, besides variable costs, may also affect the fixed costs of the firm. Such examples could be the installation of a filter in a polluting facility in order to abate externalities caused by its operation, or the deployment of a production process that decreases labor accidents so as to ensure working safety for employees. Our results are sensitive to the assumption of CSR affecting the fixed costs of the firm. More specifically, if fixed costs are not significantly high, then nothing will change regarding the results. In the opposite case, the results will be sensitive to the extent that fixed costs may effect the profitability of the firms that engage in CSR. Thus, the case where no owner engages in CSR may appear in equilibrium.

¹⁶ Note that a similar modeling can also be considered for the case in which a non for profit organization, such as a NGO, provides the certification, instead of the regulator with respect to social welfare. In this case, like in

to the previous subsection, the owner of each firm can set the CSR effort proposed by the regulator or not engage in CSR activities at all. The regulator has to monitor and certify CSR effort made by firms, assuming that the probability of tracing an owner that reveals untruthful information is almost unity. The fixed cost of monitoring is denoted by M and it is paid by each firm that wishes to be certified.¹⁷ Thus, the objective function of each firm's owner is now given by the following expression:

$$\Pi_i^R = (a + \bar{\theta}s_i - q_i - \gamma q_j)q_i - c(1 + s_i^2)q_i - M \quad (23)$$

where $M = 0$ in the case in which a firm does not engage in CSR, hence, certification is inapplicable.

We consider a three stage game. At the first stage, the regulator fixes a standard of CSR effort s^R , with respect to total welfare. At the second stage, given s^R , both firms' owners decide on whether or not to engage in CSR activities, while at the last stage owners compete in the market a la Cournot. We solve the game using backwards induction.

Hence, at the last stage of the game, owner i sets q_i to maximize his firm's profits, now given by eq.(23), taking as given the output q_j of his rival, along with the CSR effort s^R chosen by the regulator at the first stage.

Solving the system of focs and rearranging, we obtain the equilibrium output of the third stage:

$$q_i(s^R) = \frac{a - c}{2 + \gamma} + \frac{s^R(\bar{\theta} - cs^R)}{2 + \gamma} \quad (24)$$

Plugging eq.(24) into (4) and (23) one obtains firms i 's price and profits during stage 2, respectively:

$$p_i(s^R) = \frac{a + c(1 + \gamma)}{2 + \gamma} + \frac{s^R[\bar{\theta} + cs^R(1 + \gamma)]}{2 + \gamma} \quad (25)$$

$$\Pi_i(s^R) = \left(\frac{a - c}{2 + \gamma}\right)^2 + \frac{s^R(\bar{\theta} - cs^R)}{(2 + \gamma)^2} [2(a - c) + s^R(\bar{\theta} - cs^R)] - M \quad (26)$$

the "certification by the regulator" scenario, the fee will be equal to the monitoring and informative advertizing expenses.

¹⁷M can only be spent by the regulator in order to cover monitoring costs and informative advertizing expenses that will acknowledge the certification to consumers.

At the second stage, both firms decide on whether to engage in CSR activities or not. Firms will undertake CSR effort only if their profitability is higher, comparing to the benchmark case without CSR activities. Hence, by considering eq.(26), firms will engage in CSR only if: $\frac{s^R(\bar{\theta}-cs^R)}{(2+\gamma)^2}[2(a-c) + s^R(\bar{\theta} - cs^R)] > M$, or $s_{pc}^R \leq \frac{\bar{\theta} + \sqrt{4c(a-c) + \bar{\theta}^2 - 4c\sqrt{(a-c)^2 + M(2+\gamma)^2}}}{2c}$, $M \leq \frac{\bar{\theta}^2[8c(a-c) + \bar{\theta}^2]}{16c^2(2+\gamma)^2}$, where s_{pc}^R represents the CSR effort participation constraint of each firm. Note that $s_{pc}^R \leq \bar{\theta}/c$ for every $\bar{\theta}$, $0 \leq M \leq \frac{\bar{\theta}^2[8c(a-c) + \bar{\theta}^2]}{16c^2(2+\gamma)^2}$. Thus, from the analysis of eq.(10), if the above condition holds, the increase in firms' profits due to higher demand and revenues from producing CSR related products overcomes the increase in firms' costs due to a higher CSR effort and monitoring expenditures (comparing with the benchmark case without CSR activities) and therefore, both firms will have incentives to engage in CSR activities. Otherwise owners will have no incentives to comply with the CSR standard.¹⁸

At the first stage, the regulator sets CSR effort so as to maximize total welfare now given by:

$$TW^R = CS_{net}^R(s^R) + 2\Pi_i(s^R) + 2M \quad (27)$$

where, with respect to eq.(21), $CS_{net}^R = \frac{3(a-p^R)^2 + 3s^R(a-p^R) + s^{R^2}}{3(1+\gamma)}$ represents the net consumers surplus in the "certification the regulator" scenario. By solving the foc and rearranging, we obtain the socially optimal minimum CSR effort s^{R*} .¹⁹ Note that if $s^{R*} \leq s_{pc}^R$, then the regulator will set s^{R*} and both firms will comply with the standard. However, if $s^{R*} > s_{pc}^R$, then s^{R*} does not give incentives to firms to get involved in CSR, hence the standard is useless. Since the regulator's objective is that both firms engage in CSR, that will improve welfare he sets s^R such that:

$$s^R = \min[s^{R*}, s_{pc}^R] \quad (28)$$

By comparing the CSR effort level set in the "certification by the regulator" scenario (s^R) with the one set in the "certification by a private organization" scenario (s^{pc}) we find that $s^R > s^{pc}$, hence the following Proposition holds:

Proposition 3: *In the "certification by the regulator" scenario, the CSR effort level standard*

¹⁸In this case, the prevailing equilibrium coincides with the Benchmark case without CSR.

¹⁹Due to space limits, some algebraic formulas are not presented. These are available from the authors upon request.

$s^R = \min[s^{R^*}, s_{pc}^R]$ chosen by the regulator, is always higher comparing with the one chosen by the profit maximizing certifier.

For proof see Appendix

The intuition behind this result is that, in the "certification by a private organization" scenario the private certifier's objective is to maximize each firm's gross profits, so as to maximize the fees to be collected. However, in the "certification by the regulator scenario", the regulator, besides firms' profits, also includes net consumers surplus in his objective function in order to maximize total welfare. As a result CSR effort standard level set by the regulator is always higher than the one set by the private certifier.

3.3.1 Comparative Analysis

We cannot obtain an analytical solution regarding which level of CSR effort that the regulator will finally set (s^{R^*} or s_{pc}^R). In order to present some qualitative comparative results we restrict our attention to the case in which the relative market size ($a - c$) is sufficiently high, and the marginal that is not connected to CSR (c) is not too low in order to avoid corner solutions and ensure the concavity in the total welfare function.

Remark 1 stands for the comparison of the market outcomes for the three alternative scenarios:

Remark 1: *In the "certification by the regulator scenario", equilibrium output is always lower (higher) comparing with the ones obtained under the certification by a private organization regime (the benchmark case without CSR activities). Net profits are equal or higher and consumers' surplus and total welfare are always higher than in any alternative scenario.*

For proof see Appendix

The rationale behind output levels is being analyzed in the Appendix. Regarding firms' profits. In the "certification by the regulator scenario", with respect to the firms participation constraint to CSR activities, firms net profits will be equal or higher to the ones obtained in the alternative scenarios. The reason behind this that since $s^R = \min[s^{R^*}, s_{pc}^R]$ then if $s^{R^*} \leq s_{pc}^R$ then the inequality holds, while if $s^{R^*} \geq s_{pc}^R$ then profits in all scenarios are equal. However, the results regarding the gross profits since $s^R \geq s^{pc}$, the total profits obtained in the "certification

by the regulator" scenario will be lower than the gross profits in the "certification by a private organization" scenario, due to higher CSR expenses and less output. This is due to the fact that in this case firms put more CSR effort, than they would optimally choose. Now, let us focus on consumers' surplus. This is increasing in CSR effort. Hence, with respect to proposition 3, since $s^R \geq s^{pc}$, then consumers surplus in the certification by the regulator scenario is equal or higher comparing with the alternative ones. Finally, let us consider total welfare. There are two opposite effects on total welfare. First, the increase in the consumers surplus due to higher CSR effort in the "certification by the regulator" increases welfare. Second, as analyzed above, the total profits obtained in the "certification by the regulator" scenario will be lower than the gross profits in the "certification by a private organization" scenario. Results in equilibrium reveal that the positive increase on consumers' surplus dominates over any negative effect, hence total welfare is higher under the "certification by the regulator scenario", comparing with any alternative configuration.

4 Conclusions

The present paper examines the conditions under which the regulator can complement the provision of CSR by private firms. We consider two alternative scenarios: The first, refers to the case in which a private, profit-maximizing organization provides firms with a credible certificate about their SR activities. The second, considers the case in which the regulator intervenes, by providing the certification himself with respect to total welfare.

Our main finding is that if there is no credible information disclosure about SR characteristics of the firms' products to consumers, no firm will have incentives to undertake CSR effort in equilibrium. However, if the necessary information about the CSR aspects of each firm's product, otherwise unobservable, is revealed to consumers through certification, then the opposite holds. More specifically, in equilibrium, both firms' endogenous choice is to engage in CSR activities, hence consumers' surplus and total welfare increase comparing to the benchmark case without CSR activities. We find that the regulator will set higher standards of CSR effort with respect to firms' participation constraint to CSR comparing to the profit-maximizing certifier. This leads to higher consumers surplus and total welfare comparing to all alternative configurations.

An interesting extension of the present model could be the examination of how an additional

policy instrument, like persuasive advertising, can be used by the regulator in order complement the provision of CSR by private firms. More specifically, following Petrakis et al.(2005), the assumption that information provision is conducted via persuasive advertising, which will increase the fraction of socially conscious consumers in the market can be formalized in the present model as an increase in $\bar{\theta}$.²⁰ From eq.(6) and (23) it is easy to check that an increase in $\bar{\theta}$ enhances the increase in demand for the final good of the firms that engage in CSR. Hence, firms' benefit from CSR increases. This could lead to the increase of CSR effort undertaken by firms, which would amplify consumers' surplus and total welfare, as well. In the present model, for this benefit to be effective, information provision should be combined with certification, or else a "market of lemons problem" will be in effect. However, investing in persuasive advertising imposes an additional cost which decreases total welfare. Thus, the final outcome from information provision via persuasive advertising depends on the relative weight of each effect on total welfare.

The analysis was carried out for a duopolistic market structure. We believe that the duopolistic market provides all essential insights about the firms' owners' incentives to undertake CSR activities. We are also aware of the limitations of our analysis in assuming specific functional forms. However, it is the nature of the equilibrium conditions that drive our results that allows us to argue that these results will also hold under general demand and cost functions. The use of more general forms would jeopardize the clarity of our findings, without significantly changing their qualitative character. Given the current debate about the market and welfare implications of Corporate Social Responsibility the present paper sheds light on the policy instruments that a regulator may impose, in order to enhance firms' incentives to engage in CSR activities in oligopolistic markets.

Appendix

Proof of Proposition 2

By comparing output, consumers' surplus and total welfare under the Private Certification scenario (q^{pc} , CS_{net}^{pc} , and TW^{pc}) to the one obtained in the Benchmark case (q^C , CS^C and TW^C) we observe that:

²⁰For instance, Garcia-Gallego and Georgantzis (2008) examine how changes in $\bar{\theta}$ may influence the competition status in a market.

$$\begin{aligned}
q^{pc} - q^C &= \frac{1}{16c(2+\gamma)} > 0, \\
CS_{net}^{pc} - CS^C &= \frac{96c(a-c)(1+\gamma)^2 + \gamma(22+7\gamma) + 19}{768c^2(1+\gamma)(2+\gamma)^2} > 0, \\
TW^{pc} - TW^C &= \frac{96c(a-c)(1+\gamma)(3+\gamma) + 7\gamma(2+\gamma) + 25}{768c^2(1+\gamma)(2+\gamma)^2} > 0.
\end{aligned}$$

Proof of Proposition 3

If the participation constraint CSR effort is set by the regulator, then

$$s_{pc}^R - s^{pc} = \sqrt{\frac{1}{4} + 4c(a-c) - 4c\sqrt{(a-c)^2 + M(2+\gamma)^2}} > 0, \quad 0 \leq M \leq \frac{[8c(a-c) + \frac{1}{4}]}{32c^2(2+\gamma)^2}.$$

If the optimal CSR effort is set by the regulator, then $\frac{\partial TW^R}{\partial s} |_{s=s^{R*}} = 0$ and $\frac{\partial TW^R}{\partial s} |_{s=s^{pc}} = \frac{1}{24c(1+\gamma)} > 0$. Hence, $s^R = \min[s^{R*}, s_{pc}^R] > s^{pc}$, always.

Proof of Remark 1

From proposition 3, $s^R = \min[s^{R*}, s_{pc}^R] > s^{pc}$, always. Furthermore, from the analysis of eq.(10), we observe that CSR effort has two opposing effects on owner i 's output decision. On the one hand, positive CSR effort augments the demand for the firms' good and thus tends to increase equilibrium output, through an outward shift of both firms' reaction function. On the other hand, it increases firms' unit costs, tending to decrease equilibrium output via an inwards shift of both firms' reaction functions. For $0 < s < \bar{\theta}/c$ the first effect is dominant and the CSR effort undertaken by firms shifts their reaction function outwards. This outwards shift increases for $0 < s < \frac{\bar{\theta}}{2c}$, attains a maximum for $s^{pc} = \frac{\bar{\theta}}{2c}$ and decreases for $\frac{\bar{\theta}}{2c} < s < \bar{\theta}/c$. It is easy to check that $s_{pc}^R < \bar{\theta}/c$, always. At $s = \bar{\theta}/c$ the two opposing effects neutralize each other, hence, there is no shift on the firms reaction function. Thus, since $\bar{\theta}/c > s_{pc}^R \geq s^{pc} = \frac{\bar{\theta}}{2c} > 0$, then $q^C < q^R < q^{pc}$, holds.

Note also that from eq.(21) $\frac{\partial CS}{\partial s} = \frac{3(a-p^R) + 2s^R}{3(1+\gamma)} \geq 0$ for $\bar{\theta}/c \geq s_{pc}^R$. Since $\bar{\theta}/c \geq s_{pc}^R \geq s^{pc}$, then $CS_{net}^{pc} \leq CS^R$.

Regarding total welfare we have, from the proof of Proposition 3: $\frac{\partial TW}{\partial s} |_{s=s^{pc}} = \frac{1}{24c(1+\gamma)} > 0$. Hence, since $s^R = \min[s^{R*}, s_{pc}^R] > s^{pc}$, total welfare is lower under the private certification scenario.

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