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Certification of Corporate Social Responsibility Activities in Oligopolistic Markets*

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Abstract

We investigate the impact of alternative certifying institutions on firms' incentives to engage in costly Corporate Social Responsibility (CSR) activities as well as their relative market and societal implications. We find that the CSR certification standard is the lowest under a for-profit private certifier and the highest under a Non Governmental Organization (NGO), with the standard of a welfare maximizing public certifier lying in between. Yet, regarding industry output, this ranking is reversed. Certification of CSR activities is welfare enhancing for consumers and firms and thus should be encouraged. Finally, depending on whether certification takes place before or after firms' CSR activities, a public certifier and a NGO lead to different market and societal outcomes.

Keywords Corporate Social Responsibility, Oligopoly, Vertical Differentiation, Certification

JEL Classification L13, L5, M14

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1 Introduction

Corporate Social Responsibility (CSR hereafter), "*a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on voluntary basis*" (European Commission, 2001), has recently received large publicity and has led many companies to account for the social consequences of their activities.[1] In this context, consumers respond positively to the firms' efforts to become, or at least to appear as, socially responsible, and firms benefit from these efforts.[2]

Porter and Kramer (2002; 2006) distinguish two types of CSR activities: (i) philanthropy oriented donations, and (ii) investments in production technologies and business processes, along the value chain.[3] This paper focuses on CSR activities of the second type. CSR activities of this type are difficult - if not impossible - to be inferred by consumers, through search or consumption. In this context, we argue that the socially responsible (SR henceforth) attributes attached to products, through the firms' CSR activities, are classified as a *credence good*.[4] Hence, there is need for an information disclosure mechanism to credibly signal the firms' CSR efforts to consumers. Certification by a third party, verifying "the fulfillments of a firm to certain criteria or standards" (Bottega and De Freitas, 2009), serves as such a mechanism.[5]

The present paper investigates the effects of alternative certifying institutions on firms' incentives to engage in costly CSR activities as well as their relative market and societal

[1] More than half of the top 100 corporations based in the 16 more industrialized countries published a CSR report in the year 2005 (Becchetti et al., 2006). Tsoutsoura (2004) reports that "more than half of the Fortune 1000 companies issue CSR reports."

[2] There is widespread evidence that consumers express a willingness to pay a premium for goods produced by socially responsible firms (Cason and Gangadharan, 2001; Elfenbein and McManus, 2007; Hiscox and Smyth, 2006; Wasik, 1996). Regarding firms, there is evidence that spending on CSR activities has positive effects on their market performance (Baron et al., 2008; Harjoto and Jo, 2007a, 2007b; Vogel, 2005; Waddock and Graves, 1997; Posnikoff, 1997).

[3] This is the case where a firm's voluntary CSR activities are in line with the interests of its stakeholders such as its employees (investing in health and safety in the workplace), 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 or using environmentally friendly input). See for example Mayer (1999) and Bris and Brisley (2006).

[4] Examples of such attributes contain the conditions under which a product is produced, including externalities associated with production (e.g. pollution) as well as hidden hazards associated with consumption of the product. See for instance, Calveras and Ganuza (2010a, 2010b).

[5] As Auriol and Schillizzi (2003) mention, "certification may be defined as a process whereby an unobservable quality level of some product is made known to the consumer through some guarantee system, usually issued by a third independent party. In other words, certification is a process for transforming a credence attribute into a search attribute".

implications. In particular, it addresses the following four questions.

First, what is the relative effectiveness of alternative CSR certifying institutions on enhancing firms' CSR effort levels? This question has been motivated by the fact that there are private (non-profit and for-profit) as well as public institutions certifying firms' CSR activities.[6]

Second, do firms certified for their CSR activities perform better than those not certified? What are the relative market outcomes of the alternative certifying institutions? The empirical literature examining the effects of certifying firms' CSR activities on their market performance is scant and does not offer clear evidence.[7]

Third, what are the relative societal effects of the alternative certifying institutions? Interestingly, when CSR started becoming widespread, its further encouragement became a central policy objective in both the U.S. and the E.U., aiming at promoting sustainable growth and competitiveness (European Commission, 2001; 2006). Although their main objective is the same, Doh and Guay (2006) argue that "different institutional structures and political legacies in the US and EU are important factors in explaining how governments, NGOs, and the broader policy determine and implement preferences regarding CSR in these two important world regions".

Fourth, does the timing at which the CSR certification standard is set influence the firms' incentives to invest in CSR activities? One reason that this question may deserve attention is that, although CSR has been reported as a major operational activity of firms over the past 40 years (Friedman, 1970; Moskowitz, 1972; Parket and Eibert, 1975), it was only in 1998 when the first CSR certification standard appeared.[8]

To address the above questions, we consider a duopoly where firms plan to follow a "doing

[6] The Global Ecolabeling Network (GEN) is an example of an international non-profit association of third-party environmental performance labeling organizations. Ecocert and Scientific Certification Systems are examples of for-profit private certifiers. The former certifies producers whose products fulfill some environmental criteria, and the latter certifies environmental issues in manufacturing (Bottega and De Freitas, 2009). EU's *Eco-Label* is an example of public certifying institution (Baksi and Bose, 2007).

[7] Hiscox et al. (2008) present some evidence about positive correlation of ISO 8000 certified firms and their market performance. However, according to the authors this evidence is case study-specific and is not safe for drawing general conclusions.

[8] This standard is SA8000 which is based on the United Nations Universal Declaration of Human Rights, Convention on the Rights of the Child and various International Labour Organization conventions. SA8000 involves the development and auditing of management systems that promote socially acceptable working practices bringing benefits to the complete supply chain. Moreover, there are a few economic policy findings reported in the literature that crucially depend on the timing at which the policy tool is decided by the regulator. See for instance, Petrakis and Xepapadeas (1999, 2003) and Kennedy and Laplante (1999).

well by doing good" strategy through their engagement in CSR activities.[9] Following Besley and Ghatak (2005; 2007), this strategy can be represented in the firm's *mission* picked by its owners. In the spirit of Porter and Kramer (2002; 2006), we consider that CSR activities take the form of voluntary investments in production technologies and business processes along the value chain, above the requirements of the law, that are in favor of firms' stakeholders e.g. their employees and the environment (Porter and Kramer, 2002; 2006).[10] Firms' products combine horizontal and vertical differentiation aspects (Häckner, 2000; Garella and Petrakis, 2008). The vertical differentiation aspect is related to the firms' CSR activities that socially conscious consumers perceive as a "quality improvement" of the products. Consumers are heterogeneous with respect to their social consciousness and have differential valuations for the SR aspects of the firms' products.

The credence aspect of the firms' CSR activities generates a moral hazard problem. Once consumers have been convinced that a firm has undertaken the missioned CSR efforts, the firm has incentives to cheat them and avoid any spending on costly CSR activities.[11,12] In order to avoid the collapse of the SR related goods' market, there is need for an information disclosure mechanism to credibly signal the firms' CSR efforts to consumers. The certification process can be undertaken by alternative institutions that differ with respect to their objective. In this paper, we consider the following three certifying institutions: First, the certifier is a private company that sets the CSR certification standard and charges the respective fee, so as

[9] According to Benabou and Tirole (2010), "being a good corporate citizen can also make a firm more profitable".

[10] Firms care about their involvement in socially responsible actions (i.e., a "warm glow"), instead of donating to "intermediaries" (Benabou and Tirole, 2010). In fact, according to Besley and Ghatak (2005), "donating our income earned in the market to an organization that pursues a mission that we care about is likely to be an imperfect substitute for joining and working in it". Moreover, existing evidence suggests that socially responsible consumers show strong preference for CSR related products, instead of buying products not connected to CSR that cost less and donating the rest of the money to a socially responsible cause (Forsyth et al., 1999; Amacher et al., 2004; Bjorner et al., 2004). This is so because "there is no substitute for asking the firm to behave well when the state does not impose constraining regulations" (Benabou and Tirole, 2010).

[11] According to Besley and Ghatak (2007), "profit maximizing firms have an incentive to offer to do so and then renege on this promise".

[12] It is evident that firms consistently try to convince the socially conscious consumers about their CSR activities, via advertising them and publishing CSR reports (Becchetti et al., 2006; Tsoutsoura, 2004). However, these communication efforts are not always trustworthy. A widely cited example is for Nike, the athletic products company (Klein, 1999). The company used fake evidence about the working conditions of child employees in its factories in Southeastern Asia, in order to construct a SR image in his published CSR reports. Such cases create considerable doubts to consumers about the firms' devotion to CSR values (Porter and Kramer, 2002).

to maximize its profits. Second, the CSR standard is set by a public certifier that maximizes total welfare. Finally, the CSR certification is provided by a non-profit Non-Governmental Organization (NGO) whose objective is to maximize consumers' surplus.[13] This is justified on the grounds that NGOs behave in a way trying to meet consumers' "demand for corporations to behave prosocially on their behalf" (Benabou and Tirole, 2010) because of their "impure altruism" (Andreoni, 1990). We assume that the CSR certification standard is voluntarily purchased by firms in all cases and no certifier can exclude from the market any firm not complying with it.[14] For the public certifier and the NGO, we consider that the cost of monitoring is fixed and is paid by each firm that wishes to be certified.

Our main result is that under all three CSR certifying institutions, firms, seeking for competitive advantage, undertake CSR efforts complying with the respective standards, in order to become certified and credibly disclose information to consumers regarding their products' SR attributes. Nevertheless, firms' CSR effort levels depend crucially on the certifying institution. In particular, the equilibrium level of CSR efforts under the private certifier is always the lowest. Intuitively, the private certifier sets the standard at a level maximizing each firms' extra profits from CSR activities, in order to capture, via the certification fee, these extra profits and thus maximize its own profits. Clearly, there is no concern about consumers' surplus in the private certifier's objective function. In contrast, the NGO and the public certifier set the standard at a level maximizing consumers' surplus and total welfare, respectively. Hence, they both take into account the socially conscious consumers' willingness to pay for the firms' CSR activities and thus set certification standards higher than the one that maximizes firms' profits alone. Moreover, if the monitoring cost is low enough, the equilibrium level of CSR efforts are higher under the NGO rather than under the public certifier. For a high enough monitoring cost, CSR efforts under the NGO and the public certifier are equal. This occurs because both certifiers set the standard such that the firms are indifferent between purchasing or not the certification standard.

[13] Alternatively, one can assume that the NGO maximizes a social welfare function weighting consumers' surplus relatively more than the public certifier does. Heyes and Maxwell (2004) consider the case where the public certifier and the NGO maximize a differentially weighted social welfare function, with respect to environmental quality.

[14] This is in contrast to Bottega and De Freitas (2009), where the regulator sets a compulsory standard and has the ability to exclude from the market the products that do not fulfill these standards.

As regards the second question, we find that under all certifying institutions, output, price and gross profits of a certified firm are higher than the respective ones of a non-certified firm. Intuitively, a certified firm's CSR activities shift its output reaction function outwards and also increase its product's price, since consumers are willing to pay more due to its product's SR attributes. Yet, a higher CSR effort increases the firm's unit cost. It is the first effect that dominates and thus, equilibrium output, gross profits and price of the certified firm are higher. Further, the firms' output levels and gross profits are the highest under the private certifier and the lowest under the NGO, with those under the public certifier lying in between. This is due to the fact that the higher the CSR effort is, the smaller is the outward shift of the firm's output reaction function. The reverse ranking holds for the equilibrium prices, mainly because prices reflect the increased consumers' willingness to pay for higher level of products' SR attributes. Finally, if the monitoring cost is sufficiently high, output level, price and gross profits under the public certifier are equal to those under the NGO.

Regarding the third question, we find that under all certifying institutions, consumers' surplus and total welfare are higher when firms are certified for their CSR activities rather than in the no-certification case. Hence certification of CSR activities is welfare enhancing and should be encouraged. Clearly, under the NGO consumers' surplus is higher than under the public certifier and the latter is higher than under the private certifier. Total welfare is higher under the public certifier than under the other two certifying institutions. If the monitoring cost is low enough, total welfare is higher under the private certifier than under the NGO. The latter occurs because industry profits are maximized under the private certifier and are significantly higher than those of under the NGO who has no concern about profits. The negative effect of the NGO on profits does not compensate for its positive effect on consumers' surplus and thus total welfare is higher under the private certifier. When instead the monitoring cost is high enough, the NGO is forced to set the standard that satisfies the firms' participation constraint and thus, the profit effect is dominated by the consumers' surplus effect. The above findings clearly point out the alignment of market and social incentives for the certification of firms' CSR activities. Hence, policy measures that are intended to encourage firms' CSR activities and their certification should be designed.

Finally, as regards the fourth question, we find that when the CSR certification standard is

set after firms have undertaken their CSR activities (ex-post scenario), then the standard under all three certifying institutions is equal to the standard set by the private certifier in our basic ex-ante scenario. Under the private certifier, this happens because its objective coincides with the maximization of firms' extra profits stemming from their CSR activities, independently of whether the standard is set before or after the firms' CSR efforts. Further, the public certifier and the NGO set the standard in the second stage equal to the firms' profit maximizing CSR efforts undertaken in the first stage. Setting a standard higher than that would lead to lower total welfare and consumers' surplus, because no firm could become certified in this case and thus credibly signal its product's SR attributes to consumers.

Our paper contributes to the literature on the use of certification in credence goods markets. Bottega and De Freitas (2009), in a vertical differentiation setup, consider a monopoly that certifies the environmental quality of its product through an eco-label. The eco-label is provided either by a welfare maximizing regulator which sets a mandatory minimum quality standard, or by a private certifier (either a NGO maximizing average environmental quality or a for-profit firm) which sets a voluntary scheme.[15] Similarly to us, they find that the NGO sets the highest quality standard. Allowing for interactions between the certifiers, they find that the regulator may set a higher standard in the presence of a NGO, as compared to the standard in the presence of a private certifier. In a monopolistic context too, Alexander and Harding (2003) find that a social planner will set a standard higher than that set by a profit-maximizing certifier. Whether the standard in the latter case is lower or higher than that chosen by a non-for-profit certifier depends on the relative values of the highest consumer valuation for ethical behavior and the costs of production. We depart from these papers in four dimensions. First, we assume a duopolistic market so as to capture the strategic effects of firms' interactions under the alternative certifying institutions. Second, besides firms' CSR activities, which are captured by the vertical differentiation aspect, we also consider that firms' products are

[15] There is a line of research regarding the relative effectiveness of mandatory certification schemes. Heyes and Maxwell (2004) compare environmental damage, producer surplus and welfare under a World Environmental Organization-run mandatory and an NGO-run voluntary label scheme. Baksi and Bose (2007) consider that when brown firms cheat and pretend to be green, the government either makes the third party labelling mandatory for the brown or for the green firms, or requires the brown and/or green firms to self-label their product. The optimal labelling policy depends on the relative magnitude of the costs of production, labelling, and monitoring.

horizontally differentiated, so as to account for the intensity of market competition between firms. Third, firms are voluntarily certified and the public certifier cannot exclude from the market any firm not complying with the standard. Fourth, we also study the case where CSR certification standard is set after firms have undertaken their CSR activities.

In a Bertrand duopoly with asymmetric firms, with respect to their marginal costs of quality provision, Bottega et al. (2009) study the impact of different objectives of a certifier on the firms' label adoption choices. They find that firms always opt for differentiation strategies which induces an asymmetric equilibrium where only one firm (not necessarily the most efficient) adopts the label. Bonroy and Constantatos (2008) assume that consumers have different beliefs and form subjective probabilities regarding which firm produces the high quality. They find that the high quality producer may be at disadvantage because of its higher cost and the informational asymmetry. They further argue that the high quality credence goods can obtain the efficient market share via mandatory labelling. In the present paper, only symmetric equilibria emerge. This happens because when one firm certifies a certain level of socially responsible attributes attached to its products, the rival firm's best response is to follow suit.

Our paper also contributes to the literature on "strategic CSR", in the terminology of Baron (2001) and in the spirit of a "doing well by doing good" strategy (Benabou and Tirole, 2010). The present paper stresses how firms, seeking for competitive advantage, engage strategically in CSR activities that comply with the standard set by alternative certifying institutions.

The rest of the paper is organized as follows. Section 2 presents the model and the analysis of the benchmark case with no certification. In Section 3, the case of the for-profit private certifier is analyzed. In Section 4, we examine the case of the welfare maximizing public certifier. In Section 5, the case of the consumers' surplus maximizing Non Governmental Organization is presented. Section 6 compares the market and societal outcomes of the three alternative certifying institutions. In Section 7, we consider a number of extensions of our basic model. Finally, Section 8 concludes.

2 The Model

We consider a market that consists of two firms, denoted by $i, j = 1, 2, i \neq j$, with each firm producing one brand of a differentiated good. The objective of each firm is profit maximization. To attain this objective, a firm has the option to follow a "doing well by doing good" strategy, via its engagement in CSR activities. We consider that the latter take the form of voluntary investments in production technologies and business processes along the value chain, beyond the requirements of the law, that are in favor of firms' stakeholders, e.g. their employees and the environment (Porter and Kramer, 2002, 2006).

On the demand side there is a *unit mass* of consumers who have identical preferences regarding the physical characteristics of the two goods. Yet, they are heterogeneous regarding their valuation of the CSR activities undertaken by the firms. In particular, following Häckner (2000), the utility function of the θ-type consumer is given by:

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

where $x_i(\theta)$, $i = 1, 2$, represents the quantity of firm i's good bought by the θ-type consumer and $m(\theta)$ is the respective quantity of the "composite good". The parameter $\gamma \in (0, 1]$ is the degree of product substitutability, with $\gamma \to 0$ corresponding to the case of almost independent goods and $\gamma = 1$ to the case of homogeneous goods. Thus γ can also be interpreted as a measure of the intensity of competition between firms, with a higher γ corresponding to fiercer competition.

In this context, we argue that the SR attributes attached to products, via the firms' CSR activities, are *unobservable* by consumers, even after consumption. Thus, a product's SR attributes are classified as a *credence good,* with $s_i \geq 0$ representing the CSR effort undertaken by firm i, 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 its CSR effort. The more socially conscious a consumer is, the higher is his θ. A consumer who does not value the CSR activities at all is then of type $\theta = 0$. We assume that θ is uniformly distributed in $[0, 1]$, i.e., its density function is $f(\theta) = 1$ for all $\theta \in [0, 1]$.

Then $\bar{\theta} = 1/2$ represents the average type of consumer in the population.

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

$$p_i = a + \theta s_i - x_i(\theta) - \gamma x_j(\theta), \quad i, j = 1, 2, i \neq j \tag{2}$$

By inverting (2) we obtain the θ-type consumer's demand functions:

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

where p_i and p_j are the firms' prices, while the price of the composite good has been normalized to unity.

By integrating (3) with respect to θ and setting $\bar{\theta} = 1/2$, we get firm i's demand function:

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

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

$$p_i(q_i, q_j) = a + \frac{1}{2} s_i - q_i - \gamma q_j, \; i = 1, 2, i \neq j \tag{5}$$

Observe that firm i's inverse demand is positively related to the average consumer's type $\bar{\theta} = 1/2$ and the firm i's CSR effort level s_i. This reflects the main idea of our model, that is, socially conscious consumers' valuation for a product increases with the firm's CSR effort level. This, in turn, increases the demand for this firm's product.

We assume that firms are endowed with identical constant returns to scale production technologies. Firm i's total cost function is given by $C_i(q_i, s_i) = c(1 + s_i^2)q_i$ with $0 < c < a$. This implies that, for a given CSR effort level s_i, the firm i's marginal (and unitary) cost is constant and equal to $c(1 + s_i^2)$. Yet, a higher CSR effort level increases, at an increasing rate, firm i's unit costs. This is 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.

In the sequel we will make the following assumption that guarantees interior solutions in all cases.

Assumption 1 $c(a-c) \geq \frac{1}{3}$

Assumption 1 requires that the marginal production cost c whenever firm i undertakes zero CSR effort is neither too low nor too high. Under this assumption, even the $\theta = 0$ consumer-type makes positive purchases of both goods under all circumstances.[16]

Firm i's profits can then be expressed as:

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

Therefore, firm i's CSR activities s_i lead to higher consumers' willingness to pay for its product and thus to higher demand. At the same time, CSR activities increase firm i's unit and total production costs.

The credence aspect of the firms' CSR activities generates a moral hazard problem. In particular, once consumers are convinced that firm i has undertaken a CSR effort s_i, their willingness to pay for firm i's good increases. Yet, in the absence of any credible information disclosure mechanism, firm i has incentives to cheat consumers and avoid any spending on costly CSR activities. In such a situation, consumers anticipate firm i's incentives to cheat them and rationally believe that there will be zero CSR activities ($s_i = 0$). The firm, in turn, spends zero on CSR in equilibrium. Hence, it is precisely this imperfect information that will cause the breakdown of the SR related goods' market.

In order to avoid the collapse of the SR related goods' market, there is need for an information disclosure mechanism to credibly signal the firms' CSR efforts to consumers. In this context, certification by a third party, verifying "the fulfillments of a firm to certain criteria or standards" (Bottega and De Freitas, 2009), serves as a credible information disclosure mechanism of firms' CSR activities that are unobservable by consumers.

[16] Relaxing Assumption 1 would create unnecessary analytical complications without qualitatively altering our main results.

The certification process can be undertaken by alternative institutions that differ with respect to their objective. We consider the following three certifying institutions. First, the certifier is a private company that sets a CSR certification standard and also charges a fee, so as to maximize its profits. Second, the CSR standard is set by a public certifier that maximizes total welfare. Third, the certifier is a non-for-profit Non Governmental Organization (NGO) setting a CSR certification standard, so as to maximize consumers' surplus. We assume that the CSR certification standard is voluntarily purchased by firms in all cases and no certifier can exclude from the market any firm not complying with it. For the public certifier and the NGO, we consider that the cost of monitoring is fixed and is paid by each firm that wishes to be certified.

Following Bottega and De Freitas (2009), we make two additional assumptions: First, the certification technology is the same for all the certifying institutions. Second, monitoring is perfect, i.e., the certifier can trace a firm revealing untruthful information to consumers with probability one. Hence, consumers that observe the CSR certification of a product are aware that the certified firm is socially responsible and complies with the standard.

2.1 The Sequence of Moves

We consider a three-stage game. In the first stage, the certifier sets the CSR certification standard. In the second stage, firms simultaneously and independently, either undertake the CSR efforts complying with the standard and purchase the certificate, or do not engage in CSR activities at all.[17] In the last stage, firms compete in the market by setting quantities, while consumers make their purchases according to their type towards CSR and the firms' CSR certificates obtained in the previous stage.[18,19] We solve the game by employing the Subgame Perfect Nash Equilibrium (SPNE) solution concept.

[17] In Section 7, we also examine the case where the CSR certification standard is set ex-post, i.e., firms decide over their CSR efforts first and then the certifier decides whether or not to provide the certification.

[18] The decisions over CSR efforts and output levels are taken in subsequent stages because, although CSR efforts are unobservable, the CSR efforts of a certified in the second stage firm are guaranteed by the certifier before this firm sets its quantity.

[19] In section 7, we also examine the case where firms compete in prices.

2.2 The Benchmark case: No certification

We begin our analysis by briefly presenting the benchmark case where there is no certification mechanism to disclose credible information to consumers regarding the firms' CSR activities. As mentioned above, in this case, consumers rationally believe that firms have undertaken zero CSR activities. Anticipating this, firms do not spend on CSR ($s_i = 0$, $i = 1, 2$). This turns out to be a standard Cournot game with horizontally differentiated goods, where each firm chooses output to maximize profits:

$$\Pi_i = (a - q_i - \gamma q_j)q_i - cq_i \tag{7}$$

From the first order condition, the reaction function of firm i is:

$$q_i = R_i^N(q_j) = \frac{a - \gamma q_j - c}{2} \tag{8}$$

By symmetry, we obtain each firm's equilibrium output, price and profits, respectively:

$$q^N = \frac{a-c}{2+\gamma}; \quad p^N = c + \frac{a-c}{2+\gamma}; \quad \pi^N = (q^N)^2 \tag{9}$$

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 $x^N = q^N$ from each good; moreover, that consumers' surplus and total welfare are given by $CS^N = (1+\gamma)(q^N)^2$ and $TW^N = (3+\gamma)(q^N)^2$, respectively.

3 Private Certifier

We first consider the case in which firms' CSR efforts are certified by a private profit-maximizing certifier. Let s_i^P be the CSR standard that the private certifier sets for firm $i, i = 1, 2$. Assume for the moment that each firm undertakes the CSR efforts complying with its respective standard and purchases the certificate after paying the certification fee F_i. Later on we will show that this is so in equilibrium.

In the last stage of the game, firms anticipate that their CSR efforts have been credibly disclosed to consumers, via certification. Then firm i, taking as given the output of the rival

firm q_j, chooses q_i to maximize its profits, given by (6).

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

$$q_i^P = R_i^P(q_j) = \frac{a - c - \gamma q_j}{2} + \frac{s_i^P(\frac{1}{2} - cs_i^P)}{2} \tag{10}$$

Comparing $R_i^P(q_j)$ with the benchmark no-certification reaction function $R_i^N(q_j)$, the following observations are in order: First, $R_i^P(q_j)$ has an additional term capturing the two effects of CSR efforts s_i^P on firm i's (best-response) output level. On the one hand, a unitary increase in CSR efforts increases the demand for firm i's good by $\bar{\theta} = 1/2$, i.e., by the average consumer's type willingness to pay. Thus, CSR efforts tend to increase firm i's output and profits. On the other hand, CSR efforts increase firm i's unit costs, tending to decrease its output and profits. Second, since $\frac{\partial R_i^P}{\partial s_i^P} = \frac{1}{2}(\frac{1}{2} - 2cs_i^P)$, firm i's output level has an inverted U-shaped relation with its CSR efforts, with the maximum attained at $s_i^P = 1/4c$. The intuition goes as follows. For a relatively low level of CSR efforts ($s_i^P < 1/4c$), a small increase in s_i^P leads to an increase in output level because the positive demand effect dominates the negative unit cost effect. This reasoning is reversed for relatively higher levels of CSR efforts ($s_i^P > 1/4c$), in which case a further increase in CSR efforts induces a significant increase in unit costs and a reduction in output level. In fact, when $s_i^P > 1/2c$, the firm i's reaction function shifts in, as compared with the respective one under no certification. Third, firm i's reaction function $R_i^P(q_j)$ depends on the rival firm's CSR effort s_j, but only through q_j.

Solving the system of first order conditions, we obtain firm i's output and gross profits, respectively:

$$q_i^P(s_i^P, s_j^P) = \frac{a(2-\gamma) + \frac{1}{2}(2s_i^P - \gamma s_j^P) - c\left[2\left[1 + \left(s_i^P\right)^2\right] - \gamma\left[1 + \left(s_j^P\right)^2\right]\right]}{(4-\gamma^2)};$$

$$\Pi_{ig}^P(s_i^P, s_j^P) = [q_i^P(s_i^P, s_j^P)]^2 \tag{11}$$

where Π_{ig}^P represents firm i's profits from engaging in CSR before the payment of the certification fee F_i.

In the second stage, firms simultaneously and non-cooperatively decide whether to under-

take the CSR efforts complying with the standard set by the private certifier in the first stage and purchase the respective certificate. Firm i engages in CSR activities only if its profits, net from the certification fee, are at least equal to its profits under no certification, i.e., if and only if $\Pi_{in}^P = \Pi_{ig}^P(s_i^P, s_j^P) - F_i \geq \pi^N$.

Following Bottega and De Freitas (2009) along with Hardling and Alexander (2003), we assume that the private certifier, while setting the CSR certification standard and the respective fee, has all the bargaining power; hence, it is able to extract, via the certification fee, all the extra profits from each firm's CSR activities, i.e., $F_i = \Pi_{ig}^P(s_i^P, s_j^P) - \pi^N$.[20] Thus, in the first stage, the certifier sets the CSR standards (s_i^P, s_j^P) at the level that maximizes industry extra profits from certification, $\Pi_{ig}^P(s_i^P, s_j^P) + \Pi_{jg}^P(s_i^P, s_j^P) - 2\pi^N$. The latter is equivalent to the maximization of the sum of the firms' gross profits, $\Pi_{ig}^P(s_i^P, s_j^P) + \Pi_{jg}^P(s_i^P, s_j^P)$.

Using (11), the first order conditions are:[21]

$$2q_i^P(s_i^P, s_j^P)\frac{\partial q_i^P}{\partial s_i^P} + 2q_j^P(s_i^P, s_j^P)\frac{\partial q_j^P}{\partial s_i^P} = 0, \;\; i, j = 1, 2, i \neq j \tag{12}$$

where $\frac{\partial q_i^P}{\partial s_i^P} = \frac{1-4cs_i}{4-\gamma^2}$ and $\frac{\partial q_j^P}{\partial s_i^P} = \frac{\gamma(1-4cs_j)}{2(4-\gamma^2)}$. Solving the system of equations, we obtain the CSR certification standard that the private certifier will set for both firms in equilibrium:[22]

$$s_i^P = s_j^P = s^P = \frac{1}{4c} \tag{13}$$

Note that in equilibrium, $\frac{\partial q_i^P}{\partial s_i^P} = 0$, $i = 1, 2$. This implies that the private certifier sets the equilibrium CSR certification standard at the level maximizing each firm's output and gross profits (since $\frac{\partial \Pi_{ig}^P(s_i^P, s_j^P)}{\partial s_i} = 2q_i^P(s_i^P, s_j^P)\frac{\partial q_i^P}{\partial s_i^P} = 0$).

It is then easy to see that s^P is the level of CSR efforts that each firm will undertake in equilibrium. Assume that a firm undertakes a CSR effort level lower than s^P. Then this firm simply does not comply with the standard and cannot be certified. Clearly, since the rival

[20] This specification allows us to consider that the private certifier can spend part of F_i on monitoring as well as on persuasive advertising, in order to increase consumers' awareness for CSR related products and hence, promote the certificate (Bottega and De Freitas, 2009).

[21] It can be checked that the second order conditions are satisfied in the equilibrium certification standards.

[22] Note that under Assumption 1, an asymmetric equilibrium where the private certifier sets a certification standard for only one firm, leaving non-certified its rival, is strictly dominated by the symmetric certification equilibrium.

firm is certified, the firm concedes competitive advantage to its rival and thus, its profits will be lower than π^N. On the other hand, no firm has incentives to undertake a CSR effort level higher than s^P because this higher effort is costly and cannot be certified; hence, it would again lead to profits lower than π^N (after the payment of the certification fee F^P). As expected, the equilibrium CSR effort level decreases as the CSR (and output) "production technology" becomes less efficient, as captured by a higher c.

Substituting s^P into (11), (5) and (6), we obtain firm i's equilibrium output, price, gross and net profits, as well as the fee that the private certifier charges, respectively:

$$q^P = \frac{1+16c(a-c)}{16c(2+\gamma)};\ p^P = c + \frac{3+\gamma+16c(a-c)}{16c\,(2+\gamma)};\ \Pi_g^P = \left(q^P\right)^2;\ \Pi_n^P = \pi^N$$

$$F^P = \Pi_g^P - \pi^N = \frac{1+32(a-c)c}{256c^2(2+\gamma)^2} \tag{14}$$

The following Proposition summarizes:

Proposition 1 *In equilibrium, the private certifier sets the CSR certification standard at a level* $s^P = \frac{1}{4c}$ *and charges a fee that captures all firms' extra profits from certification. Each firm undertakes CSR efforts* s^P *and complies with the standard in equilibrium.*

The intuition goes as follows. By being certified, a firm credibly discloses information to consumers for its product's SR attributes that are unobservable. Hence, consumers increase their willingness to pay for this firm's product and the firm obtains a competitive advantage in the market, increasing its profits, provided that the rival firm is not certified. Moreover, when firm i is certified, firm j's decision either to totally abstain from CSR activities or to undertake some CSR activities but without being certified, signals to consumers that firm j's product does not have any SR attributes, thus conceding competitive advantage to its rival. Now, the cost savings on CSR effort do not compensate for the revenue losses due to the decreased consumers' valuation for the firm j's product. Thus, such a firm j's decision is unprofitable. Hence, in equilibrium, both firms undertake CSR efforts complying with the standard and purchase the CSR certificate.

The above reasoning suggests that an asymmetric configuration in which firm i is being certified while firm j is not, will never arise in equilibrium. It can easily be verified that in

this case, firm j's profits will be lower than the respective ones when both firms are certified. Moreover, the non-certified firm ends up with output and profits lower than the respective ones in the no certification benchmark. Note also that the case in which none firm is being certified is not an equilibrium configuration. Firm i's optimal response to the non-certified firm j is to be certified.

It can be checked that equilibrium output, price, gross and net firms' profits decrease as competition becomes fiercer, i.e., when products become closer substitutes (higher γ). Moreover, these equilibrium values decrease as the CSR (and output) "production technology" becomes less efficient (higher c). As gross and net profits decrease with γ and c, it turns out that the fee F^P charged by the certifier follows the same pattern.

We next compare the equilibrium outcomes in case of a private certifier with the respective ones under no certification. The following Corollary summarizes:

Corollary 1 *Equilibrium firms' output level, gross profits and price are higher than the respective ones in the benchmark case with no certification. Equilibrium firms' net profits are equal to those under no certification.*

Intuitively, since $s^P = \frac{1}{4c}$, CSR activities shift firm i's output reaction function outwards, implying a more aggressive behavior during the quantity setting stage which results in increased equilibrium output and gross profits, i.e. $q^P > q^N$ and $\Pi_g^P > \pi^N$. Moreover, since consumers' willingness to pay for CSR related products increases as firms undertake higher CSR efforts, it is clear that $p^P > p^N$. Note also that each firm ends up with net profits equal to the respective ones under no certification, i.e., $\Pi_n^P = \pi^N$. This happens because the private certifier charges a fee extracting all the extra profits from each firm's CSR activities.

3.1 Welfare Analysis

We now investigate the welfare effects of firms' CSR activities when these are certified by a private certifier. Total welfare is defined as the sum of consumers' surplus, firms' net profits and the certifier's fees. This is equivalent to the sum of consumers' surplus and firms' gross profits:

$$SW^P = CS^P + 2\Pi_n^P + 2F^P = CS^P + 2\Pi_g^P \tag{15}$$

The consumer surplus of a θ-type consumer is given by:

$$CS^P(\theta) = (a+\theta s_1)x_1(\theta) + (a+\theta s_2)x_2(\theta) - [x_1^2(\theta) + x_2^2(\theta) + 2\gamma x_1(\theta)x_2(\theta)]/2 - p_1 x_1(\theta) - p_2 x_2(\theta) \tag{16}$$

Exploiting symmetry, using (2) and after some manipulations, (16) reduces to:

$$CS^P(\theta) = (1+\gamma)[x^P(\theta)]^2 \tag{17}$$

Further, since $p^P = a + \frac{1}{2}s^P - (1+\gamma)q^P$, we have:[23]

$$x^P(\theta) = \frac{a + \theta s^P - p^P}{1+\gamma} = q^P + \frac{(\theta - \frac{1}{2})s^P}{(1+\gamma)} \tag{18}$$

Consumers' surplus is then given by $CS^P = (1+\gamma)\int_0^1 [x^P(\theta)]^2 d\theta$ (since $f(\theta) = 1$ for all θ). Using (18), we get:

$$CS^P = (1+\gamma)\left[\int_0^1 \left(q^P\right)^2 d\theta + \int_0^1 2q^P \frac{(\theta - \frac{1}{2})s^P}{(1+\gamma)} d\theta + \int_0^1 \frac{(\theta - \frac{1}{2})^2 \left(s^P\right)^2}{(1+\gamma)^2} d\theta\right] \tag{19}$$

Note that the second term is zero. Hence, consumers' surplus is equal to:

$$CS^P = (1+\gamma)\ \left(q^P\right)^2 + \frac{\left(s^P\right)^2}{12(1+\gamma)} \tag{20}$$

Comparing CS^P with the respective one under no-certification, we observe that the former is always higher. This is so because $CS^P > (1+\gamma)(q^P)^2 > (1+\gamma)(q^N)^2 = CS^N$. The intuitive explanation behind this result is similar to the one regarding the higher output level under a private certifier, relative to the output level under no-certification. It is worth stressing

[23] It can be checked that under Assumption 1, even the $\theta = 0$ consumer-type buys positive amounts of both goods in equilibrium, i.e., $x^P(0) > 0$.

here that consumers' heterogeneity in terms of their willingness to pay for the SR attributes of goods contributes positively to the consumers' surplus. In fact, the second term in (20) is proportional to $\left(s^P\right)^2$, with coefficient of proportionality the variance of consumers' preferences in the population, $var(\theta) = \frac{1}{12}$. Further, since the certifier's profits are equal to the firms' extra profits form their CSR activities, total welfare turns out to be higher under certification too. Finally, as output and profits decrease with c and γ, it is easy to see that CS^P and TW^P follow the same pattern too.

The following Proposition summarizes:

Proposition 2 *Consumers' surplus and total welfare are always higher under a private certifier rather than under no-certification. Moreover, they both increase when the production technology becomes more efficient (lower c), and decrease when the goods are less differentiated and the market competition becomes fiercer (higher γ).*

An immediate implication of Proposition 2 is that there is alignment among market and social incentives for certifying firms' CSR activities. Firms, by engaging in CSR activities, obtain higher profits due to consumers' increased willingness to pay for their products. Moreover, consumers' surplus increases because firms satisfy their demand for products with SR attributes.

4 Public Certifier

We next consider the case in which a public certifier sets an industry-wide CSR certification standard s^R, so as to maximize total welfare, and provides the respective certificate to any firm complying with the standard.[24] Similarly to the previous case, the public certifier monitors and certifies firms' CSR efforts. We assume that the public certifier can trace a firm revealing untruthful information with probability one. The cost of monitoring M is fixed and is paid by each firm that wishes to be certified.

Suppose that both firms have being certified, i.e., $s_i^R = s_j^R = s^R$. In the last stage of the game, certified firms' CSR efforts have been credibly disclosed to consumers via certification.

[24] The case in which the public certifier has the option to set a different standard for each firm does not alter our results.

Firm i, taking q_j as given, chooses q_i to maximize its profits. The first order condition leads to firm i's reaction function, which is given by (10), in which $s_i^R = s^R$. Solving the system of first order conditions and exploiting symmetry, we obtain firm i's output and gross profits, respectively:

$$q^R(s^R) = \frac{a - c + s^R(\frac{1}{2} - cs^R)}{(2+\gamma)};\ \Pi_g^R(s^R) = [q^R(s^R)]^2 \tag{21}$$

where Π_g^R represents firm i's gross profits from engaging in CSR, net of the payment of the monitoring cost.

In the second stage, firms simultaneously and non-cooperatively decide whether to undertake the CSR efforts complying with the standard set by the public certifier in the first stage and purchase the respective certificate. Firm i engages in CSR only if its profits, net from the monitoring cost, are equal or higher than those under no certification, i.e., only if $\Pi_n^R = \Pi_g^R(s^R) - M \geq \pi^N$. Equivalently, firm i engages in CSR activities only if $s^R \leq \bar{s}(M)$,where $\bar{s}$ represents the maximum certification standard that the firm has incentives to purchase, or else, the CSR standard that satisfies its participation constraint:

$$\bar{s}(M) = \frac{1 + \sqrt{1 - 16c\left(\sqrt{(a-c)^2 + M(2+\gamma)^2} - (a-c)\right)}}{4c},\ 0 \leq M \leq M_{\max} = \frac{1 + 32c(a-c)}{256c^2(2+\gamma)^2} \tag{22}$$

Note that when the monitoring cost is null, $M = 0$, then $\bar{s}(0) = s_{\max} = 1/2c$. In the latter case, firm i's reaction function under certification coincides with that under no certification. The two opposing effects of CSR efforts on firm i's output (the positive demand increase effect and the negative unit cost effect) cancel out and hence, there is no shift in firm i's reaction function. Further, $\frac{\partial \bar{s}}{\partial M} < 0$, implying that the maximum standard that the public certifier can set, such that firms have incentives to engage in CSR activities, decreases with the monitoring cost. Finally, observe that the maximum permissible monitoring cost is equal to the optimal fee that the private certifier sets ($M_{\max} = F^P$). In the latter case, $\bar{s}(M_{\max}) = s^P = 1/4c$.

In the first stage, the public certifier sets the CSR standard so as to maximize total welfare:

$$TW^R = CS^R(s^R) + 2\Pi_g^R(s^R) + 2M = CS^R(s^R) + 2\Pi_g^R(s^R) \tag{23}$$

where, as we saw above, $CS^R(s^R)$ is given by:

$$CS^R(s^R) = (1+\gamma)\ \left(q^R\right)^2 + \frac{\left(s^R\right)^2}{12(1+\gamma)} \tag{24}$$

The first-order condition (23) determines the socially optimal CSR certification standard s_o^R.[25]

$$\frac{\partial TW^R}{\partial s^R} = 2(3+\gamma)q^R(s_o^R)\frac{\partial q^R}{\partial s^R} + \frac{2s_o^R}{12(1+\gamma)} = 0$$

Note that $\frac{\partial TW^R}{\partial s^R}\ |_{s^P=1/4c} = \frac{1}{24c(1+\gamma)} > 0$; hence, $s_o^R > s^P = \frac{1}{4c}$. Moreover, $\frac{\partial TW^R}{\partial s^R}\ |_{s_{\max}=1/2c} = -\frac{(3+\gamma)(a-c)}{(2+\gamma)^2} + \frac{1}{12c(1+\gamma)} < 0$ (under Assumption 1); hence, $s_o^R < \frac{1}{2c}$. An immediate consequence of these, coupled with our discussion above, is that there exists a $\widehat{M}_R$ such that for all $M < \widehat{M}_R$, $s_o^R < \bar{s}(M)$, and vice versa. Hence, if the monitoring cost is relatively low, $M < \widehat{M}_R$, the public certifier sets the certification standard s_o^R that maximizes total welfare. Substituting s_o^R into (21), (5) and (6), we obtain firm i's equilibrium output, price, gross and net profits, respectively. In contrast, if the monitoring cost is relatively high, $M > \widehat{M}_R$, the public certifier sets the CSR standard $\bar{s}(M)$ that leaves firms with no extra profits from CSR certification. Substituting $\bar{s}(M)$ in the above expressions, we obtain the respective equilibrium outcome. Note also that both s_o^R and $\bar{s}(M)$ decrease as the CSR (and output) "production technology" becomes less efficient. The above hold for reasons similar to those stated in the case of the private certifier.

The following Proposition summarizes:

Proposition 3 *In equilibrium, if the monitoring cost is relatively low (high), i.e., $M < \widehat{M}_R$ ($M > \widehat{M}_R$), the public certifier sets the certification standard $s^R = s_o^R$ ($s^R = \bar{s}(M)$). Each firm undertakes CSR efforts s^R and complies with the standard in equilibrium.*

The intuitive arguments are along the lines of those under the private certification case. A number of additional observations are in order. First, an asymmetric configuration in which

[25] Due to space limitations, the analytical formulas are available from the authors upon request.

firm i is being certified while firm j does not, will never arise in equilibrium. Second, equilibrium firm i's output level, gross profits and price are always higher than the respective ones under no certification. Regarding equilibrium firm i's net profits, if $M < \widehat{M}_R$ and $s^R = s_o^R$, they are higher than under no certification. For higher monitoring costs, they are equal to those under no certification because the public certifier sets $s^R = \bar{s}(M)$. As expected, consumers' surplus and total welfare are always higher under a public certifier rather than under no-certification. Finally, equilibrium output, price, gross and net firms' profits as well as consumer surplus and total welfare follow the same pattern in c and γ, as in the private certifier case**.** The above hold for reasons similar to those stated in the private certifier case.

5 Certification by a Non Governmental Organization

In this section we consider the case in which the industry-wide CSR certification standard is provided by a Non Governmental Organization (NGO) who is interested in enhancing the welfare of consumers. We thus postulate that the objective function of the NGO is to maximize consumers' surplus.

Similarly to the public certifier's case, here too, the cost of monitoring M is fixed and is paid by any firm wishing to be certified. Moreover, the probability of tracing a firm revealing untruthful information is one. Here too, we assume that both firms comply with the CSR standard s^G set by the NGO and we then show that this is so in equilibrium.

The last stage of the game is as in Section 4 and output levels and gross profits are given by (21), where s^R has been replaced by s^G. In the second stage, firm i engages in CSR only if its profits, net from the monitoring cost, are equal or higher than its profits under no-certification, i.e., only if $\Pi_n^G = \Pi_g^G(s^G) - M \geq \pi^N$. Hence, firm i engages in CSR only if $s^G \leq \overline{s}(M)$ (see (22).

In the first stage, the NGO sets the CSR standard so as to maximize consumers' surplus given by:

$$CS^G(s^G) = (1+\gamma)\ \left(q^G\right)^2 + \frac{\left(s^G\right)^2}{12(1+\gamma)} \tag{25}$$

The first-order condition of (25) determines the optimal CSR certification standard s_o^G:[26]

$$\frac{\partial CS^G}{\partial s^G} = 2(1+\gamma)q^G(s_o^G)\frac{\partial q^G}{\partial s^G} + \frac{2s_o^G}{12(1+\gamma)} = 0$$

Note that $\frac{\partial CS^G}{\partial s^G}\mid_{s^P=1/4c} = \frac{1}{24c(1+\gamma)} > 0$, while $\frac{\partial CS^G}{\partial s^G}\mid_{s_{\max}=1/2c} = -\frac{(1+\gamma)(a-c)}{(2+\gamma)^2} + \frac{1}{12c(1+\gamma)} < 0$ (under Assumption 1). Hence, $\frac{1}{4c} < s_o^G < \frac{1}{2c}$. An immediate consequence is that there exists a $\widehat{M}_G$ such that for all $M < \widehat{M}_G$, $s_o^G < \bar{s}(M)$, and vice versa. Therefore, if the monitoring cost is relatively low, $M < \widehat{M}_G$, the NGO sets the certification standard at its optimal level s_o^G. In contrast, if it is relatively high, $M > \widehat{M}_G$, the NGO sets the standard $\bar{s}(M)$ that satisfies the firms participation constraint. Substituting s_o^G and $\bar{s}(M)$ into (21), (5) and (6), we obtain firm i's equilibrium output, price, gross and net profits, for the case where the NGO sets the CSR certification standard at s_o^R and at $\bar{s}(M)$ respectively. Note also that when the monitoring cost takes the maximum permissible value, ($M_{\max} = F^P$), firm i's CSR efforts, output level and gross profits under the NGO are equal to the respective ones under the public and the private certifier. Finally, it is easy to see that $\widehat{M}_G < \widehat{M}_R$.

The following Proposition summarizes:

Proposition 4 *In equilibrium, if the monitoring cost is relatively low (high), i.e., $M < \widehat{M}_G$ ($M > \widehat{M}_G$), the NGO sets the certification standard $s^G = s_o^G$ ($s^G = \bar{s}$). Each firm undertakes CSR efforts s^G and complies with the standard in equilibrium.*

The intuitive arguments are along the lines of the analysis for the public certifier. Note also that under the NGO too, an asymmetric configuration where only one firm is being certified, will never arise in equilibrium. Our observations for the case of the public certifier, regarding the comparison of the equilibrium results under the NGO with those under no-certification as well as the effects of c and γ, hold in the present case too.

6 Comparison

We next turn to the comparison of the equilibrium outcomes under the three alternative certifying institutions, in order to evaluate their relative market and societal effects.

[26] Due to space limitations, the analytical formulas are available from the authors upon request.

The following Proposition summarizes our findings regarding the certification standards under the three alternative institutions:

Proposition 5 *(i) If the monitoring cost is low enough, i.e., $M < \widehat{M}_G$, the public certifier and the NGO set the certification standard at their respective optimal levels, s_o^R and s_o^G. The certification standard is the highest under the NGO, it is the lowest under the private certifier, while it lies in between under the public certifier ($s_o^G > s_o^R > s^P$).*

(ii) For intermediate values of the monitoring cost, i.e., $M \in [\widehat{M}_G, \widehat{M}_R]$, the public certifier sets the certification standard at its optimal level s_o^R while the NGO sets the standard at the level satisfying the firms' participation constraint $\bar{s}(M)$. Again the certification standard is the highest under the NGO, it is the lowest under the private certifier, while it lies in between under the public certifier ($s^G = \bar{s}(M) > s_o^R > s^P$).

(iii) If the monitoring cost is high enough, i.e., $M \in (\widehat{M}_R, M_{\max})$, both the public certifier and the NGO set the certification standard at the level satisfying the firms' participation constraint $\bar{s}(M)$. The latter is higher than the certification standard under the private certifier ($s^G = s^R = \bar{s}(M) > s^P$).

(iv) If the monitoring cost takes its maximum permissible value ($M_{\max} = F^P$), the certification standard is equal across all three certifying institutions ($s^G = s^R = s^P = \bar{s}(M_{\max})$).

- These results are illustrated in Figure 1.

The intuition behind these results goes as follows. The private certifier sets the standard at a level maximizing each firm's extra profits from CSR activities, in order to capture, via the certification fee, these extra profits and thus maximize its own profits. There is, thus, no consideration for consumers' surplus in the private certifier's objective function. On the contrary, the NGO and the public certifier set the standard at a level maximizing consumers' surplus and total welfare, respectively. Hence the NGO and the public certifier incorporate in their objective function the socially conscious consumers' valuation of the firms' CSR activities and their respective optimal CSR standards are higher than the certification standard maximizing firms' profits alone. Moreover, since the NGO certifier cares only about consumers' surplus, and not about firms' profits, its certification standard is, in general, higher than the standard set by the public certifier. In fact, if the monitoring cost is sufficiently low ($M < \widehat{M}_R$), $s_o^G > s_o^R$

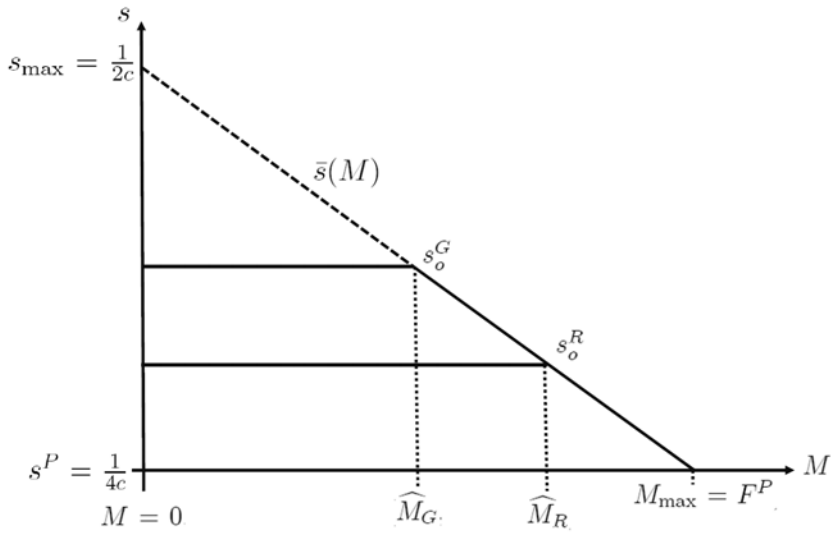

Figure 1: Equilibrium CSR certification standards under the three certifying institutions.

(Proposition 5(i) & (ii)). However, if the monitoring cost is high enough ($\widehat{M}_R < M < M_{\max}$), both the NGO and the public certifier are restricted by the firms' participation constraints and set the standard at the level that leaves firms with no extra profits from their CSR activities (Proposition 5(iii)). Finally, in the polar case where the monitoring cost takes its maximum permissible value ($M_{\max} = F^P$), all three certifiers set the same CSR standard that satisfies the firms' participation constraints.

Let us now compare the equilibrium market outcomes under the three alternative certifying institutions. The following Proposition summarizes:

Proposition 6 *(i) If the monitoring cost is sufficiently low, i.e., $M < \widehat{M}_R$, firm i's output level and gross profits (price) are the highest (lowest) under the private certifier, they are the lowest (highest) under the NGO, while they lie in between under the public certifier ($q^P > q^R > q^G$, $\Pi_g^P > \Pi_g^R > \Pi_g^G$ and $p^P < p^R < p^G$).*

(ii) If the monitoring cost is sufficiently high, i.e., $M \in (\widehat{M}_R, M_{\max})$, firm i's output level, price and gross profits under the public certifier and the NGO are equal. Firm i's output level and gross profits (price) are higher (lower) under the private certifier rather than under the public certifier and the NGO ($q^P > q^R = q^G$, $\Pi_g^P > \Pi_g^R = \Pi_g^G$ and $p^P < p^R = p^G$).

(iii) If the monitoring cost takes its maximum permissible value ($M_{\max} = F^P$), firm i's output level, price and gross profits are equal across all three certifying institutions ($q^P = q^R = q^G$, $\Pi_g^P = \Pi_g^R = \Pi_g^G$ and $p^P = p^R = p^G$).

Regarding output level and gross profits, the intuition goes as follows. For a sufficiently low monitoring cost ($M < \widehat{M}_R$), the fact that the certification standard is the highest under the NGO has two negative effects on firm i's output level and gross profits. As compared to the CSR standard under the private certifier, firstly, it induces a relatively smaller outward shift of firm i's output reaction function (recall that s_o^R and s_o^G lie in the area where $\frac{\partial q}{\partial s} < 0$); and secondly, it leads to a relatively larger unit cost increase. In addition, under the NGO, the outward shift of firm i's output reaction function is smaller and the unit cost increase is larger, as compared to the public certifier case. Hence, firm i's output level and gross profits are, in general, higher under the private certifier than under the public certifier and the latter are higher than those under the NGO.

Regarding equilibrium prices, the intuition is straightforward. Firm i's price increases with its CSR effort level s_i, while it decreases with aggregate output level. For $M < \widehat{M}_R$, the output effect under the private certifier is the most severe, while it is the least severe under the NGO. In contrast, the firm's CSR effort is the highest under the NGO, while it is the lowest under the private certifier. It turns out that the CSR effort effect always dominates the output effect and hence, the equilibrium price under the NGO is higher than the price under the public certifier, which, in turn, is higher than the price under the private certifier. Finally, Proposition 6 (ii & iii) derive directly from Proposition 5 (iii & iv), respectively.

Next, we compare the welfare effects of the three alternative certifying institutions. Regarding consumers' surplus, the following Proposition summarizes our findings:

Proposition 7 *(i) If the monitoring cost is sufficiently low, i.e., $M < \widehat{M}_R$, consumers' surplus is the highest under the NGO, it is the lowest under the private certifier, while it lies in between under the public certifier ($CS^G > CS^R > CS^P$).*

(ii) If the monitoring cost is sufficiently high, i.e., $M \in (\widehat{M}_R, M_{\max})$, consumers' surplus under the public certifier and the NGO are equal and higher than the respective one under the private certifier ($CS^G = CS^R > CS^P$).

(iii) If the monitoring cost takes its maximum permissible value ($M_{\max} = F^P$), consumers' surplus is equal across all three certifying institutions ($CS^G = CS^R = CS^P$).

The intuition behind these results goes as follows. Recall from Proposition 5 that for all $0 \leq M < M_{\max}$, it holds that $\frac{\left(s^G\right)^2}{12(1+\gamma)^2} \geq \frac{\left(s^R\right)^2}{12(1+\gamma)^2} > \frac{\left(s^P\right)^2}{12(1+\gamma)^2}$. Hence, the CSR effort-related part of consumers' surplus is, at least, as high under the NGO than under the public certifier, with the latter being always higher than that under the private certifier. Recall also that the reverse ranking holds for the output-related part of consumers' surplus, i.e., $(1+\gamma)\left(q^P\right)^2 > (1+\gamma)\left(q^R\right)^2 \geq (1+\gamma)\left(q^G\right)^2$ (see Proposition 6 i & ii). It turns out that the output effect is always dominated by the CSR effort effect. As a consequence, if $M < \widehat{M}_R$, the NGO is the most preferable certifying institution from the consumers' point of view. While for higher values of the monitoring cost, the NGO and the public certifier are equivalent, and both of them are preferable to the private certifier.

Regarding total welfare, our findings are summarized in the following Proposition:

Proposition 8 *(i) If the monitoring cost is sufficiently low, i.e., $M < \widehat{M}_R$:*

(ia) Total welfare is always higher under the public certifier than under the private certifier and the NGO.

(ib) Total welfare is higher (lower) under the private than under the NGO if and only if the monitoring cost is low (high) enough, i.e., $M < \widetilde{M}$ ($M > \widetilde{M}$).

(ii) If the monitoring cost is sufficiently high, i.e., $M \in (\widehat{M}_R, M_{\max})$, total welfare under the NGO and the public certifier are equal and higher than the respective one under the private certifier ($TW^R = TW^G > TW^P$).

(iii) If the monitoring cost takes its maximum permissible value ($M_{\max} = F^P$), total welfare is equal across all three certifying institutions ($TW^R = TW^G = TW^P$).

Intuitively, we know from Proposition 6 (i & ii) that for all $0 \leq M < M_{\max}$, industry gross profits under the private certifier are the highest across all three certifying institutions. In addition, they are, at least, as high under the public certifier than under the NGO. As expected, the relatively higher industry gross profits under the private certifier are dominated by the relatively higher consumers' surplus under the public certifier and as a consequence, total welfare is higher under the public certifier. A similar reasoning applies when we compare

the NGO with the public certifier, with the only exception when the monitoring costs are high enough, in which case the two certifying institutions lead to the same welfare level.

Interestingly, our analysis suggests that if the monitoring cost is low enough, i.e., $M < \widetilde{M}$, total welfare is higher under the private certifier than under the NGO. This is explained as follows. For low values of M, industry profits are maximized under the private certifier and are significantly higher than those under the NGO who does not care about firms' profits. The negative effect of the NGO on profits does not compensate for its positive effect on consumer's surplus and as a consequence, total welfare is higher under the private certifier. In contrast, for high values of the monitoring cost, the NGO is forced to set the certification standard at a level that satisfies the firms' participation constraints. In this case, the NGO's positive effect on consumer surplus more than compensates the negative effect on firms' profits, leading thus to higher total welfare under the NGO.

7 Extensions - Discussion

In this section we examine a number of modifications of the basic model in order to briefly discuss the robustness of our main results.[27]

7.1 Timing of Certification

In the basic model we have assumed that the certifier sets the CSR certification standard before firms decide whether to undertake CSR efforts complying with this standard or not (*ex ante* scenario). We now consider the case where the CSR standard is set *ex post*. In this scenario, firms undertake their CSR activities in the first stage, and in the second stage the certifier sets the CSR standard and examines whether the firms' CSR efforts comply with it. In the last stage, firms compete in the market by setting their quantities. The solution of the ex-post certification game is summarized in the following Proposition:

Proposition 9 *When the CSR certification standard is set after firms have undertaken their CSR activities, all certifying institutions (private, public, NGO) set the standard at a level*

[27] For each extension discussed below, the detailed analysis is available from the authors upon request.

$s^* = \frac{1}{4c}$. *This is the equilibrium level of CSR efforts that each firm undertakes and corresponds to the level of CSR efforts that maximizes each firm's profits.*

Observe that in the *ex post* certification scenario, the CSR certification standard of all certifying institutions is equal to the standard set by the private certifier in the *ex ante* scenario ($s^* = s^P$). Regarding the private certifier, the intuition goes as follows. As in the *ex ante* scenario, here too, the private certifier's objective coincides with the maximization of firms' extra profits from their CSR activities. Hence, in the second stage, the private certifier sets the certification standard at a level equal to that already chosen by the firms in the first stage.

Regarding the public certifier and the NGO in the *ex post* scenario, the intuition goes as follows. In the first stage, firms set their profit-maximizing CSR efforts, $s^* = \frac{1}{4c}$. In the second stage, neither the public certifier nor the NGO has incentives to set the CSR standard at a level higher than the CSR effort level undertaken by the firms in the first stage. By doing so, firms would be unable to be certified and hence, there would be no credible information disclosure to consumers regarding the firms' CSR activities. Now since firms' CSR efforts result in consumers' surplus and total welfare higher than the respective ones under no CSR (see Proposition 2), both the public certifier and the NGO are better off by setting the certification standard at a level equal to the firms' profit-maximizing CSR effort undertaken in the first stage. Interestingly, this finding suggests that under both a public certifier and a NGO, market and societal results crucially depend on whether certification takes place before or after firms' CSR efforts.

7.2 Price Competition

In the basic model we have assumed that firms compete in quantities. Consider now the case where firms compete in prices. Keeping all other modeling specifications fixed, we find that our results remain qualitatively robust under this scenario too. In particular, we reconfirm that under all three alternative certifying institutions: First, firms have always incentives to engage in CSR activities complying with the standard. Second, consumers' surplus and total welfare are higher than the respective ones under no-certification. Interestingly, we find that the NGO always sets the certification standard at the level satisfying the firms' participation constraint. This occurs because consumers' surplus turns out to be always increasing in CSR efforts. Here

too, the CSR standard is the lowest under the private certifier, while it is higher under the NGO rather than under the public certifier, except if the monitoring cost is sufficiently high, i.e., $M^B \in (\widehat{M}_R^B,\, M_{\max}^B)$, in which case these two are equal.

7.3 Multiple Certifying Institutions

In the basic model we have assumed that only one among the three alternative certifying institutions is active in each case. Assume now that all three certifiers are active and set their CSR certification standard simultaneously in the first stage. In this case, each firm has the opportunity to choose among the three certification standards. Our analysis suggests that each firm would choose to certify its CSR efforts by the public certifier because this results in the highest net profits from certification. Only if the monitoring cost is sufficiently high, i.e., $M \in (\widehat{M}_R,\, M_{\max})$ for Cournot and $M^B \in (\widehat{M}_R^B,\, M_{\max}^B)$ for Bertrand, the public certifier and the NGO result in equal net profits and hence, firms will be indifferent among these two certifying institutions.

8 Conclusions

In this paper we have investigated the impact of alternative certifying institutions on firms' incentives to engage in costly Corporate Social Responsibility activities as well as their relative market and societal implications. We have considered three certifying institutions: a private certifier seeking to maximize its own profits, a public certifier that maximizes total welfare and a NGO that maximizes consumers' surplus.

We have found that under all CSR certifying institutions, firms, seeking for competitive advantage, undertake CSR efforts complying with the standard set, in order to credibly disclose information to consumers regarding their products' SR attributes. Yet, the equilibrium CSR certification standard depends crucially on the certifying institution. In particular, the standard under the NGO is higher or equal to that under the public certifier, which is always higher than that under the private certifier. Regarding output level and gross profits this ranking is reversed. Certification of CSR activities is welfare enhancing for consumers and firms and thus, policy makers should take measures to promote certification. We have also identified

circumstances under which equilibrium market and societal outcomes under the public certifier are equal to the respective ones under the NGO. Interestingly, if the certification takes place after firms' have undertaken their CSR activities (ex-post scenario), the market and societal outcomes under all certifying institutions are equal those under the private certifier in the ex-ante scenario where the certification standard is set before the firms' CSR activities.

Our findings provide some guidelines for future empirical research regarding the effects of certifying firms' CSR activities on market performance which, as mentioned above, is so far scant and inconclusive. Empirical analyses should begin with a detailed study classifying firms undertaking CSR activities according to whether they are certified or not. Then, the certified firms should be further classified according to whether they are certified by private for-profit companies, public welfare-maximizing regulators or NGOs. A number of testable hypotheses emerge from our analysis. First, the certified firms are expected to spend on CSR activities more than the non-certified. A second testable hypothesis is that firms certified by NGOs are expected to have spent the highest amounts on CSR activities, while firms certified by private companies are expected to have spent the lowest amounts. A third testable hypothesis is that the probability of a firm to certify its CSR activities decreases as the cost to purchase the certificate increases.

In our analysis we have assumed that the CSR certificate is voluntarily purchased by each firm complying with the certification standard. An interesting direction for future research would be to investigate how our results are expected to change in case of a third party establishing ranking for firms, with respect to the amounts invested in CSR activities. Another direction would be to consider production and CSR effort cost asymmetries among firms. Our conjecture is that in this case, asymmetric outcomes in which some firms certify their CSR activities, while others do not, could emerge in equilibrium (as e.g. in Bottega et al., 2009 and Bonroy and Constantatos, 2008).

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