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Market Effects of Changes in Consumers' Social Responsibility

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Abstract

In a duopoly model of vertical differentiation, we study market equilibrium and the resulting social welfare following an increase in the consumer's willingness to pay (WTP) for products sold by socially responsible manufacturers. Different types of such changes emerge depending on their effects on consumer heterogeneity. We show that, in most cases, increases in the consumers' social consciousness yield higher profits to socially responsible firms and may lead to higher levels of social welfare, provided that the market structure is left unchanged. However, when an increase in the consumer's social consciousness changes the market structure, welfare may fall, while one of the duopolists' profits rise. The resulting tension between private and social interests calls for a cautious attitude towards information campaigns aimed at increasing the consumer's social consciousness.

Key words: WTP changes, vertical differentiation, corporate social responsibility.

JEL: A13, L13, D43, D62

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1. Introduction

In modern societies, people are increasingly aware of the impact of their consumption choices on the quality of public goods like, for example, the environment. Ostrom (2000) suggests that such an increasing trend in the consumer's social awareness can be explained as an evolutionary process leading to the emergence and expansion of social norms fostering prosocial behavior. Bénabou and Tirole (2006) illustrate several cases of interaction between an individual's self image and the social norms prevailing in the economy as a source of motivation for prosocial behavior. A practical consequence of these analyses is that private and public decisionmakers may affect the consumer's social responsibility in order to induce the desired market outcomes. For obvious reasons, economists have been reluctant to study changes in welfare when preferences change. However, Stigler and Becker (1977) and Becker (1996) assume that, even when individual choices vary, the underlying preferences are stable, while people develop social and personal capital that changes their consumption decisions over time. Thus, the aforementioned increases in the consumers' social responsibility can be seen as part of the personal and social capital formation process.

There are several empirical studies reporting measures of consumers' WTP for green products.[1] A look at the most recent of them confirms two broadly accepted facts which are central to our analysis. First, there is an increasing trend among consumers world-wide to prefer green products over their standard substitutes.[2] Second, consumers are heterogeneous with respect to their WTP for green products.[3] The issue of taste heterogeneity has been captured by most theoretical models studying the role of consumers' ecological consciousness on market equilibrium. Approaches adopted by different authors vary in many ways, especially depending on whether consumer heterogeneity concerns their WTP for the ecological attribute itself, as in Moraga-González and Padrón-Fumero (2002), or some other features like their income, as in Arora and Gangopadhyay (1995) and Bansal and Gangopadhyay (2003), or their ideal product variety, as in Conrad (2005). Taking the distribution of consumers' valuations as given, all of these studies focus on standard policy instruments, like minimum environmental quality, taxes

and subsidies.[4] To our knowledge, ours is the first *normative* approach to the issue of consumer heterogeneity[5] in the context of a vertical differentiation model with application to markets with a public good externality.

Various studies, Endres (1997) among them, propose the use of state campaigns as a means of increasing people's ecological awareness. However, there seems to be no systematic recognition of the effect such campaigns may have on consumer heterogeneity and its effects on the economic and overall performance of the market. An example of heterogeneity-reducing changes in elicited degrees of environmental consciousness is provided by Tsagarakis and Georgantzís (2002), who present results from a survey responded before and after an informative session on the use of recycled water for irrigation. It is found that the informative session significantly increases the respondents' willingness to use recycled water. Heterogeneity among respondents is reduced, given that the information provided during the session is more effective among those who had initially reported a lower willingness to use recycled water. Suzuki et al. (2004) present evidence for the contrary effect of information contingent on people's initial environmental consciousness. In their study, the informative session is more effective among those who were initially more environmentally conscious. Thus, in terms of our framework, their reported information-led change in environmental consciousness is of the heterogeneity-enhancing type. Harris (2006) recognizes the effectiveness of environmental awareness campaigns in China among university students and the urban population. However, it is suggested that more satisfactory results would be reached if state campaigns were targeted towards those who have lower environmental knowledge and consciousness, like old people and rural populations.

In all of these studies, the social desirability of increasing a population's environmental consciousness seems to be taken for granted. Our analysis shows that this is not necessarily true without relying on the argument, used for example by Conrad (2005), that the social value of products manufactured by socially responsible firms may be overestimated by the consumer. Our framework illustrates the possibility of socially undesirable increases in the consumers'

social responsibility using an argument similar to Rodríguez-Ibeas (2006). However, the description of tastes through two parameters, corresponding to the minimum and maximum valuation of a firm's greenness, allows us to distinguish between heterogeneity-enhancing and heterogeneity-reducing changes in consumers' social responsibility. The need for such an approach is dictated by the plausibility of the hypothesis that consumers with different initial attitudes towards social issues may be affected in different ways by changes in their personal capital caused by exogenous shocks like advertising or social trends.

Following Baron (2001), committing to a socially beneficial investment is a form of strategic corporate social responsibility (CSR). Our approach explains a firm's CSR as a vertical differentiation strategy. Examples include cause-related marketing, eco-labeling, and corporate donations to "worthy" causes. Although many real-world examples of socially responsible behavior concern markets with an environmental externality, Bagnoli and Watts (2003) adopt a more broadly applicable framework in which a socially responsible manufacturer links his product to a public good, while in the absence of any prosocial concerns, the manufacturer does not link the product to such a public externality.

Adopting the vertical differentiation framework by Mussa and Rosen (1978), we assume that, apart from the standard *feel good* effect perceived by the buyers of a green seller's products, firms' corporate strategies imply a contribution to a public good which is not captured by consumers' valuations. Our basic assumption is that, all other being equal, consumers have some preference for products sold by socially responsible manufacturers. Increases in the consumers' WTP for a firm's CSR may increase or decrease consumer heterogeneity. We model the support of consumer tastes through two independent parameters between which valuations of CSR are uniformly distributed. Given the two degrees of freedom resulting from the two-parameter description of tastes, we show that there are only three meaningful structures that should be analyzed in this framework: 1) duopoly with incomplete coverage of the market, 2) duopoly with complete coverage of the market and 3) monopoly with complete market coverage. This generalization of the product differentiation framework allows us to consider

changes in the consumers' WTP for green firms' products leading to discontinuous jumps across different market structures. This feature of our model is responsible for our main results, which can be summarized as follows.

First, as preference heterogeneity increases, equilibria progress from monopoly, to duopoly with the full market covered, to duopoly without full coverage. Second, as consumer preferences shift toward more socially responsible ones, market structure can change in a welfare-reducing fashion. This is possible both for shifts that raise the concern for quality of less socially conscious consumers and for shifts that raise the environmental concerns of already highly responsible ones.

The remaining part of the paper is structured as follows. Section 2 presents the theoretical model. In Section 3 we discuss the main results. Section 4 concludes. Appendix A provides the proofs of the main results. Appendix B compares equilibrium with the first best solution and discusses the implications of our framework for social welfare.

2. The model

Let a maximum of two potentially socially responsible firms sell a private product to a population of consumers. Consumer *i*'s utility from the consumption of up to one product unit from firm *j*, is given by:

$$U_{ij} = \max\{v_i s_j - p_j, 0\} \tag{1}$$

where $j \in \{1,2\}$, while s_j denotes firm *j*'s degree of CSR, v_i is consumer *i*'s valuation of a marginal increase in a firm's CSR, and p_j is seller *j*'s price. The standard product is also sold in a perfectly competitive market at a price *p*, which is normalized to $p = 0$, by firms which cannot adopt any kind of CSR. Therefore, without loss of generality, we assume that when the market is not covered by the sales of the two firms, consumers can still buy the standard product in the competitive market enjoying the non CSR-related aspects of it. This implies that the product is perceived as differentiated by the consumers as long as at least one of the two firms

adopts a different level of CSR from its rival. Therefore, if one of the two firms wants to sell the product at a higher price than the competitive one, potentially yielding a positive profit, it must commit to a positive level of CSR.

We normalize the consumers' population to unity and assume that the consumer-specific valuation parameters reflecting their preferences for firms' CSR are distributed uniformly between m and n. By assuming that the density of the distribution is $d= 1/(n-m)$, we keep the population of consumers constant in all types of changes in the distribution of v.

Figure 1 presents the types of changes in the consumers' social consciousness, which can be modeled as increases in one of the two taste parameters, m (example 1) and n (example 2), or both of them (example 3). Given that this last case is a very special one, we focus on the first two types of changes. We use the term *heterogeneity-reducing* for the case of WTP changes depicted in example 1, and *heterogeneity-enhancing* for the case showed in example 2.

Notice that we focus on the case of total-mass-preserving changes in the distribution of consumers, which could be due to, say, some prosocial campaign targeting the existing consumer population. To model non-mass-preserving ones would be of some interest, as an analogue of changes caused by the entry of new, more socially conscious consumers. However, although this alternative approach would produce qualitatively similar results to those reported here, it would not allow us disentangle the effects of changes in the consumer's WTP for quality from the effects of increasing the total consumer population.

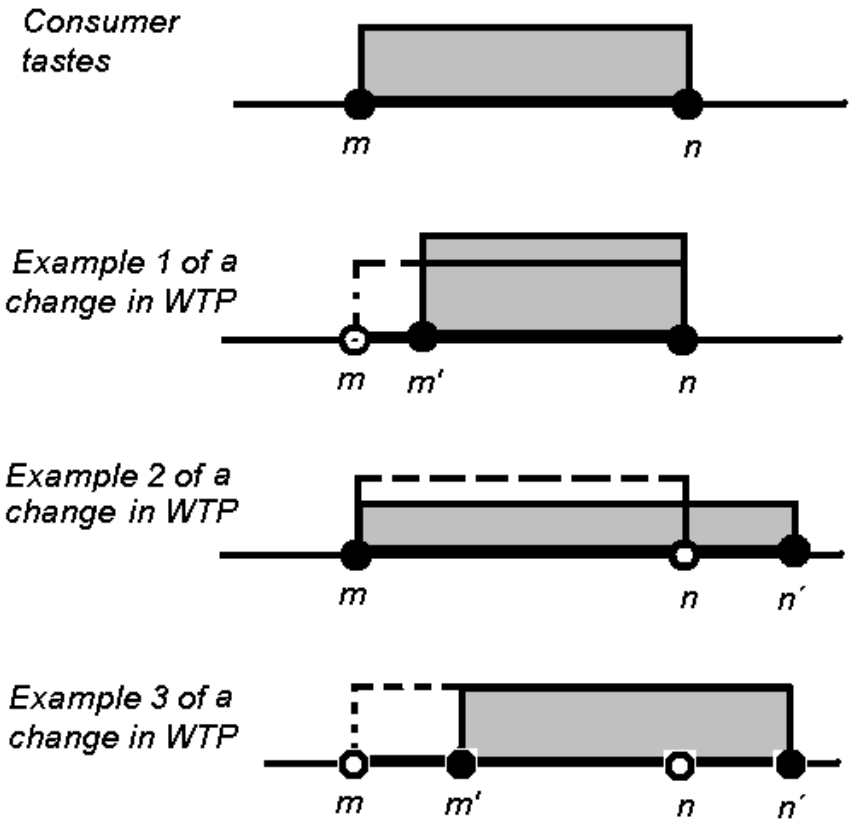

FIGURE 1: Examples of increases in consumers' WTP for socially responsible firms' products.

Similar to Lutz et al. (2000), we assume that the firm's degree of CSR implies a fixed cost which is a convex function of the firm's level of social responsibility as denoted by:

$$C_j(s_j) = \frac{1}{2} k \cdot s_j^2 \tag{2}$$

We consider that firms first choose their level of social responsibility and then their price. We solve the two-stage decision problem following backward induction. Therefore, in all cases, we solve first for firms' pricing decisions and then substitute into firms' profit functions to obtain the subgame perfect equilibrium degrees of social responsibility.

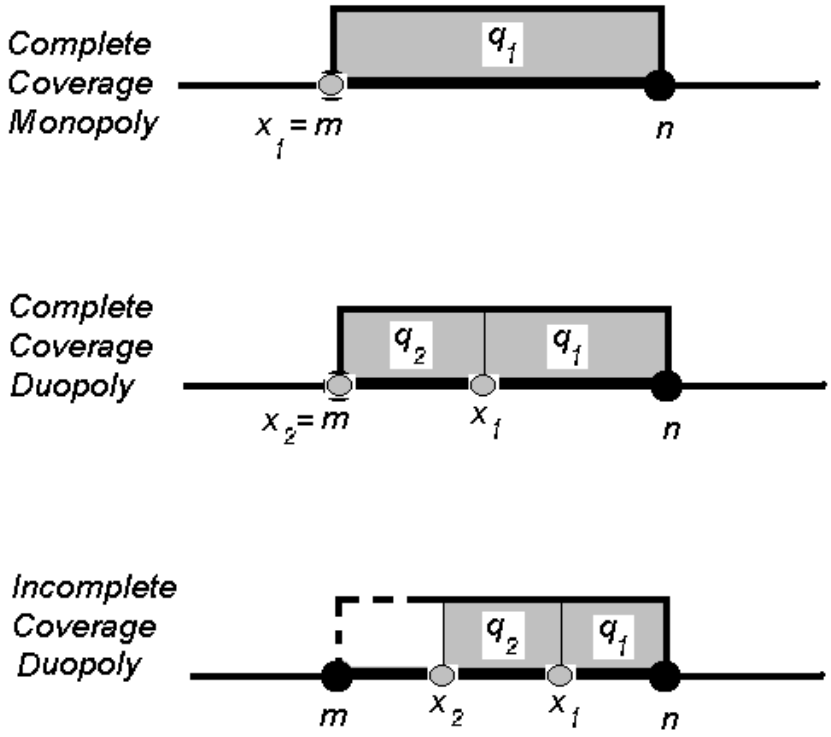

FIGURE 2: Market partitions under the three cases studied.

Regarding the market structure, there are three relevant configurations: 1) *Monopoly with Complete coverage of the market* (for whose magnitudes we use the subscript *MC*), 2) *Duopoly with Complete coverage of the market* (denoted by *DC*), and 3) *Duopoly with Incomplete coverage of the market* (denoted by *DI*). Given that consumers buying the standard product in the competitive market enjoy zero utility, the part of the market which is not covered by the two firms' sales contributes nothing to the social welfare and is equivalent to the case of zero consumption. We analyze each case separately, deriving the conditions under which each one of them will emerge. An asterisk denotes that the expression of a given magnitude corresponds to the subgame perfect equilibrium in each structure. Figure 2 shows each firm's demand under each case.

2.1 Monopoly with Complete coverage of the market (*MC*)

The monopolist will cover the whole market by fixing the maximum price that makes all consumers buy a unit of the product. This price equals the level at which the *least* socially conscious of all consumers values the seller's degree of social responsibility (the one with the minimum v_i):

$$p_{MC} = m \cdot s_{MC} \tag{3}$$

The firm's revenue from selling at this price to the whole market is $r_{MC} = p_{MC} \cdot 1 = m \cdot s_{MC}$. Taking the cost of the firm's level of social responsibility into account, the firm's profit is given by $\pi_{MC} = r_{MC} - C_{MC} = m \cdot s_{MC} - \frac{1}{2} k s_{MC}^2$, which has a single maximum for:

$$s_{MC}^* = m/k \tag{4}$$

At this level of social responsibility the firm's price becomes: $p_{MC}^* = m^2/k$, yielding maximum profits:

$$\pi_{MC}^* = \frac{m^2}{2k} \tag{5}$$

We assume that social welfare is the sum of consumers' utility due to the *feel good* effect from consuming a socially responsible firm's product, *plus* the public good externality due to a firm's CSR, *minus* the associated fixed cost. More detailed discussion of the consequences of our assumptions for social welfare is provided in the appendix. However, it must be noted that assuming a linear relation between a firm's level of CSR and its associated contribution to the public good, is a simplifying but certainly restrictive way of modeling the public good externality as an increasing function of a firm's social responsibility. Nevertheless, our main results on assessing the desirability of changes in the consumers' social responsibility through discontinuous shifts across different market structures do not depend on the aforementioned linearity assumption.

For the monopoly case considered here, given that all consumers buy a unit of the product, and that the firm has adopted the level of social responsibility in (4), social welfare is:

$$SW_{MC}^* = \frac{m+n}{2} s_{MC}^* + s_{MC}^* - \frac{1}{2} k s_{MC}^{*2} = \frac{m(n+2)}{2k} \tag{6}$$

which is an increasing function of both extremes of the distribution of tastes *m* and *n*, whereas the monopolist's choice of social responsible activity level, price and associated profits only depend on the minimum among all valuations of social responsibility in the market. Therefore, the monopolist's interest is, in general, incompatible with social welfare maximization. This is a general property of the market-driven social responsibility studied here, as can be shown by comparison between equilibrium social welfare and the corresponding first best choices (see Appendix B).

It would be reasonable to ask now whether the monopolist would rather leave a part of the market uncovered by raising the price to reach up to a consumer with a valuation of socially responsible sellers' product of $v_o > m$. Such a strategy would reduce its demand below maximal market coverage, yielding a higher profit margin. However, in the presence of a second firm, this will never happen given that the condition for the emergence of the incomplete coverage monopoly case ($n>2m$) coincides with the condition under which the second firm appears with a strictly positive share, equal to the part of the market left uncovered by the monopolist. Hence, the list of cases studied here is complete without the case of an incomplete coverage monopoly.

2.2 Duopoly with Incomplete coverage of the market (*DI*)

Most of the analysis in this case closely follows Motta (1993). However, for the purposes of our analysis, we restate the main results in terms of the parameters *m* and *n*. In this structure, there are two marginal consumers. One, with valuation $x_{1DI} = \left(p_{1DI} - p_{2DI}\right)/\left(s_{1DI} - s_{2DI}\right)$, who is indifferent between the two sellers, and another, with valuation $x_{2DI} = p_{2DI}/s_{2DI}$, who is indifferent between buying from the less socially responsible firm and buying from the competitive market. The two firms' demands are expressed as:

$$q_{1DI} = \left(n - \frac{p_{1DI} - p_{2DI}}{s_{1DI} - s_{2DI}}\right)\left(\frac{1}{n-m}\right) \tag{23}$$

$$q_{2DI} = \left(\frac{p_{1DI} - p_{2DI}}{s_{1DI} - s_{2DI}} - \frac{p_{2DI}}{s_{2DI}} \right) \left(\frac{1}{n-m} \right). \tag{24}$$

Then, the revenues from the price-setting stage are:

$$r_{1DI} = p_{1DI} \cdot \left(n - \frac{p_{1DI} - p_{2DI}}{s_{1DI} - s_{2DI}} \right) \left(\frac{1}{n-m} \right) \tag{25}$$

$$r_{2DI} = p_{2DI} \left(\frac{p_{1DI} - p_{2DI}}{s_{1DI} - s_{2DI}} - \frac{p_{2DI}}{s_{2DI}} \right) \left(\frac{1}{n-m} \right) \tag{26}$$

whose derivatives must be equal to zero for the first order conditions of the Bertrand equilibrium to be satisfied, giving us the equilibrium of the price-setting stage:

$$p_{1DI} = \frac{2ns_{1DI}(s_{1DI} - s_{2DI})}{4s_{1DI} - s_{2DI}} \tag{27}$$

$$p_{2DI} = \frac{ns_{2DI}(s_{1DI} - s_{2DI})}{4s_{1DI} - s_{2DI}} \tag{28}$$

yielding revenues:

$$r_{1DI} = \frac{4n^2 s_{1DI}^2 (s_{1DI} - s_{2DI})}{(n-m)(4s_{1DI} - s_{2DI})^2} \tag{29}$$

$$r_{2DI} = \frac{n^2 s_{1DI} s_{2DI} (s_{1DI} - s_{2DI})}{(n-m)(4s_{1DI} - s_{2DI})^2}. \tag{30}$$

It is straightforward to apply the result shown by Arora and Gangopadhyay (1995) to show that, for each firm, these revenue functions are concave in own levels of engagement with the socially beneficial activity. Also, the positive cross derivatives of equilibrium revenue with respect to the involvement of the rival firm with a socially beneficial activity indicate that social responsibility levels are strategic complements.

Equilibrium in the first stage of the game requires:

$$\frac{\partial \pi_{1DI}}{\partial s_{1DI}} = 0 \Rightarrow \frac{\partial r_{1DI}}{\partial s_{1DI}} = \frac{\partial C_{1DI}}{\partial s_{1DI}} \Rightarrow \frac{4n^2 s_{1DI}(4s_{1DI}^2 - 3s_{1DI}s_{2DI} + 2s_{2DI}^2)}{(n-m)(4s_{1DI} - s_{2DI})^3} = ks_{1DI} \tag{31}$$

$$\frac{\partial \pi_{2DI}}{\partial s_{2DI}} = 0 \Rightarrow \frac{\partial r_{2DI}}{\partial s_{2DI}} = \frac{\partial C_{2DI}}{\partial s_{2DI}} \Rightarrow \frac{n^2 s_{1DI}^2 (4s_{1DI} - 7s_{2DI})}{(n-m)(4s_{1DI} - s_{2DI})^3} = ks_{2DI} \tag{32}$$

whose simultaneous solution gives the equilibrium choices of firms in the first stage of the game. As the aforementioned authors observe, the equilibrium characterized by the solution of the system of (31) and (32) is guaranteed by the concavity of the revenue functions and the convexity of the cost function. We use expressions (31) and (32) in order to obtain an analytical solution for the subgame perfect equilibrium, where the ratio of marginal revenues must be equal to the ratio of marginal costs:

$$\frac{\partial r_{1DI} / \partial s_{1DI}}{\partial r_{2DI} / \partial s_{2DI}} = \frac{4(4s_{1DI}^2 - 3s_{1DI}s_{2DI} + 2s_{2DI}^2)}{s_{1DI}(4s_{1DI} - 7s_{2DI})} = \frac{s_{1DI}}{s_{2DI}} \tag{33}$$

Concerning this equation, Motta (1993) has already pointed out that it has a single real root[7] given by:

$$s_{1DI} = \lambda \cdot s_{2DI}\,, \tag{34}$$

where $\lambda = 5.251233966277267$. Once this relation is used in the solution of the equation in (31), we obtain the subgame perfect equilibrium levels of social responsibility:

$$s_{1DI}^{*} = \frac{\lambda^3 n^2 (4\lambda - 7)}{k(n-m)(4\lambda - 1)^3} \tag{35}$$

$$s_{2DI}^{*} = \frac{\lambda^2 n^2 (4\lambda - 7)}{k(n-m)(4\lambda - 1)^3}. \tag{36}$$

With these levels of social responsibility chosen in the subgame perfect equilibrium of the game, equilibrium prices become:

$$p_{1DI}^{*} = \frac{2\lambda^3 n^3 (4\lambda - 7)(\lambda - 1)}{k(n-m)(4\lambda - 1)^4} \tag{37}$$

$$p_{2DI}^{*} = \frac{\lambda^2 n^3 (4\lambda - 7)(\lambda - 1)}{k(n-m)(4\lambda - 1)^4}. \tag{38}$$

For these social responsibility levels and prices, firms' shares are defined by the two marginal consumers' conditions on the [*m*, *n*] interval:

$$x_{1DI}^{*} = \frac{(2\lambda - 1)n}{4\lambda - 1} \tag{39}$$

$$x_{2DI}^{*} = \frac{(\lambda - 1)n}{4\lambda - 1} \tag{40}$$

which guarantees that for all positive values of n and non negative values of m the former is higher than the latter and that the higher boundary never exceeds n. However, the other restriction for this structure to emerge is satisfied if: $x_{2DI}^{*} \geq m \Rightarrow n \geq 4.705677463013651$.

In the subgame perfect equilibrium characterized here, both firms' profits are positive and those earned by the more socially responsible firm are higher than the profits of the less socially responsible one as indicated by:

$$\pi_{1DI}^{*} = \frac{\lambda^4 n^4 (4\lambda - 7) \cdot \left[8 \cdot (\lambda - 1) \cdot (4\lambda - 1) - \lambda^2 \cdot (4\lambda - 7)\right]}{2k(4\lambda - 1)^6 (n - m)^2} = \frac{n^4 \cdot 0.0244386}{k(n - m)^2} \tag{41}$$

$$\pi_{2DI}^{*} = \frac{\lambda^3 n^4 (4\lambda - 7) \cdot \left[2 \cdot (\lambda - 1) \cdot (4\lambda - 1) - \lambda \cdot (4\lambda - 7)\right]}{2k(4\lambda - 1)^6 (n - m)^2} = \frac{n^4 \cdot 0.00152741}{k(n - m)^2} \tag{42}$$

Finally, the social welfare corresponding to equilibrium behavior under this market structure is given by:

$$\begin{aligned} SW_{DI}^{*} &= \int_{x_1}^{n} \nu \cdot s_{1DI}^{*} \cdot d\nu + \int_{x_2}^{x_1} \nu \cdot s_{2DI}^{*} \cdot d\nu + s_{1DI}^{*} + s_{2DI}^{*} - \frac{1}{2} k\left(s_{1DI}^{*2} + s_{2DI}^{*2}\right) = \\ &= \frac{n^2}{(n - m)k}\left(\frac{0.0691842 \cdot n^2}{n - m} + 0.30155\right) \end{aligned} \tag{43}$$

At this stage, it is helpful to summarize the conditions under which each one of the three market structures will emerge. Figure 3 gives a representation of the three conditions.

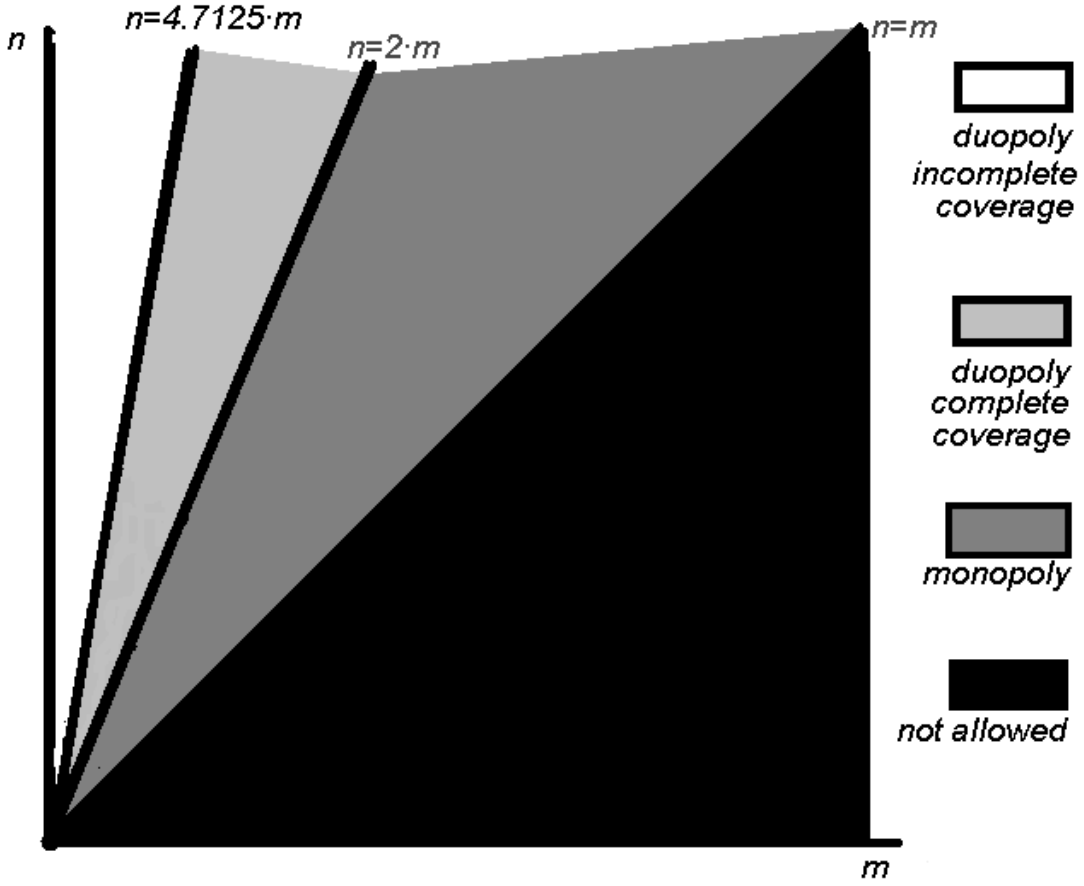

FIGURE 3: Equilibrium market structures.

2.3 Duopoly with Complete coverage of the market and Corner pricing (*DC*)

In this case, the two firms *1* and *2* are active in the market, with a strictly positive market share each. Previous studies by Ronnen (1991), Arora and Gangopadhyay (1995) and Lehmann-Grube (1997) have presented the main results obtained in this case. Below, we restate the solutions in terms of the taste parameters *m* and *n*.

Without loss of generality, we consider that one of the two firms chooses a higher degree of CSR than the other: $s_{1DC} > s_{2DC}$.[6] Then, for any pair of prices $p_{1DC} > p_{2DC}$, leading to this market structure, there will be a consumer whose valuation of his supplier's level of social responsibility will make him indifferent between the more responsible firm which charges a higher price and the less responsible firm charging a lower price. This marginal consumer's valuation is $x_{1DC} = (p_{1DC} - p_{2DC})/(s_{1DC} - s_{2DC})$. We can write each firm's quota on the [*m*, *n*]

segment as $d_{1DC} = n - x_{1DC}$ and $d_{2DC} = x_{1DC} - m$, which, when multiplied by the consumer density *d=1/(n-m)* give us, respectively, each firm's demand:

$$q_{1DC} = \left(n - \frac{p_{1DC} - p_{2DC}}{s_{1DC} - s_{2DC}} \right) \left(\frac{1}{n-m} \right) \tag{7}$$

$$q_{2DC} = \left(\frac{p_{1DC} - p_{2DC}}{s_{1DC} - s_{2DC}} - m \right) \left(\frac{1}{n-m} \right). \tag{8}$$

We use expressions (7) and (8) to write the two firms' revenue functions which are relevant for the decisions of firms in the price setting stage of the game:

$$r_{1DC} = p_{1DC} \left(n - \frac{p_{1DC} - p_{2DC}}{s_{1DC} - s_{2DC}} \right) \left(\frac{1}{n-m} \right) \tag{9}$$

$$r_{2DC} = p_{2DC} \left(\frac{p_{1DC} - p_{2DC}}{s_{1DC} - s_{2DC}} - m \right) \left(\frac{1}{n-m} \right). \tag{10}$$

From the derivative of each one of these expressions with respect to the corresponding firm's price, we obtain the first order conditions for the equilibrium prices in the second stage of the game, whose solution gives equilibrium prices:

$$p_{1DC} = \frac{(2n-m)(s_{1DC} - s_{2DC})}{3} \tag{11}$$

$$p_{2DC} = \frac{(n-2m)(s_{1DC} - s_{2DC})}{3}. \tag{12}$$

The pair of equilibrium prices reveals that the choice of the same level of social responsibility would drive the price down to the competitive level, yielding zero profits to both firms. Also, from (12) we see that *n* must exceed *2m* in order for the second firm's price to exceed the competitive price $p = 0$, which also guarantees that the second firm's quantity is positive. Otherwise, as we mentioned in the previous subsection, the first firm will act as a monopolist covering the whole market.

Substituting the equilibrium prices obtained above, we can obtain the revenues of the two firms from the price-setting stage of the game:

$$r_{1DC} = \frac{(s_{1DC} - s_{2DC})(2n-m)^2}{9(n-m)} \tag{13}$$

$$r_{2DC} = \frac{(s_{1DC} - s_{2DC})(n-2m)^2}{9(n-m)}. \tag{14}$$

In the space of values of *m* and *n* for which both firms' equilibrium prices and quantities are non negative (that is, $n \geq 2m$), thus guaranteeing that this structure does not collapse to the case of monopoly with complete market coverage, these expressions have a straightforward property:

$$\frac{\partial r_{1DC}}{\partial s_{1DC}} = \frac{(2n-m)^2}{9(n-m)} \tag{15}$$

$$\frac{\partial r_{2DC}}{\partial s_{2DC}} = -\frac{(n-2m)^2}{9(n-m)}. \tag{16}$$

A well known property of the model is that, due to the negative sign of (16), even in the absence of any cost associated with the firm's choice of a socially responsible profile, the second firm will choose not to be a socially responsible one. Then, the only price that it can sustain in equilibrium is the competitive price, $p^*_{2DC} = 0$. Also, from the positive sign of (15), if the choice of a socially responsible profile were costless, the first firm would adopt the most socially responsible profile available. But with the convex cost associated with a firm's degree of social responsibility, an interior choice will be optimal as indicated by:

$$\pi_{1DC} = r_{1DC} - C_{1DC} = \frac{(s_{1DC} - s_{2DC})(2n-m)^2}{9(n-m)} - \frac{1}{2}k \cdot s_{1DC}^2 \Rightarrow \frac{\partial \pi_{1DC}}{\partial s_{1DC}} = 0 \Rightarrow s^*_{1DC} = \frac{(2n-m)^2}{9k(n-m)} \tag{17}$$

leading to the adoption of the price:

$$p^*_{1DC} = \frac{(2n-m)^3}{27k(n-m)} \tag{18}$$

This means that the socially responsible firm's demand is

$$q^*_{1DC} = \frac{m+n}{3(n-m)} \tag{19}$$

because the firm sells to consumers whose valuation of the socially responsible profile of the firms are in the interval [(*n*-*m*)/3 , *n*], while the remaining consumer population,

$$q_{2DC}^{*} = \frac{2(n-2m)}{3(n-m)} \tag{20}$$

buys the product from the second firm at the competitive price. While the competitive price yields the second firm zero profits, the socially responsible firm earns:

$$\pi_{1DC}^{*} = \frac{(2n-m)^4}{162k(n-m)^2}. \tag{21}$$

In this case, the social welfare corresponding to this equilibrium is

$$SW_{DC}^{*} = \frac{1}{n-m}\int_{\frac{2n-m}{3}}^{n} vs_{1DC}^{*}dv + s_{1DC}^{*} - \frac{1}{2}ks_{1DC}^{*2} = \frac{(2n-m)^2\left[n(18+n)+m(8n-18)-2m^2\right]}{162k(n-m)^2} \tag{22}$$

The full coverage duopolistic structure has been studied under the assumption that the second firm cannot further raise its degree of social responsibility in order to set a higher price than the competitive one. This would imply leaving unserved some consumers with low valuations of the social responsibility aspect. This is analyzed in the following subsection.

3. Welfare effects and profitability of changes in the consumer's social responsibility

In this section, we present the main results of our analysis. We are interested in assessing the profitability and welfare consequences of changes in the consumer's WTP for a socially responsible firm's products. We undertake this task, considering infinitesimal increases of *m* or *n,* which either leave the equilibrium market structure unchanged, or they shift the industry from one configuration to an "adjacent" one.

Regarding the *profitability* of increases in the consumer's social responsibility, we show that Propositions 1.1 and 1.2 hold (proofs are given in the appendix):

> ***Proposition 1.1:*** *In any of the two duopolistic structures, infinitesimal increases in m or n, which do not affect the industry structure, are profitable for any firm, which in equilibrium adopts a positive level of social responsibility (both firms in DI and firm 1 in DC). However, in DI, firms prefer heterogeneity-reducing changes to heterogeneity-*

enhancing ones, while the socially responsible firm in DC prefers the opposite. Also, in the monopoly case, the firm benefits only from increases in m (heterogeneity-reducing ones), whereas it remains indifferent towards changes in n.

Proposition 1.2: *Infinitesimal changes in the consumer's social responsibility which shift the industry across "adjacent" industry structures, are profitable for:*

i) *firm 1, if the market moves from DI to DC and from DC to MC.*

ii) *firm 2, if the market moves to DI.*

Concerning the *welfare* consequences of increases in the consumer's social responsibility, we show that propositions 2.1 and 2.2 hold (proofs in the appendix):

Proposition 2.1: *Provided that the industry structure is not affected, infinitesimal increases of either m or n are welfare improving in all industry structures considered. In all cases, social welfare increases more by heterogeneity-decreasing changes than by heterogeneity enhancing ones.*

Proposition 2.2: *When an infinitesimal change in the consumer's social responsibility shifts the industry across "adjacent" industry structures, social welfare exhibits discontinuous jumps downwards as we move from DC to DI, as long as m and n tend to points lying on the segment defined by (0, 0) and (0.5051411976895118, 2.37031079556). Social welfare is enhanced in a continuous way by increases in m (n), if the industry structure shifts from DC to MC (MC to DC).*

The main intuition behind these results is that, generally speaking, increasing the consumer's WTP for a socially responsible manufacturer's products can be beneficial for socially responsible sellers and the society as a whole. However, not all types of increases in consumers' social responsibility intensify the incentives for a firm to engage in socially beneficial activities. Furthermore, not all types of increases in the consumer's social consciousness are equally attractive to the two manufacturers and the society. For example, in *MC*, the firm would only benefit from increases in the least socially responsible consumers'

awareness WTP while, as a duopolist, it would benefit from both heterogeneity-enhancing and heterogeneity-reducing changes, although it would prefer the former over the latter. In both structures with complete coverage of the market, the second firm earns zero profits. Thus, the second firm remains indifferent towards all types of changes, except for those leading to *DI*. Once this structure emerges in equilibrium, all agents' interests with respect to *m* and *n* are compatible.

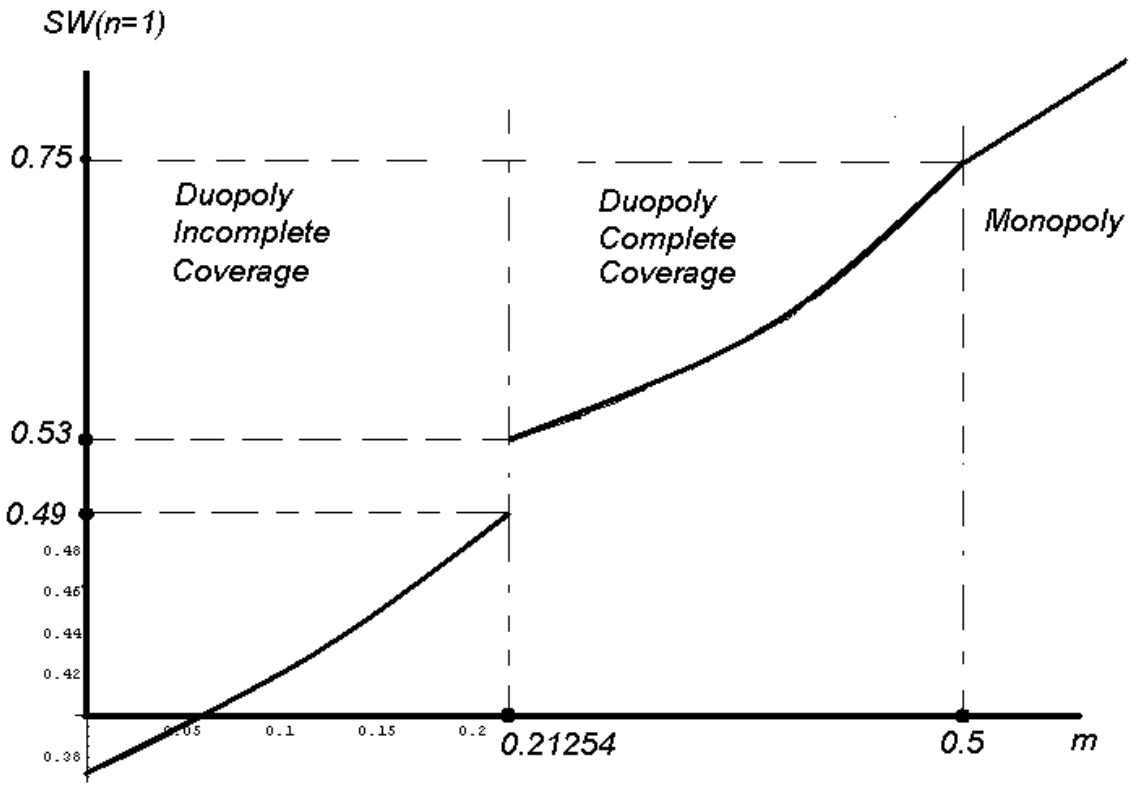

FIGURE 4: Social Welfare as a function of *m* for *n=1*.

Let us focus on the two cases mentioned in Proposition 2.2. As a general rule, we see that heterogeneity-enhancing increases in the consumers' social responsibility favor the entry of a second firm and, eventually, incomplete coverage of the market. On the contrary, heterogeneity-reducing changes go into the opposite direction leading, in the margin, to the monopolization of the market. Figures 4-7 show us the behavior of equilibrium social welfare with respect to *m* and *n*. In particular, Figures 4 and 7 correspond to discontinuous but

monotonic increases of social welfare with respect to both types of increases in the consumer's social responsibility. On the contrary, Figures 5 and 6 depict the case in which either heterogeneity-reducing or heterogeneity-enhancing increases in the consumer's WTP for socially responsible firms' products may reduce social welfare. As formally stated in Proposition 2.2, this happens following the shift from the Incomplete coverage Duopoly structure to the Complete coverage one (Figure 5) after some heterogeneity-reducing change, or due to the opposite shift (Figure 6) in the heterogeneity-enhancing case.

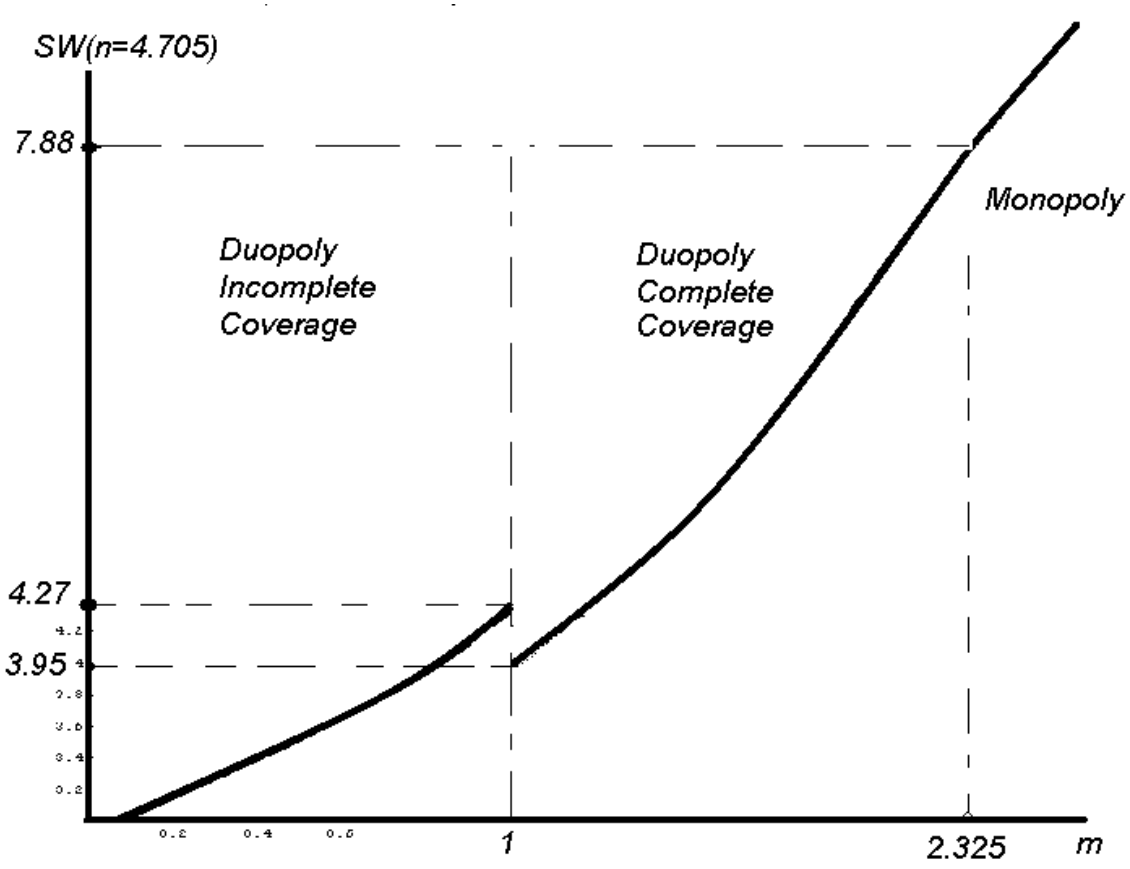

FIGURE 5: Social Welfare as a function of *m* for *n=4.705*.

Therefore, the most systematic divergence between private and public interests is observed when an increase in the consumer's social consciousness causes the market structure to change. Specifically, combined with proposition 1.2, the examples depicted in Figures 4-7 indicate that there are several kinds of incompatibility of interests among the agents considered in our model. Figure 4 depicts the case of a globally welfare-enhancing increase in *m*, causing

the market structure to change from *DI* to *DC*, which, following proposition 1.2, is harmful for firm 2 and profitable for firm 1. On the contrary, Figure 5 depicts the case in which an increase in *m* may reduce social welfare if it causes the market structure to shift from *DI* to *DC*. This would also be harmful for firm 2 (not firm 1). Figure 6 corresponds to an example in which an increase in *n* may reduce welfare, if it causes the market structure to shift from *DC* to *DI*. Such a change would also be harmful for firm 1 (not firm 2). On the contrary, Figure 7 corresponds to a case of a globally welfare-improving increase in *n*, which would also benefit firm 2 (not firm 1) as we move from *DC* to *DI*.

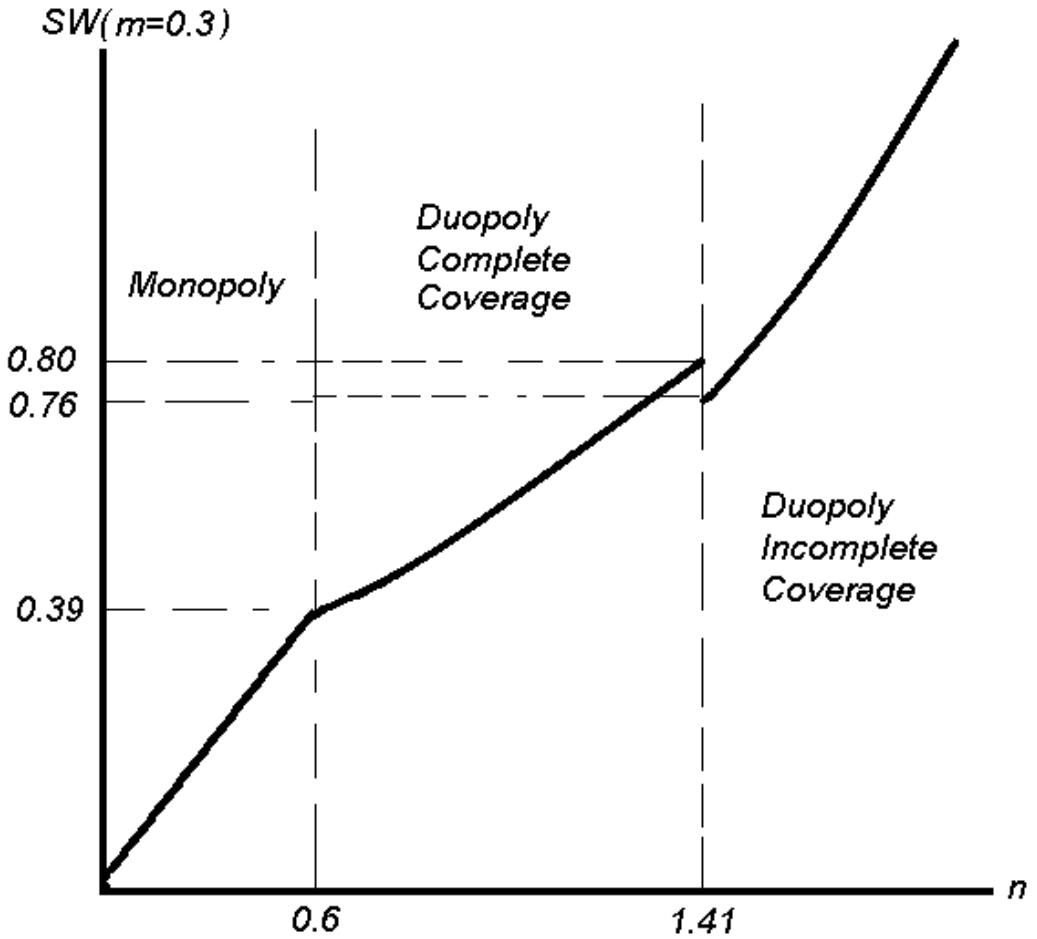

FIGURE 6: Social Welfare as a function of *n* for *m=0.3*.

Some further discussion is necessary on the intuition behind the welfare-reducing cases depicted in Figures 5 and 6. The heterogeneity-reducing increase in consumers' social responsibility presented in Figure 5 corresponds to a discontinuous jump from incomplete to

complete market coverage duopoly. The decrease in welfare is the result of the effect of this structure on the incentives for firms to contribute to the public good. Remember that in the complete coverage duopoly case, firm 1 is the only one choosing to be socially responsible. This leads to an overall reduction in both firms' (due to strategic complementarity) contribution to the public good, leading to a decrease in social welfare. The case depicted in Figure 6 corresponds to a discontinuous jump from complete to incomplete market coverage. Thus, the decrease in social welfare is due to the utility loss from incomplete coverage of the market. In this case, a heterogeneity-enhancing increase in consumers' social responsibility increases the two firms' incentives to invest in CSR in order to differentiate from each other, but this also increases their incentives to set higher prices leaving uncovered a part of the market.

The two welfare-reducing effects depicted in Figures 5 and 6 are also present in the cases represented in Figures 4 and 7, respectively. However, the values of n (Figure 4) and m (Figure 7) are such that the expected welfare-enhancing effect of increasing the consumer's social awareness prevails. An interesting property of our model, also reflected on the figures and formally proved in the appendix, is that the transition from monopoly to complete coverage duopoly does not induce any discontinuous jump in equilibrium welfare. Therefore, increases in the consumers' social responsibility which cause the market structure to shift from one of these cases to the other, are unambiguously welfare-enhancing. Finally, note that in each one of the two welfare-reducing cases in Figures 5 and 6, one of the two firms (firm 1 in the former and firm 2 in the latter) is better off. An important implication of this result is that there will always be a private agent who can benefit from a welfare-reducing increase in the consumers' social responsibility.

These findings should not be mistakenly interpreted as a trivial consequence of the fact that the differentiation motive does not provide the right incentives for the private providers of a public good to adopt the socially optimal provision levels. This point is discussed in detail in Appendix B and the main intuition behind it is the fact that the differentiation motive leads the two firms to adopt different levels of CSR from each other, whereas the first best solution is

symmetric with respect to *s*. Here, rather than a comparison between first and second best solutions, our findings concern the comparative statics of market equilibrium under different types of increase in the consumer's social consciousness. Our general policy recommendation is that increasing the consumer's social consciousness should not be seen as a globally desirable objective to aim at.

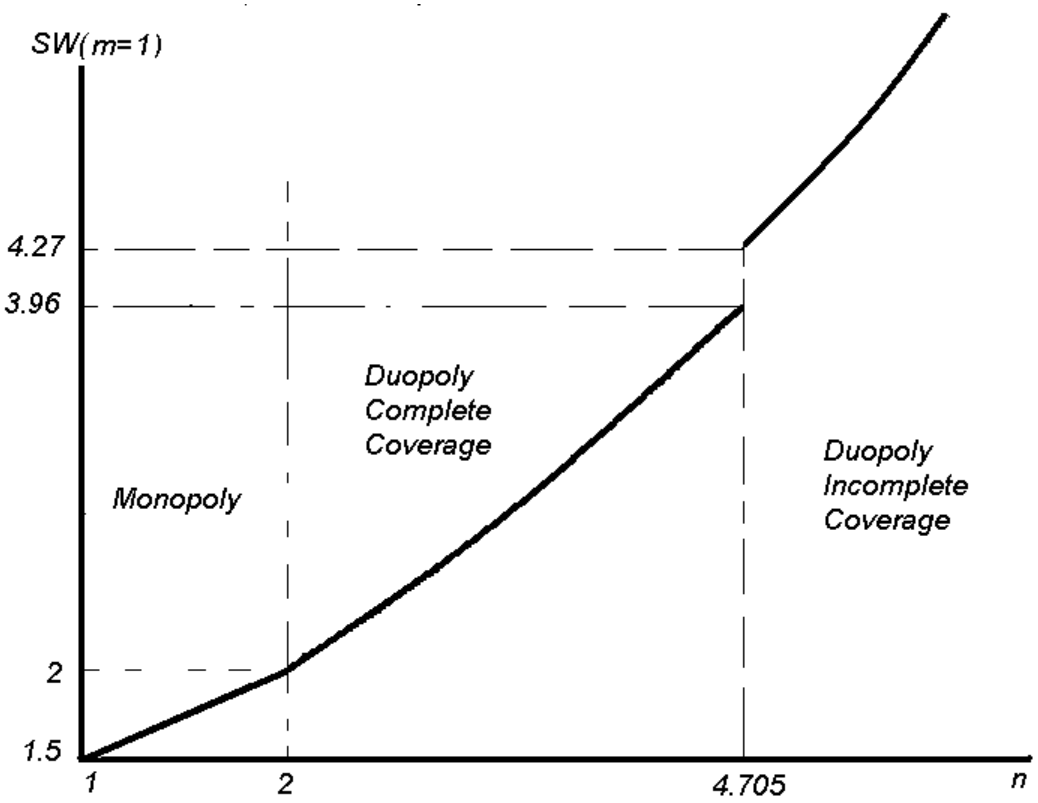

FIGURE 7: Social Welfare as a function of *n* for *m=1*.

4. Conclusions

Our theoretical framework explains corporate social responsibility as a costly differentiation strategy. Consumers are heterogeneous in their reservation prices for a marginal increase in their supplier's commitment to socially beneficial action, like the protection of the natural environment. We pay special attention to the impact of changes in consumers' social

responsibility on consumer heterogeneity and on the market outcome. As one would expect, we find that, ceteris paribus, a socially responsible producer benefits from selling to a market with more responsible consumers. Interestingly, we find that firms with lower degrees of social responsibility may also benefit from selling to a market with more socially responsible consumers.

Despite its similarity with income increases, raising the consumer's WTP for the products of socially responsible firms is far from a trivial equivalent to 'throwing money into the market'. This is especially true when increases in the WTP for socially responsible firms' products cause the market structure to change. The main message of our analysis is that increasing the consumer's WTP for the products of socially responsible firms is not monotonically beneficial, neither to the society nor to socially responsible entrepreneurs.

Our analysis is appropriate for assessing the private profitability and social welfare effects of exogenous factors, which are perceived in different ways by consumers with different attitudes towards social issues. A rather generic result concerns the fact that, in most cases, changes in consumers' WTP that are privately profitable are not necessarily the most desirable in terms of social welfare. In fact, it is neither easy to obtain interest compatibility between competing manufacturers nor compatibility between private profitability and social welfare. An apparently counterintuitive result emerging from the similarity between consumer heterogeneity and product differentiation is that, even the less socially responsible manufacturer may find it profitable to sell to a more socially responsible consumer population.

A straightforward policy implication of our results is that, while privately profitable campaigns should not be generally considered to be socially undesirable, the opposite cannot be guaranteed either. In other words, only campaigns carefully designed as welfare-enhancing devices, should be trusted by the society as a whole. Otherwise, the existence of privately profitable but potentially welfare-reducing consumer-awareness messages seems to be a non-negligible threat for modern markets. On one hand, heterogeneity-enhancing campaigns inducing jumps from complete to incomplete market coverage may be welfare-reducing due to

utility loss from unserved consumers. On the other hand, heterogeneity-reducing campaigns yielding jumps from incomplete to complete market coverage may decrease welfare because of reduced incentives for firms to contribute to the public good. In each one of these welfare-reducing cases, one of the two firms is better off, illustrating the incompatibility between private and public interests.

Although we would not like to exaggerate the possibilities of state intervention in such detailed qualitative aspects of social trends and targeted awareness campaigns, it should be clear that firms' attempts of providing the consumer with more information on the quality of their products and their corporate strategies regarding socially desirable objectives should be challenged against our main finding concerning the incompatibility of private and social interests.

As Comanor and Wilson (1979) have already pointed out, advertising undertaken by firms may increase the consumers' WTP for a more expensive product and relax price competition. This unambiguous result concerning the relation between changes in WTP and market power becomes less easy to apply by policy makers in the real world, if the effect of those changes on consumer preferences and the resulting utility is taken into account.[8] That is, more information about a firm's social objectives may result in higher prices, but people paying higher prices for those products may be happier because this information makes them like the products they consume more. Then, the comparison of *pre-* and *post*-information prices under the assumption that *pre-* and *post*-information products are essentially the same may yield misleading conclusions. It would seem that, when markets have an externality on a public good like the environment, which can be objectively evaluated in terms of social welfare, the effects of changes in the consumers' WTP become easier to assess. Contrary to this conjecture, we find that the same factors that increase the consumer's WTP for the product of a socially responsible manufacturer may change the industry structure and reduce social welfare.

Different approaches to the aspects of CSR omitted here are discussed in Windsor (2006) and Baron (2007). The robustness of our results with respect to further generalizations,

like non total-mass-preserving changes in the distribution of consumer tastes, and the numerous applications of this very simple framework to study other issues related with changing the consumers' attitude towards quality, leave a lot of space for future research.

End Notes

1. For example, Camacho et al. (2004) compare revealed and hypothetical/stated measures of the consumer's higher WTP for a recyclable office table as compared with the standard (non-recyclable) variety. They find that survey data are a good predictor of a consumer's median WTP for an improvement in the environmental performance of a marketed good.

2. Pham and Rambo (2003), Harris (2006), Suzuki et al. (2004) and Tsagarakis and Georgantzís (2002) use very different approaches to document the increasing trend of ecological consciousness in four different countries: Vietnam, China, Japan and Greece, respectively. In fact, the last two explicitly deal with the role of information as a means of increasing people's willingness to accept costlier options favoring environmentally friendlier market outcomes.

3. Explicit references to the existence and the causes of such heterogeneity can be found, for example, in Blamey (1997) where willingness to pay depends on personal attributes like awareness of environmental need, consequences of and responsibility for personal action and acceptance of policy initiatives. Loureiro and Lotade (2005) identify different factors that may be responsible for heterogeneous valuations of products with an eco-label. At a theoretical level, Nyborg's (2000) framework could be used to explain different levels of social consciousness as different combinations of *homo oeconomicus* and *homo politicus* in the consumers' utility functions.

4. Due to their focus on environmental quality standards, taxes and subsidies, these papers are rather weakly related to our main argument concerning the role of changes in consumers' WTP. Nevertheless, due to the similarity between ours and their underlying theoretical frameworks, it is worth mentioning the studies by Constantatos and Sartzetakis (1999) on environmental taxes, Motta and Thisse (1999) on environmental quality standards and Nadaï and Morel (1999) on eco-labeling. Recently, Innes (2006) used a product differentiation model, which is similar to ours to address the issue of consumer boycotts. Apart from Conrad's (2005) model, Deltas et al. (2004) also develop a horizontal differentiation model with some vertical differentiation flavor, but as stated before both papers' objectives are different to that pursued here. On the standard policy instruments, Lyon and Maxwell (2002) provide a very insightful overview with special emphasis on the existing empirical findings and Lutz et al. (2000) who use a fairly general vertical product differentiation framework to show that if the high quality firm can commit to a quality level before regulations are promulgated, it induces the regulator to weaken standards, and

welfare falls. This last study highlights the dangers of lengthy delays between legislative mandates for new regulations and their implementation. The key difference between their model and earlier models of minimum quality standards (like Arora and Gangopadhyay, 1995) is the timing of firm and government actions: now the high-quality firm has the leadership role. Finally, Crampes and Hollander (1995) rule out sunk costs and show that a low-quality producer benefits from a mildly restrictive quality standard whereas a high-quality producer suffers from it. Consumers' welfare increases if the firm producing the higher quality does not increase its quality significantly in response to the increase in quality by its rival.

5. Market effects of changes in the distribution of consumer types have been studied by von der Fehr and Stevik (1998) and Bloch and Manceau (1999). However, these papers study persuasive advertising in the context of horizontal differentiation.

6. Arora and Gangopadhyay (1995) give a detailed proof why firms will never choose $s_1=s_2$, which also holds in our case.

7. And two imaginary ones given by $s_{1DI} = 0.249383 \pm 0.564509i$. A *Mathematica* program computing these roots is available upon request.

8. Becker and Murphy (1993) analyze advertising as a product jointly sold together with other conventional products, suggesting that a changing tastes framework is not necessary in order to explain changes in consumers' attitudes towards advertised products.

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Appendix A. Proofs of Propositions 1.1, 1.2, 2.1, 2.2

We provide here the proofs of the main results.

Proof of Proposition 1.1: In the monopoly and the complete coverage duopoly cases only firm *1* earns positive profits. From expression (5) we get $\frac{\partial \pi_{MC}}{\partial m} = \frac{m}{k}$, while $\frac{\partial \pi_{MC}}{\partial n} = 0$, which indicate that the monopolist only benefits from increases in the least social responsible consumer's willingness to pay. In the duopoly with complete market coverage, the derivatives $\frac{\partial \pi_{1DC}}{\partial m} = \frac{(2n-m)^3 m}{(n-m)^3 81k}$ and $\frac{\partial \pi_{1DC}}{\partial n} = \frac{(2n-m)^3 (2n-3m)}{(n-m)^3 81k}$ show that the socially responsible firm benefits from both types of increases in the consumers' WTP: those decreasing and those increasing consumer heterogeneity, although the latter benefit the firm more given that the second of these derivatives is strictly higher than the first one in the relevant range of parameters ($n > 2m$). Finally, in the incomplete coverage duopoly case, both firms' profits are affected by changes in *n* and *m*. Apart from firm specific parameters in expressions (41) and (42), the sign and size of the derivatives of profits with respect to *n* and *m* behave in the same way as $\frac{\partial \left(n^4/(n-m)^2\right)}{\partial m} = \frac{2n^4}{(n-m)^3}$ and $\frac{\partial \left(n^4/(n-m)^2\right)}{\partial n} = \frac{2n^3(n-2m)}{(n-m)^3}$, which indicate that both firms benefit from both types of increases, although they prefer heterogeneity reducing ones (those affecting *m*). ■

***Proof of Proposition 1.2*:** We turn to changes in *m* and *n* causing the industry structure to change. First, some straightforward observations are in order. Firm 2 has a clear preference for the incomplete duopoly case, since it is the only one in which it invests in a strictly positive level of social responsibility, earning positive profits. In *DC*, this firm covers a part of the market, but its zero investment in socially beneficial activities drives its price down to the competitive level and its profits to zero. In the monopoly case, the second firm is left with zero output and profits. Preferences for firm *1* over industry configurations follow the inverse order, with the monopoly being the most preferred structure, whereas the incomplete coverage

duopoly is the least preferred market configuration. In fact, the transition from *DC* to *MC* involves no discontinuous "jumps" (see Figures 4-7) as can be shown by the limit of firm *1*'s profits in the *DC* case which tends to the monopolist's profits as *n* approaches *2m*: $\lim_{n\to 2m} \pi_{1DC} = \frac{(2n-m)^4}{162k(n-m)^2} = \frac{m^2}{2k} = \pi_{MC}$ (see expressions (5) and (21)). In an analogous way, we calculate the limits of firm *1*'s profit in (21) and (41) as *n* approaches the boundary condition separating the complete and incomplete duopoly cases. Here we find a discontinuous "jump" upwards of the firm's profit as we switch from the incomplete to the complete coverage duopoly case, as can be shown from the inequality:

$$\lim_{n\to 4.7056765174333m} \pi_{1DC} = \frac{2.25016m^2}{k} > \lim_{n\to 4.7056765174333m} \pi_{1DI} = \frac{0.87269m^2}{k}. \blacksquare$$

***Proof of Proposition 2.1*:** We compute the derivatives $\frac{\partial SW^*_{MC}}{\partial n}$, $\frac{\partial SW^*_{MC}}{\partial m}$, $\frac{\partial SW^*_{DC}}{\partial n}$, $\frac{\partial SW^*_{DC}}{\partial m}$, $\frac{\partial SW^*_{IC}}{\partial n}$ and $\frac{\partial SW^*_{IC}}{\partial m}$. In the monopoly case, it is straightforward that $\frac{\partial SW^*_{MC}}{\partial n} = \frac{m}{2k} > 0$ and $\frac{\partial SW^*_{MC}}{\partial m} = \frac{n+2}{2k} > 0$ for all positive *n*, *m*. Also, from $\frac{n+2}{2k} > \frac{m}{2k}$, note that increases in *m* have a strictly higher impact on social welfare than increases in *n*. Therefore, heterogeneity-reducing increases in the consumer's social responsibility are socially preferable to heterogeneity enhancing ones. For the case of a duopoly with incomplete coverage, we focus on the behavior of the term $\frac{n^2}{n-m}$ in expression (43), with respect to *m* and *n.* Observe that it is increasing in both taste parameters. Indeed, $\frac{\partial\left(\frac{n^2}{n-m}\right)}{\partial m} = \frac{n^2}{(n-m)^2} > 0$, $\frac{\partial\left(\frac{n^2}{n-m}\right)}{\partial n} = \frac{n(n-2m)}{(n-m)^2} > 0$ and. Also, note that $\frac{n^2}{(n-m)^2} > \frac{n(n-2m)}{(n-m)^2}$ for all positive

values of *m*, which indicates that social welfare is enhanced more rapidly by increases in the least socially responsible consumers' WTP, than in the most socially responsible one's. Finally, we study the sign of:

$$\frac{\partial SW_{DC}^{*}}{\partial n}=\frac{(2n-m)\left(27m^{2}+6m^{3}-45mn-19m^{2}n+18n^{2}+4mn^{2}+2n^{3}\right)}{81k(n-m)^{3}}$$ which, given the restriction $n\in[2m,4.7056765174333m]$, coincides with the sign of the term $27m^{2}+6m^{3}-45mn-19m^{2}n+18n^{2}+4mn^{2}+2n^{3}$ whose equality with zero gives an equation with only imaginary roots within the aforementioned interval of *n*. Arbitrary values of *m* and *n* (say, 1 and 3, respectively) give a positive sign for the derivative which, given the lack of real roots, does not change within the relevant range of parameters. Similarly, the sign of:

$$\frac{\partial SW_{DC}^{*}}{\partial m}=\frac{2m^{4}+18n^{4}-3m^{3}(4n-3)+3m^{2}n(8n-9)-mn^{2}(25n-18)}{81k(n-m)^{3}}$$ is positive in the range of parameters considered, since the equation $\frac{\partial SW_{DC}^{*}}{\partial m}=0$ has only two real roots: $m=2n$, and

$$m=\frac{1}{6}\left(-9+8n+\frac{81-90n+16n^{2}}{\sqrt[3]{-729+1215n-432n^{2}+422n^{3}+9\sqrt{3n^{2}\left(-729-972n+3132n^{2}-1216n^{3}+716n^{4}\right)}}}\right)+$$
$$+\frac{1}{6}\cdot\sqrt[3]{-729+1215n-432n^{2}+422n^{3}+9\sqrt{3n^{2}\left(-729-972n+3132n^{2}-1216n^{3}+716n^{4}\right)}}$$

both lying outside the interval of *m* satisfying $n\in[2m,4.7056765174333m]$. Thus, the sign of the derivative studied here remains unchanged in the area of relevant values. An arbitrary pair of values for *m* and *n* from the interval permitted (say 1 and 3, respectively) give a positive sign for the derivative.■

***Proof of Proposition 2.2*:** To assess the social desirability of changes in consumers' social responsibility that affect the industry structure, we check the limits of expressions (6) and (21) as *n* approaches the boundary condition separating the *MC* and *DC* cases. In an analogous way,

we check the limits of expressions (22) and (43) as n approaches the boundary condition separating the *DC* and *DI* cases. First, like in the case of firm *1*'s profits, it can be easily checked that social welfare behaves in a continuous way around the boundary condition $n = 2m$, that is, as we move from *DC* to *MC* and vice versa. This is due to the equality between $\lim_{n\to 2m} SW^*_{MC} = \frac{m(1+m)}{k}$ and $\lim_{n\to 2m} SW^*_{DC} = \frac{m(1+m)}{k}$. This is not the case for the social welfare around the boundary condition n= 4.7056765174333m separating the two duopoly cases. Furthermore, "the jump from one case to the other" does not have an ambiguous effect on social welfare. This can be shown by solving $\lim_{n\to 4.7056765174333m} SW^*_{DI} = \lim_{n\to 4.7056765174333m} SW^*_{DC}$ with respect to m, which has a unique positive real root for m=0.5051411976895118. Therefore, the point (m^*, n^*) = (0.5051411976895118, 2.3703107955668) defines two subspaces along the n= 4.7056765174333m line across which switching from incomplete to complete coverage duopolies has either a positive (from (m^*, n^*) towards the beginning of the axes) or a negative (from (m^*, n^*) outwards) effect on social welfare. ■

Appendix B. Social Welfare Analysis: First Best vs. Equilibrium

We briefly discuss here the implications of our framework regarding social welfare in the first best and second best solutions. Technical details concerning the derivation of these results are available upon request.

The First Best Solution: Consider a regulator who is facing the following problem: A maximum of two suppliers, 1 and 2 may provide a public good by committing to a provision level, $s_i, i \in \{1,2\}$, yielding costs given by the convex function in (2). Following our assumptions, there are three components in the expression giving us the level of social welfare achieved in each structure: 1) A market-based one related with the *feel good* effect experienced by the buyers of the private good when purchasing it from a producer who is committed to some level of socially beneficial activities, 2) the level of public good generated by the producers

whose quantity is a one-to-one transformation of the supplier's effort and involvement in a socially beneficial activity, and 3) the producers' costs from their prosocial behavior. We pay attention to the case in which the regulator must choose between a single- and a two-supplier provision structure and fix the optimal level of $s_i = s_i^0$ to be provided. The two suppliers also sell a private good, whose consumers enjoy some extra utility from buying the product from a socially responsible firm. All assumptions concerning such a socially responsible consumers' utility and the distribution of valuations of a socially responsible firm are kept as outlined in the main text. Notation for two-supplier (TWO) and one-supplier (ONE) first best solutions is introduced in order to distinguish them from equilibrium structures.

While the comparison of total and individual optimal contributions in the one- and two-supplier first best solutions can be ranked in a straightforward way ($s_{TWO}^0 \geq s_{ONE}^0 \geq s_{iTWO}^0$), the condition for the two-supplier provision structure to be socially preferable over the single-supplier one is:

$$SW_{TWO}^0 = \frac{(4+m+n)^2}{16k} \geq SW_{ONE}^0 = \frac{(2+m+n)^2}{8k} \Rightarrow \sqrt{2} \geq \frac{m+n}{2} \tag{44}$$

Given the decreasing returns to scale in the production of the public good favoring provision by many small plants rather than by fewer larger ones, the result in (44) may be considered a rather counterintuitive implication of our setup. However, we must not forget that the consumption-related utility of the public good is constant and equal to the average value of a firm's social responsibility in the market. Therefore, parallel to the decreasing returns of the production technology, we have "decreasing returns to plant number" in the generation of the consumption-related *feel good* effect experienced by the consumer who buys from a socially responsible seller. This is why, we get that if the market-related value of social responsibility exceeds the threshold given by (44), the *decreasing returns to plant* property dominates the production-related decreasing returns to scale and thus, the single-supplier structure is preferred by the regulator.

Comparing the Market and the First Best Solutions: One important question to ask is under which market conditions the maximum social welfare will be reached. That means that, for example, we should look for the conditions under which the complete coverage monopoly reaches the first best. Figure 8 depicts the areas of the parameters *m* and *n* in which the first best and the actual equilibrium market structure coincide.

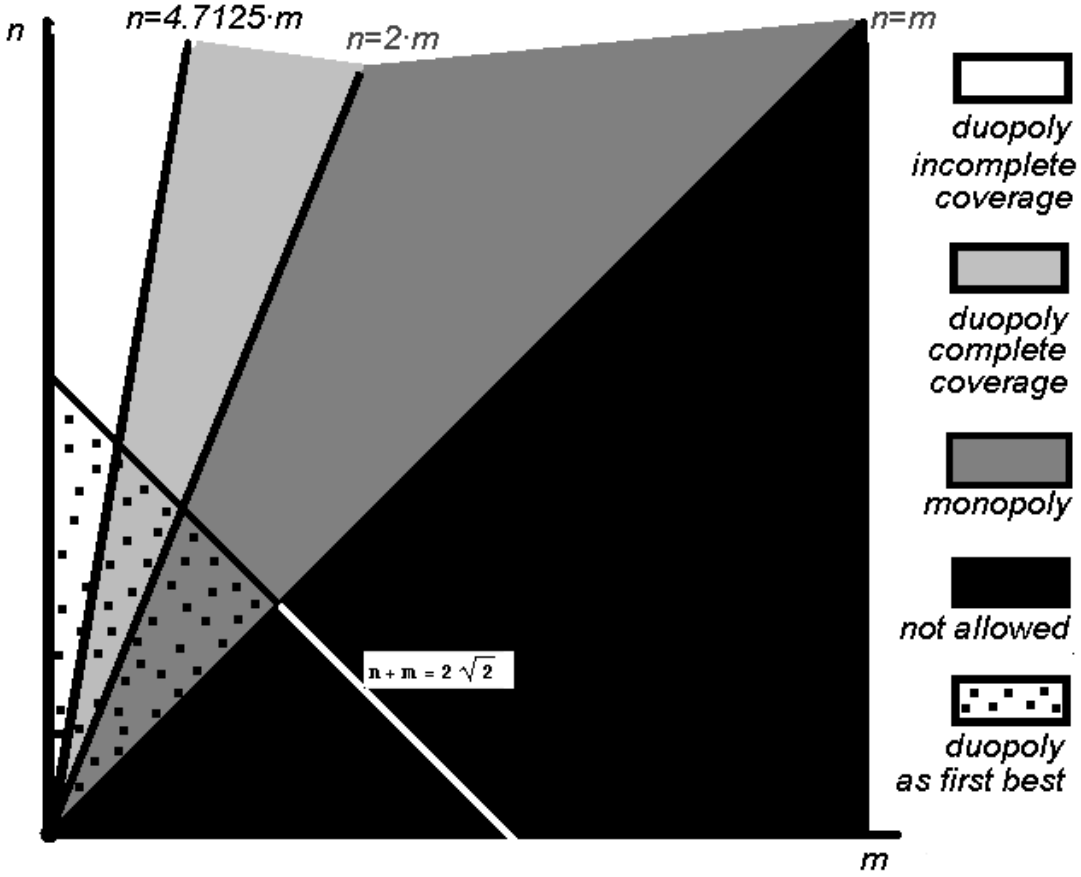

FIGURE 8: Comparison of equilibrium and socially optimal market structures.

We compare the first best solution above with the equilibrium market structures emerging for different combinations of the consumers' taste parameters. Figure 8 plots four straight lines. Three of them, the upward sloping ones, correspond to the boundary conditions between pairs of equilibrium market structures, whereas the fourth, which is downward sloping, is the condition which determines whether the single- or the two-supplier structure will be preferred by the regulator.

Of course, coincidence between the equilibrium and the first best provision structures does not imply that the first best outcome will be achieved. On the contrary, we will show that, in general, this will not be the case. However, the mapping of equilibrium market structures against the first best solution is a necessary step when assessing the sources of divergence between market equilibrium and socially optimal provision structures.

First of all, we find that the monopolist will always adopt a less socially responsible profile than is socially optimal. Second, given that the second firm in a duopoly with full market coverage does not adopt a socially responsible profile at all, it always adopts a less responsible profile than is socially optimal. In fact, the result of under-provision of the public good externality by the second firm can be extended in a less straightforward way to the case of incomplete coverage despite the fact that the firm commits to some level of socially beneficial activities.

A further general result is that due to the differentiation motive of socially responsible behavior shown to exist for both the incomplete and the complete coverage cases, the two firms will systematically avoid the social welfare-maximizing adoption of equal levels of engagement with socially beneficial activities. This is a persistent and robust source of divergence between the asymmetric social responsibility levels chosen by firms and the symmetric choice required in the corresponding first best solution.

After having established that the second firm's choice will always be below the level corresponding to the first best, we compare the more responsible firm's choices with the corresponding first best. We find that, in general, firm 1 (the socially responsible one) may both under- or over-provide the public good externality entailed in its socially beneficial behavior, depending of the magnitude of the taste parameters. Combinations of high values for m and n lead to the overprovision result, implying that the consumers' high valuation of a firm's social responsibility may lead firm 1 to the adoption of an excessively high level of CSR.