Corporate Social Responsibility and Horizontal Differentiation in Imperfect Competitive Markets with Global Warming Effects

Gustavo Barboza[*] and Sandra Trejos

Professor of Administrative Science and Professor of Economics, Clarion University of Pennsylvania, USA

Abstract: This study develops a model of corporate social responsibility (CSR) behavior that is compatible with both the mutual goals of profit maximization and the reduction of global warming effects. The theory developed in this paper indicates that, under perfect competitive and unregulated markets, firms must take an innovative entrepreneurship approach to reduce global warming externalities, and, consequently, respond to the demands of stakeholders to behave in a CSR fashion. In this setting, managers and firms find incentives to pursue strategies leading to horizontal differentiation when a segment of the market has strong revealed consumption preferences for environmentally friendly products, and when consumers derive a consumption disutility from products creating global warming effects. To achieve these goals, firms using a safe technology also incur certification/labeling costs in order to gain market power. That is, this study demonstrates that, in unregulated competitive markets, efforts to clearly identify sources of global warming effects require innovative entrepreneurship thinking above and beyond government regulatory efforts. Thus, firms behaving in a CSR fashion may achieve monopolistic power, and therefore positive profits. In sum, our model demonstrates that CSR is compatible with the triple bottom line of economic, social and environmental performance.

Keywords: Corporate Social Responsibility, Global Warming, Externalities, Horizontal Differentiation Strategies.

1. INTRODUCTION

Increased awareness about global warming effects, mostly deriving from current business practices, have resulted in growing concerns from stakeholders on the negative effects of these externalities on overall social welfare. Stakeholders reflect these concerns as pressures (particularly from environmentally-friendly consumers) onto producers to device new or improved technologies and overall production processes, conducive to global-warming effects reduction. As a result, firms must react by adopting a more social responsible behavior through their management practices and the products they bring to the market. Consequently, managers face the multiple challenges to device innovative production processes and the corresponding use of alternative inputs, to maintain or increase productivity, and to behave Corporate Socially Responsible (CSR) to the environment, while meeting stockholders expectations of profit maximization.

Conventional economic welfare analysis demonstrates that to reduce the negative effects of externalities – such as pollution – government intervention through the imposition of Pigouvian taxes is welfare enhancing, if the sources of the externality are well-known and measureable. As expected, taxes reduce the attractiveness for both producers (increased cost) and consumers (increased price), curving the

amount of externality to a preset optimal target level. In this case, government regulations force firms to comply with a new standard or, consequently, leave the market. Compliance, nevertheless, does not fit with the description of CSR behavior, as firms would only be doing what is legal. In addition, this type of regulations, if applied homogenously across an industry, do not create differentiation among firms, leaving all firms in the same competitive position as they were before the regulation. This situation normally occurs with a higher cost structure, higher prices for consumers, and the same level of profits.

General cases like the above mentioned make several assumptions regarding the efficiency of government regulation. First, it assumes that intervention is desirable, and that the cost of intervention is relatively low, resulting in increased social welfare by curtailing the externality and its negative effects by more than the cost of doing so. However, the assumption that identifying the source of the externality is feasible, and that firms can be easily targeted so that they comply with the new production processes or new technologies, is questionable at best. In addition, intervention of this nature assumes that no rent-seeking behavior would develop, and, therefore preferential treatment to one firm over others from government actions will not happen.

When the source of the externality may be somehow known but may not be precisely measurable, or fully identifiable or it is unclear where and how the externality is generated, government restrictions are normally inefficient, too costly, and welfare reducing.

*Address corresponding to this author at the Professor of Administrative Science and Professor of Economics, Clarion University of Pennsylvania, USA; Tel: 814.393.2053; Fax: 814.393.1910; E-mail: gbarboza@clarion.edu

Any of these possible scenarios create additional challenges to all parties involved, namely the regulator, the firms and the consumers, to find an optimal solution to reduce the negative externality. In addition, and because of the presence of asymmetric information, neither the government nor the market take effective actions to solve the problem. In this sense, Lence and Hayes, 2010, argue that "the decentralized competitive market equilibrium will never lead to a situation where goods produced with the undesirable technology are voluntary identified" (p.1108). In other words, these activities go on unregulated and the externality and its consequent negative effects persist. This is particularly true if, everything else equal, a consumer cannot distinguish a product produced by a firm with CSR motives. In this regard, a firm pursuing a CSR approach has to make an honest – and expensive – effort to be identified as such.

For illustrative purposes, if we were to assume that global-warming friendly technologies are conveniently available and cheaper than existing technologies – that are not as environmentally friendly – then rational profit-maximizing firms would consequently adopt them in order to achieve the goals of taking care of the environment while maximizing profits. In fact, under these circumstances, firms not adapting the superior technology would price-out of the market, as their product would be at a clear competitive disadvantage. Nevertheless, the evidence indicates otherwise; that is, global warming friendly technologies are scarce and more expensive than conventional methods of production, precisely because they internalize the negative externality. Similarly, if global warming friendly (GWF) technologies are more expensive, and not mandated by government regulation, why should a rational profit-maximizing firm adopt them? In other words, why and how can a firm be CSR?[1]

Under the above conditions – existing pressure from stakeholders and consumers for firms to contribute to the reduction of global warming externalities, and lack of clear and resolute government intervention – firms aiming at behaving in a CSR fashion face the challenge to adopt (unilaterally) technologies that are environmentally friendly despite their increased cost of production. This decision further complicates firms' performance driven by profit maximization goals and objectives of the type that we propose in this study.

The challenges just described, however, do not change the reality that for a proportion $0<\gamma<1$ of environmental aware consumers, issues relating to global warming are relevant, and most likely play an important role in their consumption decision process. For these customers, environmentally friendly products carry a higher value in relation to available perfect substitutes that are not (as) environmental friendly.

In this regard, notice that if a consumer has strong preferences for environmentally friendly or GWF products, she would strictly prefer GWF products over the alternative, if prices are identical and products are clearly identifiable as such. It is even possible that this consumer will prefer GWF at higher prices, if she can tell them apart from their competition. On the contrary, an individual that has no revealed preferences for a GWF product, would benefit if she can consume the higher quality (no pollution) product without having to pay the premium price; yet it would not buy it if the price were higher. Therefore, why should a firm produce a GWF product that is by definition less harmful to the environment when there are perfect substitutes available that are less expensive to produce and charge the same price?

Regarding firm performance, Waddock *et al.*, 2002 (p. 132) note the presence of several forms of stakeholder pressure indicating that "best of rankings, the steady emergence of global principles and standards that define expected levels of corporate responsibility and new initiatives to publicly report the triple bottom lines measuring economic, social and environmental performance" are among the most common. In particular, Waddock *et al.*, 2002 (p.132) argue "environmentalists consistently pressure companies for better environmental management and more sustainable practices". In many cases, firms consider a CSR approach to business in response to these pressures, with the success of their approach depending on the capability to address the issue at hand, while providing sufficient compensation for all parties involved.

While we agree with Waddock *et al.*, (p139) as they state "that companies respond in a variety of ways to the pressures and forces identified earlier but that their responses bear commonalities in the development of responsibility management systems", we also indicate

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[1]Schumpeter argues "Private management if actuated by the profit motive, cannot be interested in maintaining the values of any given building or machine any more than a socialist management would be … this amounts to saying that it will always adopt a new method of production which it believes will yield a larger stream of future income per unit of the corresponding stream of future outlay." P.37.

that achieving a significant change in market structure is a necessary, and possibly sufficient, condition for management changes conducive for a successful CSR behavior. In this regard, our study indicates that adopting a CSR behavior under perfect competitive markets conditions is not feasible as it affects performance negatively, and therefore it is not sustainable. More specifically, this study supports Mackey and Barney 2007, (p.187) as they indicate "socially responsible behavior can enable a firm to differentiate its products in its product market."

In regards to CSR behavior, we follow Mackey et. al., 2007, (p.818) general statement about how "CSR definitions, while they vary … may focus on voluntarily firms actions designed to improve social or environmental conditions[2]." We further expand this statement by adding, while using unconventional factors of production or technology that result in a horizontally differentiated product. Consequently, it follows that for a firm to act CSR in regards to global warming externalities, the new product(s) must have a lower or no-negative impact on the environment in comparison to its available perfect substitutes. In this regard, we hypothesize that for the CSR firm internalizing the externality results in distinctive value creation for the consumer, and possibly the creation of a new market. This is to say, differentiation with higher value for consumers in relation to existent perfect substitutes that are less environmental friendly, becomes the main means for competition away from price competition. Thus, for the purpose of this paper we understand CSR behavior, in the context of global warming, as actions beyond mandatory regulations that seek to increase social welfare and leave the firm at least equally well or better off along the triple bottom line measuring economic, social and environmental performance[3].

Our analysis is limited to products that demand CSR behavior from firms because of their possible negative attributes as they relate to global warming, and subsequently products that a consumer could potentially identify as such. For instance, businesses' practices and corresponding supply chain management that have a clear lower net footprint effect, that are both

measurable and identifiable are part of this group of firms. In this regard, Waddock *et al.* 2002, note that "[T]otal responsibility management can be a significant source of competitive advantage for those companies taking the lead." (p.133) Waddock *et al.,* 2002 also argue in favor of a "positive relationship between responsible corporate practices and corporate financial performance" (p.133). In other words, for CSR firms Return on Investment is positive as it creates opportunities that reshape market structure, and lead to the creation of (sustained) competitive advantage. However, Waddock *et al.* 2002, do not provide a theoretical model to support this claim. We propose to develop a model that addresses this relevant issue.

The problem that this research proposes to study is two fold. First, without a specific source of product differentiation between GWF and global warming (GW) products, the producer of the superior products cannot price differentiate, and consequently act rationally in terms of his profits maximization goals, if he were to adopt the new and more costly technology. If he were to sell at the same price than the competition, it would do so at a loss. While some firms may be willing to do it under the conventional CSR umbrella, it is clear that this behavior is not sustainable in a perfect competition setting, and furthermore may suffer from a principal-agent problem between management and stockholders. On the other hand, for the CSR consumer, she might not obtain the desired benefits of CSR products (GWF) because without proper identification, products would be difficult, if not impossible, to differentiate. Incidentally, the non-CSR consumer is clearly better off always, as she might now get the better product at the same price as the non-differentiated. As Lence and Hayes 2010 (p.1111) note, when verification takes place, it is clear that higher prices could be charged for the better good. Incidentally, on trust alone, consumers will not pay more for a product that is environmentally friendly if the product lacks proper identification.

To illustrate our point, let us look at a few examples of specific actions taken by firms and government agencies to address issues relating to global warming and CSR behavior. For instance, Waddock *et al.* 2002 (p.137) note in Table 1 that some environmental principles and standards currently in use are the CERES, ISO 14000&14001, and Responsible Care Principles. Also, in an ad in the Economist is noted, "the European Commission is currently looking for a Director of Climate Action with responsibilities related to its mission of developing and implementing policies

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[2]To this end, McWilliams and Siegel 2001 (p.117) note "The definition of CSR is not always clear".
[3]We recognize that CSR behavior could find its roots in other elements such as but not limited to treatment of employees, child labor, working hours, safety, human rights, and ecological issues. Yet these topics are beyond the scope of the present research.

in areas of energy, transport, industrial gases and climate change mitigation" (July 2nd 2011. p15). Another example of firms taking a step farther in terms of identification, implementation and design of CSR behavior beyond requirements established by law is the case of Nissan's Leaf Zero Emissions (Tailpipe emissions) advertised as a more environmentally responsible way to get there. (Bicycling Magazine August 2011). Also Aqva di Vita, producer of Grappa, makes a clear distinction of its production process using environmentally friendly techniques along with other forms of CSR behavior such as respect for women rights, and conservation practices, among others. Another example is that of BANFI Winery, that clearly states in its labeling "1st WINERY in the WORLD recognized for exceptional Environmental, Social & Ethical Responsibility & Leadership in Customer Satisfaction." In all these examples, one can see the emphasis in the clear identification of CSR impact and methods of production as a central point for a competitive advantage.

Based on the above discussed issues, our research question is two fold: how do firms react to the existence of global warming effects in undifferentiated markets; and why should firms assume responsibility (CSR) to curve/reduce its existence? We organize the rest of the paper as follows. The next section develops, first, a parsimonious model for both the consumer and the firm in a market characterized by perfect substitutes and perfect competition, and the existence of a negative global warming effect. We proceed to relax the initial assumptions and introduce imperfect competition as a mean to achieve sustainable CSR behavior. We then provide an analysis of the model's main empirical, theoretical and managerial implications. We conclude in the last section with some basic policy recommendations.

2. MODEL

In this section, we develop a simple model for the consumers and producers when consumption and production decisions consider the global warming effects of a given product in the presence of perfect substitutes, and therefore operating under perfect competitive settings. We use this model to identify the effects that social responsible behavior, from consumers and producers, has on the market equilibrium and price determination. As noted above, CSR behavior requires specific actions intended to reduce global warming effects beyond any mandatory

regulatory measure enforced by a central planner (government).

To construct the model we use a set of assumptions regarding consumers' preferences, initial market structure, resources availability and overall firm's objectives. To be more specific, we assume that firms are profit-maximizing agents with the constraint to respond to several demands from stakeholders to behave socially responsible regarding the issue of global warming[4]. We assume, at least initially, that firms operate in a perfect competitive market, and, therefore are price takers producing an undifferentiated product. We also assume that consumers are rational individuals with the objective to maximize utility given a standard budget constraint. We will assume for simplicity that all income must be spent each period. We also assume the existence of a global warming problem generated through the production and consumption of a given good.

2.1. Consumers

Let us assume that the economy is inhabited by a large number of consumers with the same initial level of wealth that must be spent between otherwise perfect substitute products, global warming friendly X_{GWF}. and global warming X_{GW}. The goods have two main attributes, first they share the same physical characteristics (perfect substitutes), and second the differentiation in their production processes and corresponding generation of global warming effects. Unless otherwise stated, consumers are indifferent between these products, provided that they cannot differentiate them. Individuals are therefore rational, and everything else equal a proportion $0<\gamma<1$ of consumers would prefer X_{GWF} type-products over its perfect substitutes X_{GW}. For now, we will assume that for the average consumer X_{GW}, X_{GWF} are identical.

The utility function for a typical consumer is therefore given by,

$$U(X_{GW}, X_{GWF}) = \alpha X_{GWF} + \beta(1-\delta)X_{GW} \qquad (1)$$

where $\alpha>0$ and $\beta>0$ are parameters, and $0\leq\delta\leq1$ is a parameter reflecting the possible degree of disutility

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generated by consuming X_{GW} type of products, when they are identifiable[5]. We assume that $U'>0$ and $U''<0$. Since X_{GWF} and X_{GW} are perfect substitutes they satisfy the same needs given the corresponding proportions α & β, when $\delta=0$, and therefore individuals would be indifferent between consumption of either good[6]. Since U is concave on X_{GWF} and X_{GW}, then there is an optimal combination (X^*_{GWF}, X^*_{GW}) that maximizes utility if $P_{GW} \neq P_{GWF}$, or (X^*_{GWF}, X^*_{GW}) if $P_{GW} = P_{GWF}$, where we assume $P_{GW} > 0$ and $P_{GWF} > 0$ are the corresponding market prices for both type of goods.

The budget constraint for the typical consumer is given by $W = P_{GW}X_{GW} + P_{GWF}X_{GWF}$

Thus, the consumer's optimization problem and corresponding F.O.C. are given by the following functions

$$L_{XGW,XGWF} = \alpha X_{GWF} + \beta(1-\delta)X_{GW} + \lambda(W - P_{GW}X_{GW} + P_{GWF}X_{GWF})$$
(2)

$$\frac{\partial L}{\partial X_{GW}} = \beta(1-\delta) - \lambda P_{GW} = 0$$

$$\frac{\partial L}{\partial X_{GWF}} = \alpha - \lambda P_{GWF} = 0$$

$$\frac{\partial L}{\partial \lambda} = W - P_{GW}X_{GW} + P_{GWF}X_{GWF} = 0$$

Solving for the optimal levels of (X^*_{GWF}, X^*_{GW}) yields:

$$X^*_{GWF} = \frac{W}{P_{GWF}} - \frac{\alpha X_{GW}}{\beta(1-\delta)}$$
(2.1)

$$X^*_{GW} = \frac{W}{P_{GW}} - \frac{\beta(1-\delta)X_{GWF}}{\alpha}$$
(2.2)

Since, X_{GW} and X_{GWF} are perfect substitutes, it is easier to see that the optimal consumption combination is going to be determined by the relationship between prices and utility coefficients

$$\frac{P_{GWF}}{P_{GW}} \lesseqgtr \frac{\alpha}{\beta(1-\delta)}$$
(3)

There are three general possible solutions to this optimization process: two corner solutions and one intermediate combination. First, if the price ratio is equal to the ratio of parameters the individual is indifferent between any combinations of the two goods. Second, in the event the price ratio is greater, then the individual will consume all in X_{GW} and otherwise if price ratio is less. Notice that the relevant element of this condition in (**3**) is that as the disutility factor δ increases the individual is willing to pay more for X_{GWF} creating opportunities for the firm to explore this segment of the market. The disutility parameter allows for a surcharge on price creating a stimulus for the consumer to prefer the higher quality more environmentally friendly product vis-à-vis the less environmental friendly one. Therefore as long as long as $P_{GWF} \leq \frac{\alpha P_{GW}}{\beta(1-\delta)}$, for any given value $\delta>0$ the individual with strong global warming friendly preferences would be willing to buy all in X_{GWF}. For the market segment for whom $\delta=0$, any difference in price will make them buy all in X_{GW}. In the extreme case when $\delta = 1$, the demand for X_{GW} disappears. However, it is also possible that if P_{GWF} is set too high, individuals may consume only X_{GW}, notwithstanding that $\delta>0$. In other words, the presence of a negative externality does not give firms the ability to charge consumers any price for the environmental friendly product, but it does provide an opportunity to price differentiate along the negative externality.

2.2. Producers

Now let us consider an economy composed of N firms producing perfect substitutes in a competitive market – or a least a contestable market – where entry and exit is free. Firms are profit maximizing and there is no principal-agent[7] conflict between stockholders and managers. Profits in this market are identical to each firm and equal to the economic return on all factors of production. Some firms may have two technologies available for production, one safe and one risky where the cost of safe technology is higher than the risky and it is greater by the amount *Tech* per unit produced. The safe technology produces goods of type X_{GWF} with $P_{GWF} > 0$ and the risky technology produces goods X_{GW} with $P_{GW} > 0$. The risky type of products carry an externality that results in global warming effects. However, goods of type X_{GWF} also must be certified/identified/classified as such or else they are perceived by the customers as $X_{GWFw/o}$- global warming friendly without certification-, and therefore of equal quality to the risky goods. The cost of certification is

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[5]Alternatively δ captures differences in production processes as they relate to global warming. The greater δ the larger the disutility the consumer receives.
[6]As we will see later the existence of consumers for whom $\delta=0$, is a key determinant of equilibrium outcomes and corresponding number of different products that can simultaneously been produced (see Giannakas and Yiannaka 2008 for more details in the case of GM products).

[7]See Mackey, *et al.* 2007 for some discussion on the principal-agent issue.

equal to $\rho > 0$ per unit produced and it only occurs when the firm explicitly completes the required certification process and purposely requires the product to be certified as such[8]. In this regard, certification serves the main purpose to take care of information asymmetries between X_{GW}, X_{GWF}. The presence of this information asymmetry makes it difficult for consumers to separate the two types of products. By purposely certifying a product, the producer changes the physical appearance of the product, making the product be horizontally differentiated[9]. When products are not certified they are sold as $X_{GWFw/o}$ and can only receive P_{GW}. We also assume that firms are profit maximizing even when behaving CSR in regards to the issue of global warming effect reduction.

Therefore, profits for a producer with several available technologies are given by[10]:

$$\pi = P_{GWF} X_{GWF} + P_{GW}(X_{GW} + X_{GWFw/o})$$

$$-[c(X_{GWF} + X_{GWFw/o} + X_{GW}) + \rho X_{GWF} + \quad (4)$$

$$Tech(X_{GWF} + X_{GWFw/o})]$$

Where all variables are defined as before and $c' > 0$, $c'' > 0$ and $c(0) = 0$. The firm will produce any possible combination of products to maximize profits according to the given prices. Several possible scenarios are worth analyzing. First, when $P_{GWF} - \rho - Tech = P_{GW}$ firms will produce any combination of the different types of goods to maximize profits, and secondly when $P_{GWF} - \rho - Tech \neq P_{GW}$ the firm will produce specific amounts of each good to satisfy the needs for the market, according to prevailing demand conditions. Note, as stated earlier, that access to the safe technology is limited, and, therefore not available to all firms in the market. In fact, the safe technology may be the limited result of an active R&D process that is firm specific. Notice that without the safe technology, the firm clearly produces in a perfect competitive market and is a price taker, with no option to supply the environmentally friendly product.

The F.O.C. for profit maximization from equation (**4**) are

$$\frac{\partial \pi}{\partial X_{GWF}} = P_{GWF} - c'(X_{GWF} + X_{GWFw/o} + X_{GW}) - \rho - Tech \leq 0, \text{ and}$$

$$X_{GWF}^* \geq 0, \text{ and } X_{GWF}^* \frac{\partial \pi^*}{\partial X_{GWF}} = 0 \quad (4.1)$$

$$\frac{\partial \pi}{\partial X_{GWFw/o}} = P_{GW} - c'(X_{GWF} + X_{GWFw/o} + X_{GW}) - Tech \leq 0, \text{ and}$$

$$X_{GWFw/o}^* \geq 0, \text{ and } X_{GWFw/o}^* \frac{\partial \pi^*}{\partial X_{GWFw/o}} = 0 \quad (4.2)$$

$$\frac{\partial \pi}{\partial X_{GW}} = P_{GW} - c'(X_{GWF} + X_{GWFw/o} + X_{GW}) \leq 0, \text{ and}$$

$$X_{GW}^* \geq 0, \text{ and } X_{GW}^* \frac{\partial \pi^*}{\partial X_{GW}} = 0 \quad (4.3)$$

Whether the firm possessing the safe technology decides to produce one product over the other depends on the respective prices it could charge to the different customers, and the level of prevailing competition, along with the existent demand for each product. If after the use of the safe technology the products remain undifferentiated, the firm will produce the less environmentally friendly product; alternatively, if the price difference is greater than the additional cost to certify and use the safe technology producing environmentally friendly products, the firm will specialize in the product using the safe technology. This is to say that the firm – as in the consumer case – may decide to produce one type of product or the other, or produce a combination of the two in order to maximize profits as noted in 4.1-3 above.

Now, a profit-maximizing producer that observes the phenomenon in the market where a proportion of consumers (λ) have a strong preference for the higher quality product – and given the existent externality (global warming effect δ) – and knowing that they are willing and able to pay a higher price could benefit from a CSR behavior by producing the more expensive product. This result supports the findings stated by Waddock *et al.,* (2002) where they note the possibility of "responsibility management as a competitive imperative" (p.133). By the same token, McWilliams and Siegel also note "one way to assess investment in CSR is as a mechanism for product differentiation".

As noted earlier the market is composed of a rather large number *n* of firms so that each firm supplies a relative small amount of a product with an individual supply equal to $q_i = \dfrac{Q_S}{n}$. Recall that under perfect competition with undifferentiated products, consumers

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[8]We use a similar model specification as that found in Lence and Hayes 2010.
[9]Giannakas and Yainnaka 2008 provide a specific example of the GM products.
[10]For the firm that does not have access to the safe technology the profit function is equal to that of a firm in perfect competitive market producing an undifferentiated product, and therefore lacking any market power.

will buy the cheapest product. However, it is also pertinent to recall that a proportion λ of consumers have strong preferences for the environmentally friendly product and would buy it if the price does not exceed the difference with the less environmentally friendly after accounting for the amount of the externality δ.

Because of the consumers' willingness to pay a higher price for the certified environmentally friendly product under the appropriate conditions, firms operating in the perfect substitutes perfect competitive market, and because of the pressure from several stakeholders regarding global warming, have both a challenge and an opportunity to adopt/develop the safe technology and produce X_{GWF}. Now, a key element in this decision is that a firm that sees the opportunity to differentiate its product would gain market power as a first mover. In this regard, successful implementation of a CSR behavior, aiming at producing a horizontally differentiated product, results in the creation of imperfect competition conditions; where the firm no longer is a price taker but rather faces a downward sloping demand curve. This new demand curve is at least initially of the amount γD with an upper bound equal to the maximum price consumers are willing to pay for the new differentiated and environmentally friendly product X_{GWF}. Also remember that this demand curve increases as the amount of the externality δ increases, and the proportion of environmentally friendly consumers λ rises. In general the upper binding price for X_{GWF} is given by equation (**3**). Further inspection indicates that as long as $P_{GWF} \leq \dfrac{\alpha P_{GW}}{\beta(1-\delta)}$, the firm producing the environmentally friendly product will face a downward sloping demand curve. Notice how as the amount of the externality (disutility) increases so does the maximum price consumers are willing to pay, because $\beta(1-\delta)$ decreases.

Now, when firms spend the extra effort to act CSR through product differentiation and with the intention to serve a segment of the market λ, then P_{GWF} becomes a function of X_{GWF} and the firm incurs in the extra cost of production $Tech$ and ρ. Similarly, the CSR behavior provides the firm with access to a restricted market where now $P_{GWF}(X_{GWF})$ along the segment of the demand curve dictated by the size of the disutility δ. As soon as some firms are able to adopt the newer and safer technology and the full identification process takes place, then the market splits between a perfect competitive segment for lower quality environmentally unfriendly products, and, a second segment with those of higher quality (more expensive) under imperfect market competitive conditions.

2.3. Horizontal Product Differentiation and Imperfect Competition

To better understand the implications of a horizontal differentiation strategy, let us first assume that given the higher cost of the safe technology and the extra cost of certification[11], only a very limited number of firms are able to take advantage of these price differential opportunities. Recall that the differentiated market size is given by λD. Under the new conditions, those firms willing and able to explore the benefit of a CSR behavior, in regards to global warming reduction efforts, will now face a profit maximization problem given by:

$$\pi = P_{GWF}(X_{GWF}, \delta) * X_{GWF}$$
$$- [c(X_{GWF}, \delta) + \rho X_{GWF} + Tech(X_{GWF})] \qquad (5)$$

Where all variables are defined as before, and price is now a function of both quantity and quality. Therefore, it is fundamental to recall that under these conditions the firm will face a downward sloping demand curve. Note that the quality issue directly relates to the degree of disutility that consumers have in relation to environmentally unfriendly products. The resulting F.O.C. for profit maximization for the CSR firm are:

$$\frac{\partial \pi}{\partial X_{GWF}} = P_{GWF}(X_{GWF}, \delta) + X_{GWF} \frac{\partial P_{GWF}}{\partial X_{GWF}}$$
$$- c'(X_{GWF}, \delta) - \rho - Tech = 0 \qquad (5.1)$$

$$\frac{\partial \pi}{\partial \delta} = X_{GWF} \frac{\partial P_{GWF}}{\partial \delta} - c' \delta - \rho - Tech = 0 \qquad (5.2)$$

Equation 5.1 is the standard marginal cost=marginal revenue identify for a monopolist to determine the profit maximizing level of production –assuming that at the present state of the market there is a sufficient large demand for the environmentally friendly product. Under the new market structure, the firm can charge $P_{GWF} > MC$ and clearly exercise its market power. However, the final price is also a function of the quality level of the environmentally friendly product in question. To account for value issues, Equation 5.2 provides the necessary information to determine the actual final quality level for X_{GWF}^{*}, so that the marginal cost of production for the corresponding level of quality (degree of environmentally friendliness δ), is equal to

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[11]The model could be easily extended to account for additional costs in the process of horizontally differentiation such as marketing, distribution and service, in order to make consumers aware of the product's new and added characteristics.

the revenue it generates. This is an important element in the overall analysis and in the firm's final strategic selection. The identity (5.2) indicates the existence of multiple levels of environmental friendliness, for which a firm selecting to act in a CSR fashion can aim at while achieving maximum profits, subject to the customers' preferences. From a practical perspective, it would be naïve to think, that overnight, firms can produce a complete global warming free product or that they want to do so even if technology is available. It is more realistic to expect that as new technologies are developed, firms make steady progress in the process of global warming effects reduction, as customers become more willing to pay more for the higher quality products.

Figure **1** illustrates our analysis and corresponding market decomposition between the initial perfect competitive scenario and the horizontal differentiation segment, after the CSR firm adopts the safer technology. First, note that the upper limit of the new demand curve – faced by the CSR firms – is given by the upper limit of price differentiation and consumer preferences for X_{GWF} products and the amount of the disutility, as shown earlier by inequality (**3**). In fact, the disutility parameter acts as a measure of quality expectation from the environmentally friendly product and its relationship to the willingness to pay for the higher quality product. In this regard, the CSR firm may

choose the appropriate level of externality reduction that suffices consumers' preferences and corresponding willingness to pay for the differentiated product vis-à-vis its cost structure. In other words, while the firm may opt to remove completely the externality, it may just as well reduce the externality to the marginal level where it meets consumers' expectations. Clearly, the lower bound of the demand curve is given by the price of the substitute that is not environmentally friendly, and where the individuals, consequently, are indifferent between the consumption of either good.

To illustrate and understand the implications of horizontal differentiation let us explore in further detail Figure **1**. Our analysis represents three possible scenarios. In the first scenario – depicted in Figure **1** – we assume that the firm's cost structure (*ST* for safe technology) is higher than its corresponding perfect competitive counterpart in the amounts of ρ and *Tech* per unit produced. Therefore, the marginal cost curves relationship is such that ($MC_{ST} > MC_{PC}$). Let us assume that the firm is capable of effectively enforcing its horizontal product differentiation strategy and therefore acquiring market power, consequently facing a downward sloping demand curve such as D_1. The corresponding equilibrium occurs now at $MR_{GWF} = MC_{ST} < P'_{GWF}$. Because the AC_{ST} is lower than P'_{GWF} at
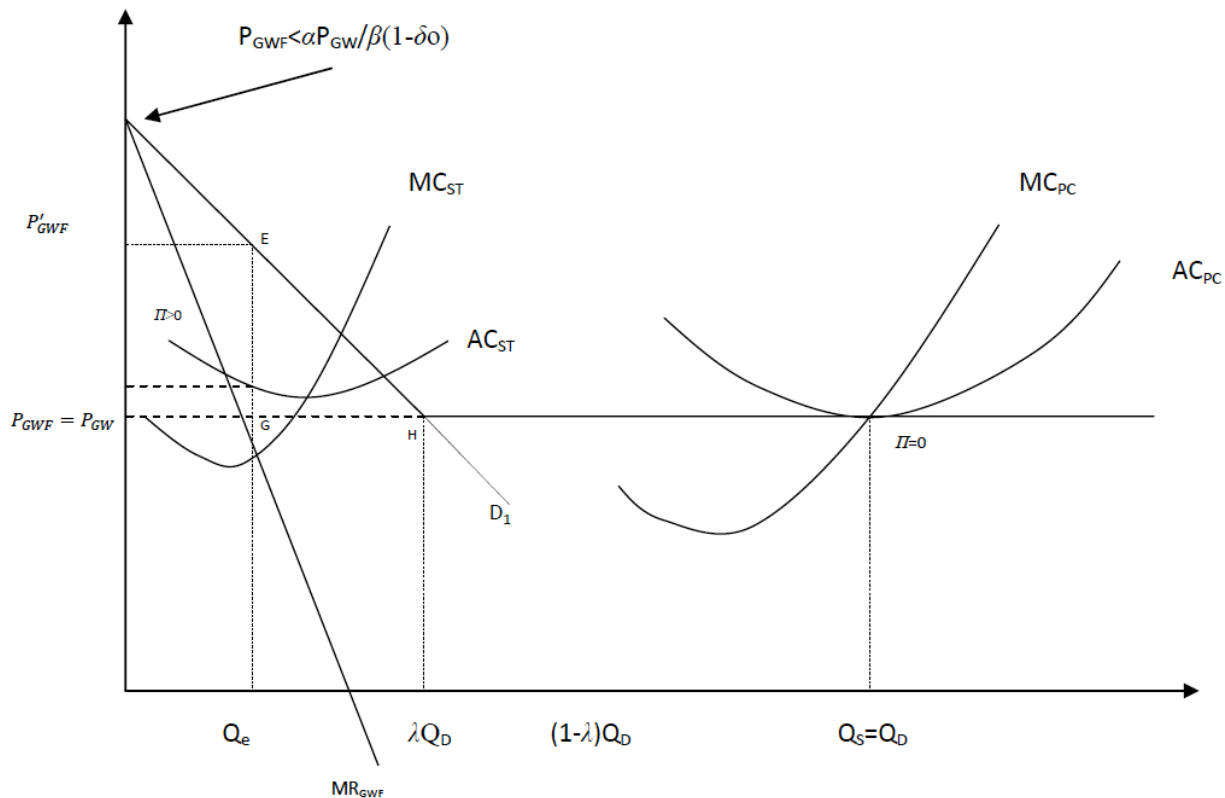

Figure 1: Horizontal Product Differentiation.

the equilibrium quantity Qe, the firm is capable of maximizing profits so that π>0. Notwithstanding the fact that the firm incurs higher production costs to successfully differentiate its products, it is also capable of behaving socially responsible by producing X_{GWF} products of quality δ. However, the reader can easily see that just as well the firm's cost structure may be higher than the one initially assumed. There are two general cases of interest – not shown in the graph for simplicity purposes – that the reader can easily construct. First, if the AC_{ST} is tangent to the demand curve at point (E), then the firm can successfully price differentiate, yet it would do so with π=0. It is sufficient to indicate that if the AC_{ST} is greater than D at Eq quantity, the firm will encounter π<0, and therefore would not be able to pursue the horizontal differentiation strategy. In the second case mentioned above, the firm would however be able to pursue its CSR behavior while breaking even. This strategy provides the firm with the possibility to explore innovation options conducive to cost reduction as it achieves the much needed economies of scale. In the purest of senses, a firm under these conditions has all incentives to continue producing the X_{GWF} product and

behave – as in the case where π>0 – as a first mover in the differentiated portion of the market.

A few implications of the product differentiation strategy on market equilibrium deserve further consideration. First, assuming the original cost structure (Scenario 1 in Figure **1**), we observe that a portion of the demand λD is not served with the X_{GWF} products – segment GH – since producing the totality of the environmentally friendly demand is not consistent with the profit maximization goal. This result indicates that while firms' CSR behavior is desirable by environmentally friendly consumers, the overall result is a decrease in quantity produced and an increase in price. Incidentally, this change in equilibrium outcome also results in a decrease amount of the externality and overall improvement in social welfare. Environmentally friendly consumers are now better off since they can access a higher quality and fully certified product. Notice that the consumer is willing and able to buy X_{GWF} as long as its price is less than the adjusted price of the less environmentally friendly product weighted by the degree of disutility; any price higher than that will make the environmentally friendly consumer to reverse
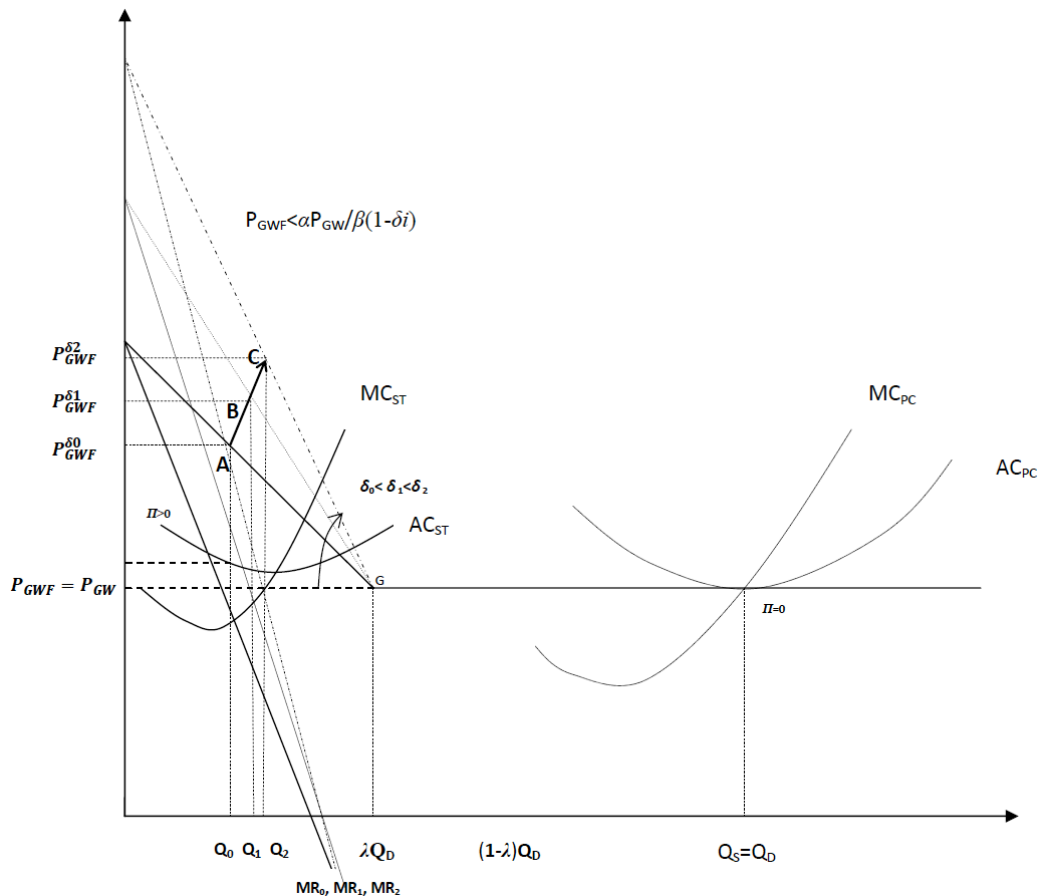

Figure 2: Change in Disutility Level δ.

preferences to X_{GW}. So notice that as long as $\delta > 0$, then there is a possibility for a successful CSR behavior that allows for profit maximization greater than zero.

2.4. Changes in Disutility Factor (see Figure 2)

Another important implication of our model is represented in Figure **2**. Let us now pay some attention to the implications of changes in the level of disutility (amount of externality) on the equilibrium outcome. Let us assume for simplicity the same cost structure for the CSR firm. Notice that for any $\delta_1 > \delta_0$, the environmentally friendly demand curve rotates outward along G, given that the highest possible price for X_{GWF} is a negative function on δ, as noted in equation (**3**). Thus, higher levels of disutility provide the CSR firm with higher incentives to undertake further R&D efforts to develop and implement its product differentiation strategy. Higher disutility levels may be the result of better information (less asymmetric information) available regarding the nature and effects of the externality, changes in preferences, or simply market power gained as a result of regulation. Also, as δ increases, consumers demand a higher quality for X_{GWF} and, are, therefore, willing to pay more for it. Because of increasing MC_{ST}, higher disutility levels result both on higher output and price levels.

Line ABC in Figure **2** depicts the new equilibrium path for increased levels of disutility. Along this line we observe $(\delta_0, Q_0, P_{GWF}^{\delta o}) < (\delta_1, Q_1, P_{GWF}^{\delta 1}) < (\delta_2, Q_2, P_{GWF}^{\delta 2})$ with corresponding $\pi_0 < \pi_1 < \pi_2$. The final shape of line ABC depends on several factors such as use and/or development of better technologies and cost certification, amount of disutility change, and increase competition as environmentally friendly practices become the industry standard, among other factors. The determination of the final shape of this line is beyond the scope of this study and remains an element for further research.

2.5. Changes in Individual Preferences (see Figure 3)

Another relevant issue to explore is the effect that changes in consumers' preferences have on the development and production of environmentally friendly products by CSR firms. This is to say, more consumers become aware of the possible negative effects of less environmentally friendly products and their corresponding externalities. Figure **3** provides a simple analysis to this case. Let us assume that the level of disutility δ remains constant.

Under the new scenario, the maximum possible price charged for environmentally friendly products remains unchanged. However, as λ increases a larger proportion of consumers are now aware and therefore willing and able to buy X_{GWF} instead of the less environmentally friendly substitute, for a given price range as determined earlier. In graphical terms, higher λ is represented as an outward rotation of the demand curve at $P_{GWF}^{\max}$ (see Figure **3**). Notice that as demand rotates outward this implies an effective increase in the marginal revenue curve for the firm pursuing horizontal product differentiation. This shift is reflected by $MR_0 < MR_1 < MR_2$. In turn, the increase in demand creates more opportunities for safe technology adoption, and more X_{GWF} to be supplied at every price. As the demand for X_{GWF} increases profits also increase for the CSR firm, provided they can successfully maintain barriers to entry, as more competition is expected as a result of an increased market. The resulting equilibrium path is depicted by the line segment $\xrightarrow[ABC]{}$ in the graph. As in Figure **2**, line ABC in Figure **3** depicts the new equilibrium path for increased preferences for environmentally friendly products. Along this line we observe $(\lambda_0, Q_0, P_{GWF}^{\lambda o}) < (\lambda_1, Q_1, P_{GWF}^{\lambda 1}) < (\lambda_2, Q_2, P_{GWF}^{\lambda 2})$ with corresponding $\pi_0 < \pi_1 < \pi_2$.

From a competitive strategic development perspective, as change of preferences takes place, more firms will recognize the nature of the change, and how the market is moving from less to more environmentally friendly products. Recognition of this fact provides the necessary – yet not sufficient – incentives for firms to advance and search for safer technologies, and correspondingly moving away from risky technologies. This shift assumes that as demand increases, the barriers to acquire the safe technology also decrease, though not necessarily proportionally. An additional element to explore is the impact that increase in preferences for X_{GWF} may have on quality issues. Without complete knowledge of the causes and implications, one expects a positive relationship between preferences and quality. Incidentally, as preferences continue to increase more firms will find profitable to join efforts to produce the environmentally friendly product – also as the demand for less environmentally products decreases – seeking in turn to increase profits, and turning the imperfect competitive market into a more competitive one.

As in all previous cases, horizontal differentiation creates imperfect competitive equilibria where the amount of the externality is reduced while consumers face a Deadweight Loss (DWL) (The reader can
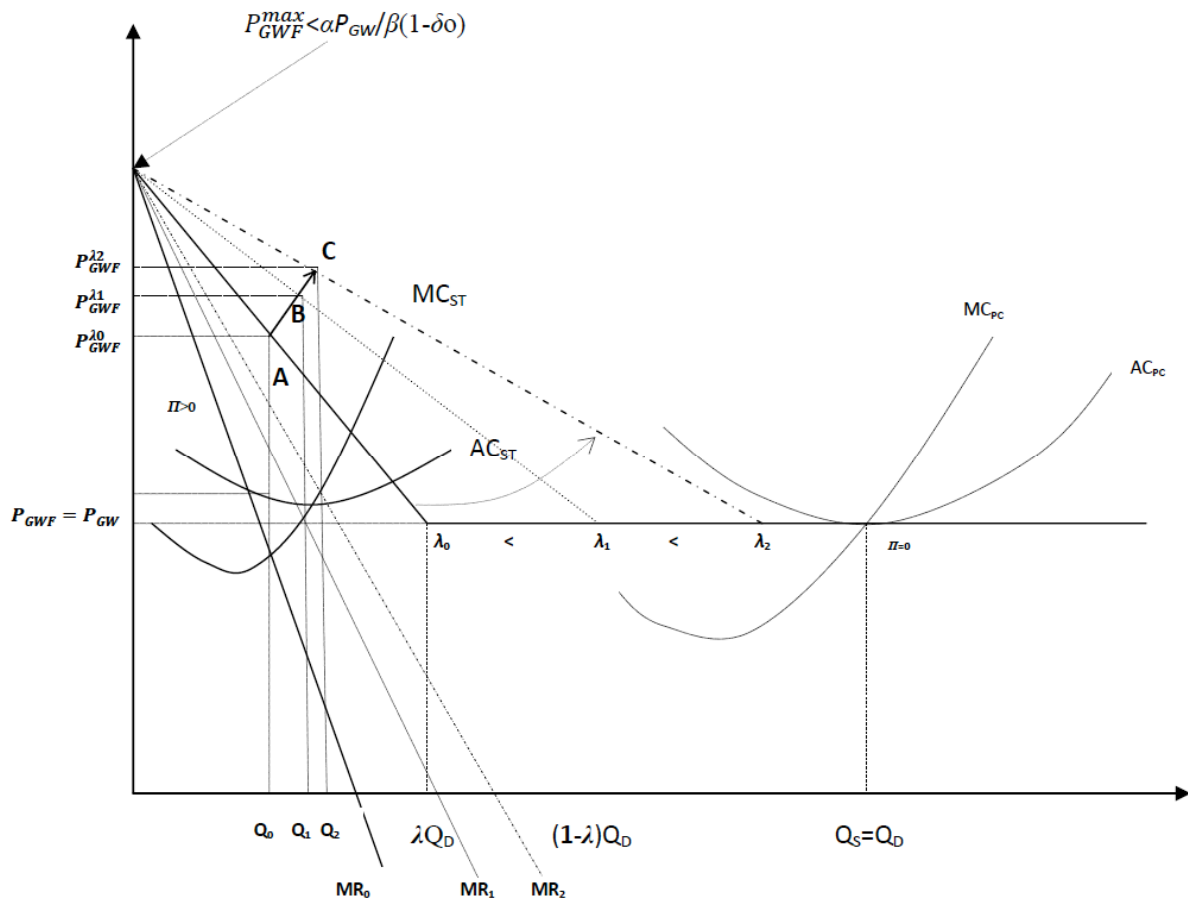
Figure 3: Changes in Preferences (λ) for Environmentally Friendly Products.

conduct a welfare analysis on her own). Because of the monopolistic power derived from horizontal differentiation, a segment of the λD market would not be able to buy the product of choice despite their preferences for the environmentally friendly product. From our model analysis, we observe that as λ and δ increase more incentives exist for the follower firms to actively seek options to horizontally differentiate their products; thus turning the exception into the norm. The more firms enter into the market, as barriers to entry declined mostly because of time effects, the more competitive the market becomes, and the larger the benefits to consumers. Finally, new industry imposed standards – namely higher quality for less environmentally harmful products – may result in overall higher prices, lower overall equilibrium quantity, and less pollution with a possible higher level of social welfare. The net social welfare effect is the resulting difference between increased social welfare as less global warming is generated and the negative effect of an overall lower output produced in equilibrium as markets turn from perfect competition to imperfect competition. This last statement needs to be evaluated empirically.

3. MODEL EXTENSIONS

As indicated earlier, our model makes several simplifying assumptions, to draw attention to the main issue at hand, which is, why would a firm decide to act CSR in relation to global warming issues when it operates in a perfect competitive market? To further investigate the implications of our model we can provide some relaxation of some of the assumptions. In particular, we have interest in studying the impact in changes in income, the role of R&D, imperfect competition settings, government intervention, and variations in the level and perception of the disutility derived from less environmentally friendly products.

3.1. Changes in Income

We initially assumed that all consumers have the same level of income and all income must be spent, however, it is quite feasible that consumers' purchasing power differs. In particular, we can argue that as income increases consumers will find more affordable to purchase the more environmentally friendly product even if it is more expensive. In particular, we can now argue that the two types of goods X_{GW}, X_{GWF} are

inferior and normal respectively. At low levels of income, people (countries) can only consume the cheaper, risky technology product, however as we observe increases in income consumers will shift their consumption patterns to more environmentally friendly products. In this regard, we expect that companies serving developed markets will take the lead in dealing with issues relating to global warming before they implement similar policies in less developed countries. Once technology becomes available, firms developing economies of scale and economies of scope, through active competition will start spilling over the positive effects of better technologies into developing markets and make these products available to lower income people. Consequently, increases in income will produce a shift in the demand curve allowing the more environmentally friendly firm to produce products of higher quality, increase price, and increase profits as well.

3.2. Role of R&D

Another element deserving further consideration is the role that R&D plays in the process of reducing global warming effects. Our model provides evidence that firms operating in a perfect competitive market with an undifferentiated product that creates a negative externality have a strong incentive to invest in CSR behavior. This business strategy stimulates the development of safer technologies conducive to the production of higher quality, safer and more expensive goods, targeted to a proportion of the market that has strong preferences for environmentally friendly products. Unregulated and highly competitive markets make a great opportunity for CSR behavior to develop through technological change useful to reduce global warming effects. However, the introduction of this more expensive technology and the costs associated with the certification of the products gives market power to the leading firm because it creates barriers to entry to the new segment of the industry. This leading power, in turn, allows firms to produce products of several qualities, designed to meet the needs of environmentally conscientious customers, willing and able to pay more. Firms pursuing active research will therefore develop a first mover advantage in the environmentally friendly market.

Another issue deserving extra attention is the one relating to the fact that under imperfect competition markets, the CSR with profit maximization goals finds optimal to price at the level where MC=MR<P. Monopolistic power results in a net loss of social welfare that is extracted from the customers as described above, by restricting economic activity. On the one hand, the CSR firm reduces the externality effect of the traditional product, but on the other hand, it creates a deadweight loss to the customers. While in theory, this inefficiency seems to run counter with the increased overall social welfare gain resulting from global warming reduction, it is relevant to indicate, that based on our model specifications, the only feasible way to promote more environmentally friendly production processes is by creative firms developing strong R&D that allows them higher profits than in the perfect competitive case. In particular, the perpetuation of the perfect competitive market – where government regulation is inefficient *per* the discussion in the introduction – proves larger than the possible loss that monopolistic power gives to a few firms in the short run.

It is precisely this dilemma – higher than normal profits with overall global warming effect reduction – that leads to the development of active and purposely driven R&D geared to promote safer and overall better technologies leading to market power concentration. Without the economic rewards deriving from horizontal product differentiation and market concentration, it is hard to understand, and subsequently justify, how a firm may be interested in spending significant amounts of capital in R&D to reduce global warming effects deriving from risky and inferior technologies. As Schumpeter well said, the process of creative destruction moves us away from perfect competition, and allows for development of better production processes in the long run, something that mere government regulation cannot achieve in this case.

3.3. Imperfect Competition

The preceding sections, lead us to the consideration regarding market power and the role of perfect competitive markets as they relate to environmental issues. As noted, safer or better technologies are not widely available to all firms in the market. Furthermore, these technologies are expensive – as expected – mainly because they use resources that either do not create global warming, or emphasize on production processes that reduce the externalities. In this regard, as Lence and Hayes 2010 point out, the perfect competitive market will not resolve the problem of unregulated externalities. Instead, as our argumentation indicates, it is through active and intended product differentiation that firms are able to create new products, develop new markets or simply

create value in the form of horizontal differentiation. This differentiation process provides CSR firms with opportunities to serve a segment of the market that under perfect competitive settings is underserved, and receives a lower quality product than what they desire and are willing to pay for. Firm strategy; first in the form of a superior product, and second as barriers to entry and limited access to the new technology arise; gives market power to the leading firm, effectively moving it from a perfect competitive market to an imperfect competitive setting. Under the new market structure, the firm is now able to increase profits vis-à-vis those found in unregulated perfect competitive markets.

On a related issue, when the cost of technological change and development is too high for any single firm to undertake, it is possible that cooperative agreements between firms develop in order to address the issues at hand. Joint R&D processes provide cooperating firms access to the horizontally differentiated product that will have to share the differentiated market. In this case, the differentiated market becomes an oligopoly with competition among firms somehow implicitly regulated, yet clearly providing higher profits than the perfect competitive segment still buying the inferior quality product at a distinctive lower price.

3.4. Government Intervention

In our initial analysis, we assumed that global warming regulations are too costly and difficult to administrate because of the lack of a precise definition and the existence of several possible causes. In some cases, government intervention can indeed increase social welfare provided that regulations are not costly and that the regulation could be relatively easily identified and enforced efficiently. In the case that the government successfully devices a mechanism to reduce global warming effects, there is reduced room for firms to act CSR since all firms must operate under the umbrella dictated by the law. Government regulations, because they raise the bar, challenge firms to develop even more expensive and innovative ways to address marginal global warming effects, which in turn make it more difficult to act under the CSR business strategy.

Additionally, a competitive advantage for the safer technology developer and user(s) could be achieved through banning and/or segregation of the low quality product. In some instances, while full identification of the global warming source may still be difficult, it might be clear to identify those products that evidently create

a distinctive externality and banned them from the market. Banning of undesirable low quality products secures a market share for firms producing the safer and more environmentally friendly product. This protection reduces the incentives for firm to seek further differentiation since regulations have by *de jure* increase profits and reduce competition. Government regulations could then limit the scope of CSR behavior leading to further reduction of global warming effects.

Incidentally, R&D processes may result in products that possess other negative characteristics even though they reduce global warming effects. For instance, Giannakas and Yiannaka (2008) provide evidence of how GM products are not well-received by a segment of consumers and in some cases banned by governments.

3.5. Changes in Disutility Levels

We also assume that only a portion (γ) of the market demand has strong preferences for global warming friendly products. Our conclusions indicate that the capacity for a firm to develop a new product directly depends on the possibility to determine effectively the size of the demand and the willingness to pay for the superior product. However, we did not address the much more complicated issue of whether firms can affect the individuals' disutility perception as an act of direct CSR behavior. So far we assume that the degree of disutility is exogenously determined and that consumers are responsible for determining how much they may dislike a product or its negative effects on the environment. In the event that firms were able to affect the individual preferences then an endogenous process of global friendly product preferences develops securing a larger market share for the firms undertaking this task. Obviously, firms would be forced to provide the goods, with the respective quality that they promise. This scenario is beyond the scope of this research.

4. IMPLICATIONS AND DISCUSSION

The central conclusion of our model is that CSR behavior in the production of X_{GWF} products creates market power for the firm with the horizontally differentiated product, and therefore results in profits above normal. On the one hand, this strategic movement is expected to be voluntary in unregulated markets with existent externalities. On the other hand, these expected higher profits provide opportunities for investors to fund CSR activities with the goal to reduce

GW effects. In this regard, we assume that investors are profit-maximizing agents, and see these opportunities as a way to gain market power and price differentiate. In other words, investors are willing to allocate resources to this type of CSR business venture because they provide the capabilities to yield success in the triple bottom lines, as noted by Waddock *et al*. As Mackey *et al*., 2007 note "There continues to be significant and steady demand for mutual funds that specialize in investing in firms that meet certain CSR criteria." (p831)

4.1. Empirical Implications

With these considerations in mind, we proceed to study the empirical implications of our research. First, our analysis assumes that firms engage in CSR behavior responding to pressure from stakeholders willing and able to pay for clearly differentiated products. In our case, because of the existence of consumers with strong preferences for GWF products in markets characterized by perfect substitutes and little to no regulation or government intervention, firms are able to maximize profits.

In practice, the reason firms engage in CSR behavior is to response to the lack of a market for GWF products (higher cost) and the need to fill this gap. Firms pursuing a first mover approach, increase profits through strategic management geared toward value creation and differentiation. A key element for a successful CSR strategic development is to identify and measure the market size λ, and to recognize the nature and magnitude of the degree of disutility that consumers face. This, in sum, is no different from any other technique used in market development strategies. However, the challenge for the firm is to implement the more costly technology and certification processes in such a way that consumers are willing to pay for the higher quality and consequently more expensive product. Therefore, understanding differences in customer preferences when there are perfect substitutes is fundamental for market development through a successful internalizing of an externality that government regulation cannot control.

Nevertheless, this paper is not an empirical approach to CSR in global warming issues, rather it provides the theoretical background for that analysis. While we recognize the relevance of providing specific details on how to discover and develop a new market that promises an opportunity to maximize profits, the task is beyond the scope of this research. Of course, it

is very difficult to measure accurately the effective demand and supply for global warming friendly products. On the one hand, consumers may have a hard time identifying those products from their perfect substitutes when certification is incomplete, unclear or simply not present. On the other hand, producers must address the issue of how to estimate the willingness to pay for a product that is different, in its certification and overall global warming effect, yet identical in every other characteristic. Thus, conducting a full price discovery task is a real challenge. It is relevant to remember that the differentiated product is more expensive to produce, and while it promises higher profits, it is not a guarantee. At the end, whether a firm produces a GWF product and consumers buy this product at the going price, is a question of effectively determining supply and demand, and maintaining significant barriers to entry in order to gain profits higher than normal.

4.2. Theoretical Implications

In this paper, the central assumption is that firms follow, and behave accordingly with, a profit maximization goal. In our construct, we have provided sufficient evidence that this goal is, not only achievable but also compatible at the theoretical level with other goals such as CSR behavior. The fundamental element of the analysis is the idea of introducing product differentiation – and different degrees of quality – to determine the optimal level of CSR that maximizes the return to the firm. We also argue that as long as the firm is consistent with its profit maximization goal, there is no principal-agent problem in pursuing a CSR approach to curve the externalities deriving from global warming products.

In this regard, our study has significant implications to understand the role managers play in the process of implementing CSR management approaches in unregulated markets. In particular, our model demonstrates that active research and development activities yielding safer technologies, allowing firms to produce higher quality products with a lower global warming effect, are strictly compatible with profit maximizing goals. In other words, global warming provides an opportunity to create a market for CSR investment decisions.

Another interesting theoretical result is that it is quite feasible for consumers to achieve a higher overall utility level, if the consumer buys less of both the lower quality product and the more expensive one. This will

occur, if the level of disutility derived from X_{GW} forces individuals to consume the more expensive product yet in lower quantities. To this extent, if a good is characterized as inferior then less is preferred over more when income increases. Incidentally, as income increases a consumer will buy less of the good that provides disutility in favor of the higher quality good (X_{GWF}), of which, because of higher prices, she may buy less as well.

By the same token, as product identification becomes available, giving the consumer information to separate the goods – identification curtails the presence of asymmetric information in favor of the higher quality product – she who has strong preferences for X_{GWF} products, will select those and more so as income increases (income is a demand shifter that allows firms to increase price). Not surprisingly, we observe that firms first introduce environmentally friendly products in more developed markets where income is by definition higher. Because of the externality that a global warming product generates an individual consumes less of it and more of the GWF product, yet consumes a lower overall quantity while achieving an overall higher utility. In this case: More is preferred to less!

5. CONCLUSIONS AND IMPLICATIONS

Our analysis emphasizes on those markets that are out of regulatory reach because of high costs of intervention and characterized mostly by perfect competition. Firms searching to maximize profits, find optimal to adopt a CSR behavior approach to their business, when there is a segment of consumers with a strictly preferred preference for GWF products that are both technologically superior and fully identifiable. This paper also shows that the success of a CSR behavior that maximizes profits through horizontal differentiation depends directly on the degree of disutility that risky technological practices make (δ), the consumer preferences for environmentally friendly products (λ), and the costs of certification (ρ) and the safe technology *Tech*.

In particular, our results demonstrate that in unregulated competitive markets, efforts to clearly identify sources of GW effects require innovative entrepreneurship thinking, beyond government regulatory efforts. Incidentally, productive firms searching for new ways to develop competitive advantages in competitive markets have a large incentive to become CSR while maximizing profits,

when consumers – or at least a proportion of them – have strong revealed preferences for GWF products. In short, demand creates its own supply without need for regulation.

In our model an incentive for a firm to act according to a CSR behavior pattern could be equated with innovative entrepreneurship initiatives. Product differentiation is used as a mechanism to break away from the pressure of perfect competition and the limited capacity to generate profits. As Schumpeter argues imperfect markets create pressure for innovation and offer the reward of higher than normal profits. While, imperfect competition may seem to reduce welfare in the short run, it is actually beneficial in the long run, as it promotes competition and innovation, something of much need to curve possible global warming effects. As Waddock *et al.* 2002 state, CSR and profit maximization are compatible objectives.

Conversely, we can extent our results to hypothesize that firms that do not see CSR behavior as a value creation option must currently operate in imperfect markets and are thus willing and able to absorb profits in exchange for other business goals. In most cases, however a principal-agent problem develops, but it is sustainable given that firms are earning $\pi>0$ and there are some type of barriers to entry, either through patents on safe technology or limited demand.

Finally, a related topic for future research would be the study of how firms' behavior may affect individuals' preferences to increase demand for GWF; in other words how CSR behaving firms explore ways to shape and to lead industry change.

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