EFFECT OF CSR ON PRODUCT DIFFERENTIATION IN THE PRESENCE OF COST ADVANTAGE

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ABSTRACT

Corporate social responsibility (CSR), once thought of only a philanthropic activity of a firm, is now treated as a serious business strategy that can contribute to a firm's profitability. The seemingly altruistic activity helps build the firm's image with all the stakeholders including its customers so that it has the potential to increase the firm's profit. This fact is now well established in research literature. Product differentiation is another corporate strategy that is pursued by some companies in order to offer a distinctive product in the market to avoid competition, charge premium price, and increase profit. What is not known is that when two firms compete in a Hotelling type product differentiation line, how much this product differentiation is affected by the extent of the CSR activity of a firm. Our study is conducted in a game-theoretic setting where the CSR firm is competing with a non-CSR firm. The CSR firm maximizes a convex combination of its own profit and a form of social utility function, while the non-CSR firm maximizes its own profit only. The CSR firm is also assumed to have a technological advantage that reduces its production cost. The interaction of the effects of both the extent of CSR and the extent of this production cost advantage is also considered. We also study a scenario of asymmetric information. Our main results include that the degree of product differentiation is reduced when CSR is practiced. On the other hand, product differentiation increases with the production cost advantage. The interaction between the two factors – CSR activity and cost advantage – is also studied.

Keywords: *Asymmetric information; Corporate social responsibility; Game theory; Product differentiation; Spatial price discrimination*

1.   INTRODUCTION

In recent times, Corporate Social Responsibility (CSR) has become an important part of corporate strategy. Many companies are establishing CSR as a separate functional area with its own objectives and policies. A majority of companies actually issue a CSR report annually. In 2011, 83% of top 100 US companies by revenue issued such report compared to 74% in 2008 and only 37% in 2005. Globally, this figure is 95% of the top 250 largest companies (KPMG 2011). Recently, the UN started a Global Compact Initiative for companies to pledge support for human rights, labor standards, and environmental protection. As a measure of success of this initiative, 8000 businesses around the world have signed this pledge (Knowledge@Wharton, 2012). Bateman and Snell (2002) defined CSR as a set of corporate actions that positively affects an identifiable social stakeholder's interests and does not violate the legitimate claims of another identifiable social stakeholder. CSR activities should do some social good and should be beyond that is required by law (McWilliams and Siegel, 2001). They also say that CSR activities would increase the social utilities of the companies' activities. Common examples include recycling, pollution reduction and product design that have social attributes and characteristics.

Product differentiation is another corporate strategy that is pursued by some companies in order to offer a distinctive product in the market to avoid competition, charge premium price, and increase profit. Usually, when the products are less differentiated in a particular industry, the firms therein will encounter more intense competition. A common tool for depicting product differentiation in a duopoly is to use the Hotelling's Principle. Hotelling considers a stretch of physical street of finite length along which customers are uniformly distributed. Two shops are deciding about the physical location along the street. Assuming that customers will choose the nearest shop, Hotelling's law predicts that both shops will find themselves next to each other at the halfway point. This law has been applied to product differentiation in some characteristic of the product, for example color, sweetness or size. Applying Hotelling's law will mean that, given price and all other product attributes remaining the same, the characteristic in question will eventually be the same for both products making them identical to each other. In our paper, we use an "augmented version", called the SPD (Spatial Price Discrimination) model. In this model, a firm charges consumers different prices according to different locations. For markets with differentiated products or large transportation costs, spatial price discrimination is an important and useful strategy for firms. Greenhut (1981) conducted a survey which showed that, in areas like the US, Europe and Japan where the transportation cost can be as high as five percent of the total cost such price discrimination is definitely resorted to. For example, in the ready-mixed concrete market, a producer could observe each customer's location and then charge different prices. In addition to the transportation of this kind of bulky product, spatial model could also be applied to horizontal differentiation. As long as producers can identify the location, (for example, taste), price discrimination would exist. Breakfast cereals vary in sweetness; airlines choose different flight time in a day. As a result, many studies in literature used this model to analyze various questions concerning both firm' best strategy and social policy.

While product differentiation strategy makes a firm's product different from others', the firms are also increasingly adopting CSR for improving their image. The research question studied in this paper is: Is there any link between a firm's CSR strategy and its product differentiation strategy? There are some anecdotal connections shown in popular media which shows that

high CSR-intensive industries are often associated with low product differentiation. For example, among top US companies, automobile industry is highly CSR-intensive. This industry, however, engages in low product differentiation across firms, that is each major auto-maker produces similar types of products and covers full range of cars, including coupe, sedan, SUV, minivan, and so on. An article published in Forbes (Fernandez-Kranz, 2010) shows some stylized facts regarding the relationship between firm's CSR strategy and the product differentiation; specifically, how low product differentiation indicates intense market competition. According to their study, more intensive CSR strategy is associated with fiercer marketplace competition. Their further empirical evidence shows that firms can use CSR strategy as a substitute for the product differentiation strategy. For example, firms tend to rely less on CSR strategy in industries which already show a high degree of product differentiation (achieved by innovation that measured by expenses on R&D). This anecdotal reference motivates us to study this link and develop a theoretical model to analyze this issue. In this paper, we investigate how the CSR activities of a firm would influence product differentiation in the market, and if it does, whether the analytical results support the anecdotal conjectures.

We consider two firms each producing and marketing a single product. One of the firms is a traditional profit-maximizing firm. The other is a CSR firm in the sense that they maximize not only their own profit but also some identifiable stakeholder's (the firm's customers) interests. In our model setting, the CSR firm has a cost advantage with a lower marginal production cost since a CSR firm in the real world is usually associated with competitive advantage in the industry. CSR would entail additional costs to the firm, but it would also bring in some kind of CSR premium. In our model the products are differentiated along a spatial competition type line. We explore the effect of a firm's CSR objective on the extent of product differentiation in the industry. We also explore the effect of cost advantage on the extent of product differentiation. Finally, we study the interaction of the two effects (CSR and cost advantage) together on the extent of product differentiation.

2. BRIEF LITERATURE SURVEY

Our paper is at the crossing of the CSR and the product differentiation literature. There is increasingly more awareness in the corporate sector that CSR activities do probably increase profit. The mechanism is an enhanced respect for the company that will, in turn, increase sales and make employees loyal (Robins, 2011). McWilliams and Siegel (2001) found that there exists an optimum level of CSR that will maximize profit, and at the same time, fulfill the CSR demand from various stakeholders. Siegel and Vitaliano (2007) studied the strategic engagement of firms in profit-maximizing CSR. The fact that firms can use CSR to increase private profits is also highlighted in Hernandez-Murrillo and Montinek (2009). Fisman, Heal and Nair (2014) found some evidence that CSR is motivated by profits and is especially profitable in consumer-oriented industries, and in competitive industries. Hsueh and Chang (2008) consider a three-tier supply chain and contrast its performance without and with CSR activities. The positive relationship between CSR activities and firms' profits is empirically found by Crifo et al. (2016) using data from French industry. Similar correlation between CSR and profitability was also found by Zhu, Liu and Lai (2016) among Chinese enterprises. An article by van Wassenhove (2006) on the co-operation between private and humanitarian sectors through CSR activities outlines the best strategies for such a co-operation. From a supply chain co-ordination point of view, a model developed by Hsueh (2014) showed that by

suitably designing a revenue sharing contract can improve total supply chain profit. While the link between CSR activity and increased profit seems to be currently intuitively well-known, there does not exist any model to analytically demonstrate this. At the same time, there is no research done about the link between other variables like product differentiation and a firm's cost efficiencies, and CSR. This paper seeks to bridge this gap in literature.

The product differentiation literature is quite mature. Product differentiation can be horizontal or vertical. A horizontal product differentiation is when the quality of the product is not easily distinguished and customers resort to different rankings for different products even when the price is same. Examples can be breakfast cereals and cola brands. In vertical product differentiation, the products have different levels of quality that is objectively measurable by the customer, with prices being same or different. Vertical product differentiation has been widely studied in several papers, for example, Gabszewicz and Thisse (1980), and Shaked and Sutton (1982). Lacourbe, Loch and Kavadias (2009) study a market where there is a mix of vertical differentiation (in case of product performance) and horizontal differentiation (for product features). The role of variable costs and volume-dependent manufacturing costs is studied.

As for horizontal product differentiation, researchers usually use spatial competition model to study it, which was first brought up by Hotelling (1929), focusing on location on a bounded linear market by two firms. In contrast to Hotelling model that did not consider spatial price discrimination, Hoover (1937) studied the market where price discrimination is through freight absorption, which is common when goods have a relatively high transportation cost compared with its value. By assuming that each firm has a single fixed location, he concludes that in the neighborhood of the market area, the seller at the nearest location is able to fix the delivered price at an amount that equals the sum of marginal cost at the next nearest selling point and the transportation cost from that point. The spatial model can be interpreted as a model of product location in the characteristics space, where individual firm's location choice can be interpreted as its product specification. This is studied by Macleod, Norman and Thisse (1985), Lederer and Hurter (1986) as well as Greenhut, Norman and Hung (1987). Anderson and de Palma (1988) extend the spatial discrimination model to heterogeneous products and show many of the strong properties in the standard homogeneous goods case no longer hold, and particularly, unless products are very different, social optimum is not sustainable any more. A paper that is similar to ours is by Kopel, Lamantia and Szidarovszky (2014) where they find that a CSR firm can have higher profit compared to a profit maximizing rival. Our paper analyzes CSR within the spatial price discrimination model.

3. THE MODEL

In this section, we will first introduce the classical spatial competition model and then its application for the case of product differentiation as used in our paper. In classic Hotelling's model, where price is exogenous and thus no price discrimination exists, at the equilibrium, the shops will locate next to each other. Each shop will capture half the market. Recall that the customers want to minimize the distance travelled and therefore would buy from the nearest shop. Let t be the unit cost of transportation for each customer. Then, it is easy to see that the total cost of transportation for all the customers in the system is $(t/4)$. But, if one is concerned about the socially beneficial solution, the above solution is not the optimum. For example, suppose the shops are located one quarter of the way along the street from each end. The shops will still get the same number of customers (half of total each), but the total

distance covered by all the customers will be reduced to (t/8). Thus, we can see that it is possible to obtain a socially responsible solution that could also be optimum for the firms. In our model, we will use such a CSR model for one of the firms, to study the role played, if any, by a CSR objective.

The spatial competition street can be a metaphor for product differentiation. The relative positions of the products along the street give the extent of differentiation between the two products and this can be for any product characteristic. We consider two firms each producing a product. Customers' preferences are uniformly distributed along a unit line segment. To the customers, the products are horizontally differentiated. The position of Firm 1's product on the line is denoted by L_1 and that of Firm 2 by L_2 (see Figure 1). Let us assume, without loss of generality, $L_1 < L_2$. We also assume that Firm 1 as a CSR company possesses superior production technology and therefore enjoys an advantage in marginal cost of production. Without loss of generality, we normalize this cost to zero. Let k be the production cost of Firm 2 (over and above that of Firm 1). So, we have $k_1 = 0$ and $k_2 = k$. Note that the value of k can be negative, which means the production cost of Firm 1 is more than that of Firm 2. In other words, it is the case where CSR firm is associated with cost disadvantage but our main analysis remains same.

Figure 1 here

Each consumer has inelastic demand for one unit of the good, with a reservation price r, where $0 < k_2 < r$. Transport cost is t per unit of distance, which can also measure firms' cost of customizing the standard product to align with each customers taste. The total cost for company i to supply all consumers in the line segment x_0 to x_1 is $C_i = \int_{x_0}^{x_1} (c_i)\,dx$ where $c_i = t\,/\,x - L_i\,/ + k_i$. The firm can use its rival's cost of customizing the product to charge discriminative prices and therefore the equilibrium delivered price schedule for any consumer located at x is as follows:

$$p^*(x, L_i) = \max\{\,|L_i - x|\,t + k_i,\,|L_{\sim i} - x|\,t + k_{\sim i}\,\}, i = 1, 2 \qquad (1)$$

$|L_i - x|$ is the deviation of the product i from the preference of a customer given by x. Consider again a customer located at x buying product i. The first argument in Equation (1) is the cost to Firm i. The second argument is the cost to the same customer buying the other product. The rationale of Equation (1) is as follows. Say Firm 1 sees that the cost c_2 to a customer to buy from the rival is higher than its own cost, c_1. Then Firm 1 can set its price at (or an infinitesimal amount less than) c_2. If its own cost c_1 is higher, then that would be the price to avoid loss.

Let $\bar{x}$ be the customer who faces the same delivered cost from each of the firms. Then $|L_1 - x|\,t + k_1 = |L_2 - x|\,t + k_2$. We get (noting that $k_1 = 0$ and $k_2 = k$):

$$\bar{x} = \frac{t(L_1 + L_2) + k}{2t}$$

Figure 1 shows the price schedule derived in Equation (1) for all customers in the line segment [0,1] given by the bold line (being the maximum of the two arguments). We assume that the indifferent customer will buy from the closest firm. Therefore, Firm 1 will get all outcomes in the segment [0, $\bar{x}$] and Firm 2 will get all customers in the segment ($\bar{x}$, 1). Also recall that the price charged by Firm 1 will be c_2 (Firm 2's cost, this being the higher) and price of Firm 2 is c_1.

The gives the profit functions of the two firms as:

$$\pi_1(L_1, L_2) = \int_0^{\bar{x}} (c_2 - c_1)dx$$

$$\pi_2(L_1, L_2) = \int_{\bar{x}}^1 (c_1 - c_2)dx \qquad (2)$$

Firm 2, which is not a CSR firm will maximize $\pi_2(L_1, L_2)$ given in Equation (2). Firm 1 on the other hand, is a CSR company and will maximize a convex combination of $\pi_1(L_1, L_2)$ and its own consumer surplus (CS) in the market. This is because a CSR firm cares about its stakeholders' (including consumers) interest. Therefore, the CSR firm takes its own consumers' surplus into account. By definition, CS of buying a product is the difference between the consumer's willingness-to-pay and the product price, and thus total CS of firm 1 becomes the difference between the market reservation price and the sum of its profit and cost. This gives:

$$CS_1 = \int_0^{\bar{x}} (r - c_2)dx = r\bar{x} - (\pi_1 + C_1)$$

Thus the utility function U that Firm 1 will maximize is:

$$U = (1-\alpha)\pi_1 + \alpha CS_1 \qquad (3)$$

Where ⍺ is a measure of the degree of the CSR consideration, $\alpha \in [0,1]$. A higher α indicates that the company cares more about its customers' surplus, indicating higher CSR. When $\alpha = 0$, the company cares only about profit; when $\alpha = 1$, the company behaves like an NGO.

The product differentiation decisions of the two firms are played as a game. The game is played in two stages. In stage one, firms make locations (i.e., differentiation) decision. In stage two, firms announce prices. Our objective in this paper is to explore the role of CSR strategy (adopted by Firm 1 in rivalry with Firm 2 which is a traditional firm) on the optimum level of product differentiation.

Note that the benchmark without CSR is the case when $\alpha = 0$ and both firms maximize profit. Simultaneous profit maximization of two firms generates equilibrium locations as

$$L_1^B = \frac{2k+t}{4t}$$ and $$L_2^B = \frac{2k+3t}{4t}$$. Thus, the market product variation becomes $$v^B = |L_2^B - L_1^B| = \frac{1}{2}$$.

Our main results are given in the next section and we will compare the equilibrium with that of the benchmark.

4.   MAIN RESULTS

In this section, we state the main results. For brevity, we omit the derivation and the proof. Equation (3) shown in the earlier section gives the objective function of firm 1 (the CSR firm). Firm 2 maximizes $\pi_2(L_1, L_2)$ given in Equation (2). In the first stage of the game the two firms develops the best response functions as follows:

$$Br_1 : L_1 = \frac{\alpha(2r - 3k) - 2k + (2 - 3\alpha)tL_2}{t(6 - 7\alpha)}$$

$$Br_2 : L_2 = \frac{k + 2t + tL_1}{3t} \qquad (4)$$

Solving two best response functions simultaneously generates equilibrium locations

$$L_1^* = \frac{2k(2-3\alpha)+3\alpha(r-t)+2t}{t(8-9\alpha)}$$

$$L_2^* = \frac{k(4-5\alpha)+\alpha(r-7t)+6t}{t(8-9\alpha)}$$

(5)

Equation (5) gives the equilibrium product designs of the two firms. L_1 and L_2 give the absolute locations while their difference is a measure of the product differentiation in the market. If L_1 and L_2 are sufficiently close to each other, then the products are essentially similar with no distinguishing features. On the other hand, if the difference is large then the two products are significantly different.

Thus, the degree of product differentiation measured by the market product variation becomes:

$$v = |L_2^* - L_1^*| = \frac{4t - \alpha(2r + 4t - k)}{t(8-9\alpha)}$$

(6)

One of the main objectives of this paper is to find the role CSR plays in product differentiation. The next proposition establishes the relationship.

PROPOSITION 1: *At the Sub-game Perfect Nash Equilibrium, there exists a negative relationship between the degree of the company's CSR and degree of product differentiation in the market.* Intuitively, product differentiation is a measure used by firms to attract consumers with certain tastes in order to get a higher profit. But a CSR-friendly company also cares about the surplus of its own consumers, so it will act more aggressively and move toward its rival's position in order to get more consumers, resulting in a decreased product differentiation.

PROPOSITION 2: *At the Sub-game Perfect Nash Equilibrium, the competitive advantage (in production cost) by the CSR-friendly company increases the equilibrium degree of product differentiation.*

Since k is the product cost difference, the larger the k, the greater is the disadvantage of firm 2 in production cost and also in price. In this case, the CSR firm intends to move towards the middle to obtain more market share, but firm 2 will be more willing to increase the product differentiation by moving farther to the right to avoid head-on competition where it is associated with cost disadvantage.

PROPOSITION 3: *At the Sub-game Perfect Nash Equilibrium, the competitive advantage (in production cost) by the CSR-friendly company softens the negative relationship between the degree of the company's CSR and the degree of product differentiation in the market.*

An analysis of Propositions 1 and 2 shows that the effects of α and k on product differentiation are opposite. Intuitively, as k increases, the product disadvantage will become a more and more important concern of firm 2 when choosing location. Thus in order to make up for this, firm 2 has more incentive to move to the right to preserve the product differentiation in order to attract consumers, which leaves the impact of α on product differentiation trivial. Thus, the increase of competitive advantage (in production cost) by the CSR-friendly company will soften the negative relationship between the degree of the company's CSR and the degree of product differentiation in the market.

COROLLARY 1: *The CSR activity increases the profit of CSR-friendly company until it reaches the optimal degree of the company's CSR. This optimal level of the company's CSR is increasing with both its cost advantage and the unit transportation cost.*

5.   EXTENSION WITH ASYMMETRIC INFORMATION

In this section, we keep all conditions the same as earlier, except the information structure of firms' production cost. Firm 2 still produces with a constant marginal cost of production k_2, $0 < k_2 = k < r$. However, we now assume that there may be different types of firm 1 with different production costs k_1, which is the private information only to itself. Specifically, there is a probability β that firm 1 may be low type ("L") with a production technology advantage (giving a lower production cost), and in this case, without loss of generality, k_1 can be normalized to zero ($k_1 = 0$). Firm 1 is of high type ("H") with a probability $1 - \beta$ with no cost advantage $k_1 = k_2 = k$. This distribution is common knowledge.

We now turn to derive the Sub game Perfect Nash Equilibrium and solve it by backward induction. In this asymmetric information case, we have two utility functions for the CSR-friendly Company's given by

$$U_L = (1-\alpha)\pi_{1L} + \alpha CS_{1L}$$
$$U_H = (1-\alpha)\pi_{1H} + \alpha CS_{1H}$$

(7)

Firm 2's expected profit function is given by

$$E\pi_2(L_{1L}, L_{1H}, L_2) = \beta\int_{\bar{x}_L}^1 (c_{1L} - c_2)dx + (1-\beta)\int_{\bar{x}_H}^1 (c_{1H} - c_2)dx\frac{1}{2}$$

$$where \ \bar{x}_L = \frac{t(L_{1L} + L_2) + k}{2t}, \bar{x}_H = \frac{L_{1H} + L_2}{2}$$

(8)

In the first stage, the two kinds of CSR-friendly company maximize U according to their own utility function (7) and its rival maximizes its own expected profit function (8). Firms develop their best response functions of location, as follows:

$$Br_{1L} : L_{1L} = \frac{\alpha(2r-3k) + 2k + (2-3\alpha)tL_2}{t(6-7\alpha)}$$

$$Br_{1H} : L_{1H} = \frac{\alpha(2r-2k) + (2-3\alpha)tL_2}{t(6-7\alpha)}$$

(9)

$$Br_2 : L_2 = \frac{\beta(k + tl_{1L}) + 2t + tl_{1H}(1-\beta)}{3t}$$

Solving three best response functions simultaneously generates equilibrium locations:

$$L_{1L}^* = \frac{8\beta k + 12t + 16k + (18r - 20\beta k - 44k - 32t)\alpha + (12\beta k + 21t - 21r + 30k)\alpha^2}{t(6-7\alpha)(8-9\alpha)}$$

$$L_{1H}^* = \frac{8\beta k + 12t + (12\beta k + 21k + 21t - 21r)\alpha^2 + (-20\beta k - 18k - 32t + 18r)\alpha}{t(6-7\alpha)(8-9\alpha)}$$

(10)

$$L_2^* = \frac{(r - 7t - k)\alpha + 4(1-\alpha)\beta k + 6t}{t(8-9\alpha)}$$

Equation (10) gives the equilibrium product design of the CSR-firm and firm 2. L_{1L}^*, L_{1H}^*, and L_2^* are the absolute locations of low type firm 1, high type firm 1 and firm 2 respectively. Thus the degree of product differentiation under both types "H" and "L" measured by the location distance becomes:

$$v_L^* = \frac{(14r + 16\beta k - 23k + 28t)\alpha^2 + (-12r - 32\beta k + 38k - 52t)\alpha + 24t + 16\beta k - 16k}{t(6 - 7\alpha)(8 - 9\alpha)}$$

$$v_H^* = \frac{2[(8\beta k + 14t + 7r - 7k)\alpha^2 + (-6r - 16\beta k + 6k - 26t)\alpha + 12t + 8\beta k]}{t(6 - 7\alpha)(8 - 9\alpha)}$$

(11)

Next, we establish propositions to show how the role of asymmetric information impacts the relationship between CSR and the product differentiation.

PROPOSITION 4: *At the Sub-game Perfect Nash Equilibrium with asymmetric information, there exists a positive relationship between the probabilities β of the CSR-friendly company being a low type and the degree of the product differentiation.*

PROPOSITION 5: *At the Sub-game Perfect Nash Equilibrium with asymmetric information, the relationship between the degree of the company's CSR α and degree of product differentiation remains negative, and this relationship would be strengthened if the CSR-firm is of low type.*

PROPOSITION 6: *At the Sub-game Perfect Nash Equilibrium with asymmetric information, the competitive advantage k (in production cost) by the CSR-friendly company diminishes the equilibrium degree of product differentiation under the low type case when the likelihood of CSR-friendly company being a low type (β) is relatively low, and vice versa. Results remain same as the symmetric information when the CSR-friendly company is of high type.*

PROPOSITION 7: *At the Sub-game Perfect Nash Equilibrium with asymmetric information, the competitive advantage of the low type CSR-friendly company moderates the negative relationship between the degree of the company' CSR and the degree of product differentiation when the CSR-friendly company is a high type. However, when the CSR-friendly company is low type, the relationship may become ambiguous, which depends on probability β .*

COROLLARY *2: At the Sub-game Perfect Nash Equilibrium with asymmetric information, CSR-friendly company's profit increases when it first initiates the CSR strategy. This holds under both the low type and high type case.*

Proof:
$$\left.\frac{\partial \pi_{1L}}{\partial \alpha}\right|_{\alpha=0} = \frac{(2\beta k + 4k + 3t)(4r + 2\beta k - 4k - t)}{192t} > 0$$

$$\left.\frac{\partial \pi_{1H}}{\partial \alpha}\right|_{\alpha=0} = \frac{(2\beta k + 3t)(4r + 2\beta k - 4k - t)}{192t} > 0$$

Underlying intuition of this result is same as corollary 1. The initiation of a CSR-strategy will lead the firm to act more aggressively and move towards the middle to obtain more market share, resulting in higher profit.
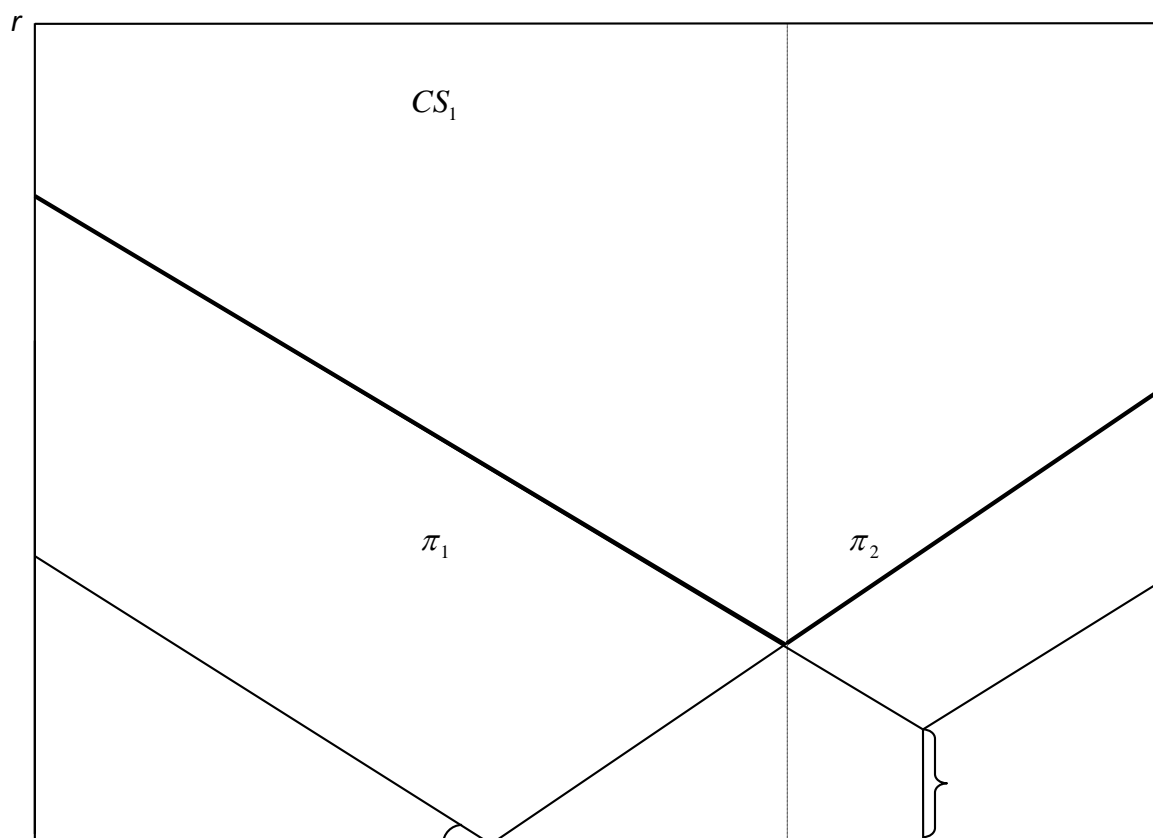
6.   DISCUSSION AND FURTHER RESEARCH
In recent times, companies are considering corporate social responsibility (CSR) as a serious business strategy. CSR is not only good for building a positive image of the company for its stakeholders, but it could also make a positive contribution to its bottom line. Because of this, and also because of motivation from various external bodies like governments and UN bodies, more and more companies are incorporating CSR in their operations. One relevant research

question that arises from this is explicitly what benefits a firm gets following a CSR strategy compared to another firm that does not adopt CSR. We have considered a game theoretic model that include two firms – one CSR and the other non-CSR – both competing in the same market with substitutable products. We operationalize the CSR firm by making its objective as maximizing a linear combination of its own profit and a form of social utility. We also assume that the CSR firm has a technological advantage so that its marginal cost of production is lower than the non-CSR firm. Our goal is to find to what extent the two firms differentiate their products from each other's (measured along a Hotelling type line), and how this degree of differentiation is influenced by the extent of cost advantage and the degree of CSR activities. First, a benchmark case where both firms are profit-maximizing (without the CSR objective) was solved to generate a benchmark product differentiation. When the game is played out between the two firms, we find that the degree of product differentiation is reduced when CSR is practiced. On the other hand, product differentiation increases with the production cost advantage. The interaction between the two factors – CSR activity and cost advantage – is also studied. Further, we study an asymmetric information scenario where the extent of production cost advantage of the CSR firm is private information and is not known to the other firm. The cost could be at two levels, a high level with no advantage and a low level as previously considered, with a probability that is common knowledge. The effect of the production cost advantage and the extent of CSR activity are studied in this scenario. We find to what extent the product differentiation is affected by the high and low type firms as well as their effect on each other.

Our work can be extended in various ways. The effect of the CSR activity can be studied in interaction with variables other than the production cost advantage as used in our paper. Another example variable could be an elastic demand for each customer that is dependent on the discriminative price. We can also incorporate a variable search cost on part of the customers in the model. The optimal level of CSR for the firm and for the whole value system might be of interest to study as well. Our one-dimensional Hotelling model used for the product differentiation can be extended to a two-dimensional spatial model.

Figure following on the next page

Figure 1: Spatial Price Discrimination with Demand Constraints

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