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Socially Responsible Firms in a Duopoly

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1 Introduction

Corporate social responsibility is the commitment by business to behave ethically and contribute to economic development while improving the quality of life of the workforce and their families as well as of the local community and society at large as defined by the World Bank Council for Sustainable Development. Over the years firms are becoming more socially responsible. They are not just driven by the motive to earn profits but also to work for the development of the society or by being more concerned towards the environment. Recently India has come up with a new mandate which requires rich firms to spend two percent of its profit for social causes. The developing countries lack in environmental quality and suffer from huge inequalities. Public expenditure is not enough to ensure the achievement of United Nations Sustainable development goals. It is not just limited resources in the hands of public sector but also their inefficient utilisation which does not result in achieving desired goals. Thus it is important for the private sector to pitch in.

Firms voluntarily engage in socially responsible activities for a various reasons like altruism, personal environmental values, peer pressure, warm glow. Besides these CSR can be used strategically to increase profits with the presence of green consumers. Firms that do not care for environmental and social issues are penalised in some way through its poor image. A firm's commitment to CSR is considered important by buyers in making informed choices. Consumers are willing to pay a higher price for the products of the firms with CSR commitment. Firms also realise that they are rewarded for engaging in CSR activities through better image, in reducing the chances of regulations and scrutiny, and retaining employees. Some multinationals like Coca-Cola and Hindustan Unilever are engaged in strategic CSR. Coca-Cola was found to have pesticide residues above the permissible limit in India. To recover its image, in June 2007, Coca-Cola implemented a water stewardship programme and committed itself to reducing its operational water footprint and to offset the water used in the company's products through locally relevant projects. It carried out many projects on water harvesting and management thereafter. Hindustan Unilever initiated a project in India by the name "Shakti." It recruits village women, provides them with access to micro finance loans, and trains them in selling soaps,

detergents, and other products door-to-door. This not only increases the market size for the company but also improves household income of the villagers, contributes to public health by providing access to hygiene products and leads to women's empowerment (Rangan et al 2015). In India There has been an increase in the percentage of firms reporting expenses on CSR from ten percent or below in previous years to about fifty percent in 2014 – 15.

We try to model the situation where there are two firms selling differentiated products. The products are differentiated horizontally. We allow firms to produce substitutes or complements varying in the degree of perfection. We define a CSR firm as a firm that takes into account not only its profits but also internalises its own share of environmental externalities and is sensitive to consumers' surplus ("social concern"). These two aspects have opposite effects on production. While the environmental concern restrains the production of a CSR firm, the social concern expands it. Thus the commitment to consumer surplus may allow the CSR firm to include environmental concern without decreasing production.

The social concern more than offsets the environmental concern in a large market, because the positive price effect going along with an output expansion is sufficiently large to outweigh the negative effect associated with pollution. This makes the CSR production strategy be more aggressive compared to the competitors' strategy, and in turn benefits the firm that engages in social responsibility.

2 Literature Review

Firms are becoming more and more socially responsible but such voluntary efforts are particularly low in developing countries ((4)) as compared to developed countries. voluntary efforts at CSR have been relatively low in developing countries ((6)). In India with a mandatory CSR law for rich companies there are about 52 percent of the firms that should be engaged in CSR however they don't. There are also spillover effects of such CSR activities which encourages firms that do not come under the purview of the law to take up CSR ((9)). There are various reasons to explain firm's behaviour towards CSR. These include reputation concerns, herding behaviour, learning and a competitive threat if firms' stakeholders value the implementation of those norms.

Kopel and Brand (2012), consider a model with two firms-one is a profit maximising firm and the other is a socially responsible firm. They find that a socially responsible firm has a better market share and higher profits. However, as the weight attached to stakeholder's welfare goes up, the profits go down after a threshold. Alves and Santos-Pinto ((3)) analysed socially responsible firms in a differentiated product market. They find that when firms produce complement goods then they would engage in CSR but in case of substitutes, they might not engage in CSR. Further, they show that when goods are substitutes, then firms play a top dog strategy by over-investing in CSR to be more aggressive. In case of

complements, firms follow a fat cat strategy and over invest in CSR to be less aggressive. (2), call socially responsible firm as the one which links provision of public good with the sales of private good. They find that competition leads to an increase in the provision of public good. Also, consumers have to be willing to pay a higher price for products produced by firms that are socially responsible. If there are green consumers present in the market then firms would voluntarily over comply the environmental standards to differentiate themselves from other firms Arora and Gangopadhyay (1995) . Such results are applicable to CSR as well where consumers appreciate the firms that are involved in CSR and are willing to pay a higher price for their products. Chander and Muthukrishnan (2015) found how coalitions amongst consumers can affect firm's decision to engage in pollution abatement technology. Our paper is closest to Lambertini and Tampieri (2015). They analyse a Cournot oligopoly with one socially responsible firm. The socially responsible firm takes into account, not just it's share of pollution but also cares for consumer surplus. They show that the socially responsible firm makes a higher profit and results in a higher level of social welfare.

3 Model

We consider a duopoly where there are two firms that produce differentiated products. The goods are horizontally differentiated and can be substitutes or complements varying in their degree of perfection. There are two firms, namely- *csr* firm and *pm* firms. The objective of the *csr* firm is not just to maximise its own profit but also to take into consideration social welfare. The *pm* firm's objective is to maximise its own profit. Utility of the consumer depends upon the consumption of both the goods. We use the utility function given by Singh and Vives, 1984. The representative consumer's utility function is given as follows.

$$U = Aq_{csr} + Aq_{pm} - \frac{q_{csr}^2 + 2\alpha q_{csr}q_{pm} + q_{pm}^2}{2}$$

Here $A > 0$. For the utility function to be concave, we need to assume that $|\alpha| < 1$. This utility function gives rise to the following linear inverse demand functions given by

$$p_{csr} = A - q_{csr} - \alpha q_{pm}$$

$$p_{pm} = A - q_{pm} - \alpha q_{csr}$$

The goods are substitutes when $\alpha > 0$, complements when $\alpha < 0$ and independent when $\alpha = 0$.

Here, q_{csr} and q_{pm} are the quantities produced by *csr firm* and *pm firm* respectively, p_{csr} and p_{pm} are the prices of their respective products. The objective function of the *csr* firm is given by:

$$O_{csr} = \pi_{csr} - gq_{csr} + z(\text{consumer surplus})$$

The *csr firm* not just cares for its own profit but also internalises the environmental damage that it causes. This damage is given by gq_{csr} . This damage is the negative externality that is produced in the process of production for example pollution. Each unit of production causes g amount of externality. Also, firms care about the surplus that consumers get from consumption of the goods which is given a weight of z by the CSR firm. The z takes a value between 0 and 1. Consumer surplus = Total utility - Total payment and Profit = Total revenue - total cost. For simplicity of calculations we assume that cost of production is zero for each of the firm. Thus,

$$O_{csr} = p_{csr}q_{csr} - gq_{csr} + z \left(A(q_{csr} + q_{PM}) - \frac{q_{CSR}^2 + 2\alpha q_{csr}q_{PM} + q_{PM}^2}{2} - (A - q_{csr} - \alpha q_{PM})q_{csr} - (A - q_{PM} - \alpha q_{csr})q_{PM} \right)$$

The objective function of the *pm firm* is given as follows:

$$O_{pm} = p_{pm}q_{pm}$$

Firms compete in quantities, i.e. there is Cournot competition. Best response function of each of the firm is given as follows: We analyse the best response functions of the firms using the first order conditions.

$$BR_{csr} : q_{csr}(q_{pm}) = \frac{A - g + \alpha(z - 1)q_{pm}}{2 - z}$$

$$BR_{pm} : q_{pm}(q_{csr}) = \frac{A - \alpha q_{csr}}{2}$$

Solving these best responses we get the following

$$q_{csr}^* = \frac{2(A - g) + A\alpha(z - 1)}{4 - 2z + \alpha^2(z - 1)}$$

$$q_{pm}^* = \frac{A(2 - z) + \alpha(g - A)}{4 - 2z + \alpha^2(z - 1)}$$

Proposition 1: $q_{csr}^* > q_{pm}^*$ iff $A > \frac{g(2+\alpha)}{z(1+\alpha)}$.

If the market size is large enough then the CSR firm produces a larger market share as compared to the PM firm.

Corollary 1 In the situation when neither of the firm is a CSR firm, a simple cournot game would have resulted in quantity produces by each firm equal to $\frac{A}{2+\alpha}$. If the goods were complements then presence of a CSR firm increases the total quantity for a large market where $A > \frac{g(2+\alpha)}{z(1+\alpha)}$.

Next we examine how the equilibrium quantities correspond to changes in z . The slope of the best response curve for firm 1 is $\frac{\alpha(z-1)}{2-z}$ and the intercept term is $\frac{A-g}{2-z}$. Similarly for firm 2 the slope of the best response curve is given by $\frac{-\alpha}{2}$ and the intercept as $\frac{A}{2}$. The slope of the best response curve changes with change in z which is given by

$$\frac{\partial^2 q_{csr}}{\partial q_{pm} \partial z} = \frac{\alpha}{(2-z)^2}$$

. It is easy to verify that the intercept increases with increase in z and best response curve becomes flatter. On the other hand slope and the intercept of the best response curve of the PM firm remains unaffected.

Proposition 2- Best response curve for the CSR firm becomes flatter as z increases.

Corollary 2 : If firms choose to increase their CSR motive then its quantity will increase if goods are substitutes. If goods are complements quantity might increase or decrease because of intercept and slope working in the opposite direction.

Profit comparison

$$\pi_{csr} = \frac{(2A - 2g - A\alpha + zA\alpha)(2g + 2A - 2zA - A\alpha - g\alpha^2 + zA\alpha^2)}{(4 - 2z - \alpha^2 + z\alpha^2)^2}$$

$$\pi_{pm} = \frac{(2A + g\alpha - zA - A\alpha)^2}{(4 - 2z - \alpha^2 + z\alpha^2)^2}$$

Proposition 3 : For the case of substitute goods;

- (i) If $A > \frac{g(2+\alpha)}{z(1+\alpha)}$ and $z < \frac{\alpha(2-\alpha)}{1+\alpha-\alpha^2}$, then $\pi_{csr} > \pi_{pm}$.
- (ii) If $A > \max\left\{\frac{g(2+\alpha)}{z(1+\alpha)}, \frac{g(2-\alpha)}{z(1+\alpha-\alpha^2)-\alpha(2-\alpha)}\right\}$ and $z > \frac{\alpha(2-\alpha)}{1+\alpha-\alpha^2}$, then $\pi_{csr} < \pi_{pm}$.

When market size is large enough and the CSR firm doesn't put much weight on the consumer surplus then its profit is larger than that of PM firm. On the other hand if market size is large enough but the CSR firm puts a lot of weight on the consumer surplus then its profit is smaller than that of PM firm. This happens because large market size brings larger market to the CSR firm. The positive price effect dominates the negative effect of social concern only when z is small enough and not otherwise.

Proposition 4: For the case of complementary goods;

- (i) If $\alpha \in [-1, -0.618]$ and $A > \frac{g(2+\alpha)}{z(1+\alpha)}$, then $\pi_{csr} > \pi_{pm}$.
- (ii) If $\alpha \in [-0.618, 0]$ and $A > \frac{g(2+\alpha)}{z(1+\alpha)}$ and $z < \frac{\alpha(2-\alpha)}{1+\alpha-\alpha^2}$, then $\pi_{csr} > \pi_{pm}$.
- (iii) If $\alpha \in [-0.618, 0]$ and $A > \max\left\{\frac{g(2+\alpha)}{z(1+\alpha)}, \frac{g(2-\alpha)}{z(1+\alpha-\alpha^2)-\alpha(2-\alpha)}\right\}$ and $z > \frac{\alpha(2-\alpha)}{1+\alpha-\alpha^2}$, then $\pi_{csr} < \pi_{pm}$.

In the case of complements with goods having high degree of complimentary then no matter how high the z is, profit of CSR firm is higher than that of PM firm. This happens because firms are like monopoly in their product. They can have a price advantage

that can dominate the negative effect of incorporating social concern. Only for less perfect complement you need z low enough.

4 Conclusion

In our model we considered a duopoly with two firms producing differentiated products. One firm is engaged in the CSR while the other is not. We established the condition when CSR firms produces a higher output than the profit maximising firm. Also it can be profitable for a firm to engage in CSR when its rival is just profit maximiser. We compared total production in the case with one CSR and one non CSR firm to the case where both the firms are profit maximisers. It was found that quantity produced can be larger in the former case.

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