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VOLUNTARY AGREEMENTS AND COMMUNITY DEVELOPMENT AS CSR IN INNOVATION STRATEGIES

By

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VOLUNTARY AGREEMENTS AND COMMUNITY DEVELOPMENT

AS CSR IN INNOVATION STRATEGIES

Abstract

The present paper examines how an innovating firm decides between two forms of voluntary agreements (VA) in a context, where a non-governmental organization (NGO) rather than a regulator watches over citizens' interests. The innovation generates profit and consumer surplus as well as environmental damage. Corporate social responsibility (CSR) within the innovation process is considered in terms of a redistribution of profit towards community development, with or without additional abatement efforts via a VA. Bargaining between firm and NGO yields the amount allocated to community development. The model demonstrates that the firm's choice of VA hinges on the tradeoffs between appropriating the full innovation profit and paying a higher lump sum towards community development or sacrificing some of the innovation profit by lowering innovation effort, but gaining in terms of paying a lesser amount towards community development. CSR with abatement is unlikely in the case of radical innovations. There is also a clear divergence of interests between the firm, the NGO and the State for some parameter configurations, which are duly identified.

Key words: Corporate social responsibility, voluntary agreements, community development donations, innovation

JEL code: M14, O32, O33

VOLUNTARY AGREEMENTS AND COMMUNITY DEVELOPMENT AS CSR IN INNOVATION STRATEGIES

1. INTRODUCTION

'Corporate Social Responsibility' (CSR) has become a buzzword in business circles as firms worldwide vie to demonstrate their engagement to society and sustainable development. Large corporations announce in their websites the variety of ways in which they are undertaking socially responsible investments, ranging from measures for good internal governance to supporting local development and preserving the environment. Such activities confirm to the definition of CSR proposed by McWilliams and Siegel (2001) as "actions that appear to further some social good, beyond the interests of the firm and that which is required by law". The theoretical economics literature on CSR has studied the rationale for many of these measures, with most of the attention being centred on incentive provision by credible regulators for abatement by manufacturing firms. However, such a focus has overlooked two interesting contexts: first, the case of innovating firms, which have the possibility to choose between technologies ex-ante, *i.e.* consider abatement ex-ante to production; and second, developing country situations, where monitoring is not very effective and non-governmental organizations (NGOs) rather than regulators act as watchdogs of public interests. The present paper thus attempts to provide some insight on these less examined situations through a study of innovating firms in developing countries facing an NGO in lieu of a regulator, while trying to compensate for the damage caused to the environment by the innovation process not only by means of abatement but also by direct investment in community development.

The process of 'innovation' is often a mixed blessing, bringing societal benefits and causing social damages at the same time. Examples abound, especially in developing countries, where monitoring is weak and regulation is less stringent. For instance, the

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diffusion of genetically modified seeds – a radical innovation, by agbiotech firms like Monsanto, Bayer and Aventis have led to contamination in some regions and threatened local biodiversity (Clapp, 2008; Ramani, 2008). Clinical trials are an essential part of new drug discovery and this risky phase of drug innovation is increasingly outsourced to developing countries. Many top pharmaceutical firms like Pfizer, GlaxoSmithKline, Sanofi-Aventis and Bayer have been hauled for malpractice related to outsourcing clinical trial contracts to unscrupulous hospitals, physicians and medical faculty with insufficient monitoring (Kelleher, 2004). Innovation creation can generate damage even in State supported projects. For instance, though STMicroelectronics has generated hundreds of jobs in the Grenoble region of France, there have been steady protests against STM on account of the capture of local resources, environmental degradation and potential risks of conducting experiments and producing products based on nanotechnology (Vinck, 2010).

The diffusion of innovations by firms can be helped or hindered by other stakeholders like NGOs. Indeed, the course of diffusion of some radical innovations like 'terminator seeds' or 'antiretrovirals' have been heavily marked by confrontation with NGOs (Ramani and Mukherjee, 2008). For instance, worldwide protests by activists rather than any public intervention led to the withdrawal of genetically modified sterile seeds called 'terminator seeds' commercialized by Monsanto in 1998, which risked changing the age old tradition of farmers to save seeds from one harvest for the next. Similarly, in 2001, when Cipla developed a HIV-AIDS drugs cocktail and offered it to NGOs at $350 per annum per patient for developing country patients, a set of pharma majors selling similar drugs all over the world for $10,000 per annum per patient, filed a case against Cipla at the World Trade Organization. However, concerted pressure from NGOs and civic bodies all over the world led to a vote in Cipla's favour.

The study of the strategic rationale of CSR undertakings by firms is relatively recent. It was triggered to explain the reality of CSR against the strong theoretical arguments of conventional economics, as exemplified by Friedman (1970), asserting that a firm's responsibility to society must be limited to compliance with existing regulations as anything over and above would be an encroachment on the rights of the State and act against the interests of shareholders. A seminal theoretical model by Baron (2001) resolved this paradox by distinguishing between different motives for CSR. Firms may redistribute their profits because of 'altruistic' preferences or as a 'strategic response' to demands being made by other stakeholders in the market such as consumers, NGOs or regulators. While the former type of CSR is profit sacrificing in its spirit and extremely rare, the latter comprises a variety of new incarnations of traditional strategies for profit maximization through reputation gains and building up of brand loyalty.

Most of the theoretical literature on CSR concerns itself with strategic CSR rather than altruistic CSR. In a recent survey of this stream of work, Lyon and Maxwell (2008) point out that the motivation for firms to practice strategic environmental CSR stems from the demand, supply and financial sides of the market. For instance, if consumers are willing to pay a premium for 'green products' then firms will invest in environmental friendly technology (Arora and Gangopadhyay, 1995). CSR could also emerge because of market competition between environmental friendly 'green products' and damaging 'brown products'. If the market for 'browns' is competitive, their price will be lower, the demand will be higher and consequently there will less incentive for firms to undertake CSR (Bagnoli and Watts, 2003). From the financial side, if investors are interested in supporting 'green' companies then CSR would also increase (Baron 2007).

Besides investment in green technologies, Lyon and Maxwell (2008) point out that voluntary agreements (VA) on abatement can also be considered as a form of strategic CSR.

Though VAs constitute an environmental friendly action not required by law to voluntarily internalize the negative externalities generated, they are usually undertaken in response to external threats either from regulators or activist groups. The scope for VAs emerges because both the firm and the regulator foresee that if the voluntary agreement fails, both of them will incur costs. Firms accept VAs because they serve to avoid or mitigate harsher regulation and costs of lobbying, while regulators prefer VAs as they eliminate the costs of formulating and passing regulation and thereafter monitoring and enforcing compliance. All these costs are avoided when the VA comes through.

Interestingly, the theoretical models dealing with VA make no reference to 'CSR' *per se*, being entirely focused on 'abatement of environmental damage' through regulation and complementary mechanisms. Indeed, there is empirical evidence that firms consider CSR investments in a more holistic manner determining allocation of investment to not only 'doing less bad' but also to 'doing more good' (Aguilera et al. 2007). Firms can do more good in a variety of ways ranging from supporting worthy causes including investing in community development to innovation. Indeed Porter and Kramer (2002) demonstrate that even corporate philanthropy can be used as an instrument of strategy to build competitive advantage.

In the above perspective, the present paper focuses on VA with strategic corporate philanthropy. It considers a developing country context in which a self-less NGO guards citizens' interests in the absence of monitoring by the regulator. It then examines the strategic options of a firm contemplating innovation to 'do more good' knowing well that the innovation by itself can also generate some environmental and social damage, i.e. 'do some bad'. If the NGO becomes aware of the damage associated with the innovation process, it moves to press for complete compensation of damages and the imposition of an additional fine. But the NGO may or may not be successful in its efforts. To avoid the threat of paying

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fines and associated transaction costs, the firm can initiate a VA that offers to redistribute profits towards community development. But the firm also has the option of choosing and announcing its abatement effort before the VA. Once the firm decides on the type of VA to offer, it bargains with the NGO on the lump sum payment for community development. The paper then analyzes the determinants of the firm's choice between the two innovation cum CSR strategies: 'voluntary agreement without abatement' and 'voluntary agreement with abatement' with VA specific lump sum transfers for community development. It also ranks the ensuring outcomes from the perspective of the NGO and the State.

The original features of the theoretical model developed in this paper are as follows. The firm considered is in innovation mode and therefore it faces a technological and market uncertainty that is absent in the environment of a standard manufacturing enterprise with an established market. The innovating firm must decide on its innovation effort, knowing full well that it may not succeed. Furthermore, the innovating firm has not just one but two CSR choices via VA. Either it can just 'do more good' by disclosing information on potential damage and investing in local community development. Or the firm can 'do more good' and 'less bad' by again disclosing the information on the potential damage, and investing in abatement effort in addition to redistributing funds for local community development. Third, in the absence of effective monitoring by the regulator, a watchful NGO monitors the innovating firm. But, unlike a regulator whose objective is to maximize social welfare, an NGO only bargains with the innovating firm to maximize the societal value from the innovation minus expected firm profit.

The contribution of our work to the existing literature on strategic CSR can now be highlighted in four points.

First, the theoretical literature on strategic CSR considers only one form of CSR at a time, either private provision of public goods or corporate philanthropy, but not both.

Moreover, the study of environmental VA is vis-à-vis an existing system of production and initiated in response to the demands of a regulator or to the threat of regulation. In contrast, the present paper develops a game theoretic model of an innovating firm choosing between more than one innovation cum CSR choices, ex-ante to production, in response to being potentially targeted by an NGO, in the absence of a credible system of public regulation.

Second, while the literature on VA explains the reasons for the often observed soft regulatory stance against polluting firms, it is silent on why some polluting firms prefer to practice CSR in the form of donations to community development instead of investing in abatement, and furthermore, why this is tolerated by regulators. Our model provides a partial explanation for this at least in the context of innovation. When a firm invests in abatement, it lowers its innovation effort, and hence its expected innovation profit, but in the process it also lowers its non-abatement related CSR. Such trade-offs play a crucial role in the determination of the firm's choice of innovation cum CSR strategy, which has been mostly ignored in the existing VA and CSR literature. We argue that such 'trade offs' are also important for society[1] because the foregone innovation value (*i.e.* sum of firm profit and consumer surplus out of the successful innovation) due to reduced innovation effort is a cost to society as well. The welfare analysis shows that there are zones of conflict, where the societal preference over the different CSR strategies does not match the firm's preference.

Third, the model indicates that NGOs, though not taking into account the interests of the firm, can play a role similar to that of a regulator in monitoring the firm, whenever the latter is missing or inefficient. In seminal papers such as by Segerson and Miceli (1998) and Maxwell, Lyon and Hackett (2000), greater the credible threat from regulators, higher the abatement level agreed upon in VA by firms. Glachant (2007) shows that if the consumer groups are allowed in the bargaining process, the abatement level itself will increase, as

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[1] Note that 'State' and 'society' are used interchangeably and their objective is to maximize social welfare.

stronger NGOs are likely to have greater public support. We refine the above results by demonstrating that in the case of innovation, if the probability of detection of damage by the NGO is very high, then the firm will not engage in innovation in the first place. However, if the probability of detection is within an appropriate range then the higher the threat from the NGO, the greater the abatement effort. Finally, it provides an alternative NGO mode of correction by VA to the scheme suggested by Blackman, Lyon and Sisto (2008) for developing countries, involving fines to be imposed on local regulatory authorities by the federal ones, which are rather difficult to implement in regions with weak enforcement capabilities.

Fourth, our model adds additional insight to the comprehensive work by Baron (2001), Baron and Diermeier (2007) and Baron (2009) on the role of NGOs in influencing firm actions. These papers examine direct confrontations between firms and NGOs, considering the bargaining power of each in different ways – such as the degree of responsiveness of firms and the financial clout of the NGOs. A common result is that the higher the bargaining power of the NGOs, the greater the CSR response from the firms. Though the nature of interaction between the firm and NGO is completely different in our model, we confirm some of their results with respect to innovation. For instance, the transfer from the firm (i.e. CSR expenditure) is higher for lower fixed costs of the activist and for higher stakes of the firm (i.e. innovation value in our case). In addition, the value-added of our work is with respect to an evaluation of total welfare, which is not examined in their models. Our inclusion of social welfare reveals that under some parameter configurations the VA outcome will not be the preferred outcome of either the NGO or society and sometimes even the preferences of the NGO can be non-welfare maximizing. The results indicate that a regulator's task is very complex when dealing with contested innovations and advocates handling them on a case by case basis.

The rest of the paper is structured as follows. Section 2 presents the theoretical model. Section 3 discusses the results. Finally, section 4 concludes.

2. THE MODEL

Consider a firm applying an innovation effort $e_i \geq 0$, which can lead to successful commercialization with a probability of $p(e_i)$. In case of market success, the innovation generates a profit $\pi > 0$ for the firm, a surplus $c > 0$ for the consumers. A negative externality amounting to a social damage of $D > 0$ is also generated in the process, irrespective of the success of the project. However, the damage can be reduced, if the firm exerts an abatement effort $e_j > 0$. The cost function of the firm is given by $g(e_i, e_j)$.

In the absence of monitoring by the regulator, an NGO protects the interests of citizens. Let the exogenous probability that the NGO will discover the social damage D be given by $\beta > 0$[2]. In case of discovery, the NGO starts a legal process for implementing the existing regulation, or in absence of one, starts lobbying for the creation of a new regulation, which will force the firm to compensate $(D + F)$ to the consumers, with $F > 0$ being the punishment levied for suppressing the damage. However, enforcement of punishment is not certain. Depending on the responsiveness of the existing legal framework, the NGO is successful with a probability $\gamma > 0$. Moreover, as the NGO puts this process into motion, both parties incur costs. Let the fixed costs of the NGO, to furnish the prosecution with hard proof of damage D be $A > 0$. Similarly, let the fixed costs of the firm to lobby and redeem its reputation be $T > 0$.

The firm and the NGO, however, can avoid the costs related to the discovery of the damage and subsequent prosecution by initiating a voluntary agreement (VA). In the VA the

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[2] In absence of the NGO, $\beta = 0$.

firm pre-empts the prosecution or new legislation by making an *a priori* payment of z towards community development projects. Two paths for VA initiation are considered namely with or without an initial 'abatement effort' on the part of the firm. In the first, the firm does not spend any abatement effort e_j before entering the VA, going directly to negotiate the community development expenditure $z = z_w > 0$ with the NGO. In contrast, in the second type, 'VA with abatement', the firm undertakes an *a priori* abatement effort $e_j > 0$ before initiating the VA and then bargains about the investment on community development, $z = z_a > 0$.

The values of e_i, e_j and z are decided sequentially as follows. At the start, say at time $t = 1$, the firm decides on its innovation effort, e_i, or its innovation and abatement efforts, (e_i, e_j). Then, at time $t = 2$, nature plays out discovery of D with probability $\beta > 0$. Following this, at time $t = 3$, the firm and the NGO bargain over z incorporating the fact that in $t = 4$, the NGO will be successful in forcing compensation with probability γ. If the bargaining is accomplished then the VAs are implemented and payoffs are realized given that the innovation will be successfully commercialized with a probability $p(e_i)$. In case of disagreement, the NGO initiates the court procedure and the firm and the NGO incur fixed costs of T and A respectively. In addition, under disagreement, the firm accepts the outcome of the legal process and pays an additional fine of F with probability γ. Payoffs are realized at $t = 5$. This sequence is represented in figure 1.

{Insert figure 1 here]

Four standard assumptions are made to simplify the model:

Assumption 1: The returns to innovation effort are positive and diminishing in scale for the firm; i.e. $\dfrac{dp(e_i)}{de_i} > 0$; and $\dfrac{d^2 p(e_i)}{de_i^2} > 0$; for all $e_i \geq 0$. Similarly, the returns to abatement effort are also positive in terms of damage reduction; i.e. $\dfrac{dD(e_j)}{de_j} < 0$ for all $e_j \geq 0$.

Assumption 2: The marginal cost of supplying either type of effort is positive and increasing in either type of effort *i.e*: $\dfrac{\partial g}{\partial e_k} > 0, \dfrac{\partial^2 g}{\partial e_k^2} > 0, \dfrac{\partial^2 g}{\partial e_l \partial e_k} > 0$ and $\dfrac{\partial g}{\partial e_k}(0, e_l) = 0$ for all l, with $k = i, j; l \neq k$. This implies that a rise in innovation (abatement) effort not only increases the marginal cost of supplying the innovation (abatement) effort, but also the marginal cost of supplying the abatement (innovation) effort. The assumption is realistic because the skill requirements of the two activities are different. Additional funding for one raises the marginal cost of funding the other.

Assumption 3: The NGO is selfless and seeks to maximize the returns to the consumer from the innovation process.

Assumption 4: There is no moral hazard on the part of the firm or NGO, and therefore, there are no costs to monitor either party in a VA.

Now we turn to analyze the outcomes of the two types of VA initiation strategies described above.

2.1 VA WITHOUT ABATEMENT

Consider the situation when the NGO has discovered the damage associated with the innovation and the firm has decided to offer a VA without abatement, i.e. with $e_j = 0$. If the

bargaining at $t = 3$ about the community development investment, z_w, is successful the agreement payoff of the firm, π_w, is given by:

$$\pi_w = p(e_i)\pi - z - g(e_i, 0);$$ (1)

and the agreement payoff of the NGO, φ_w, is given by:

$$\varphi_w = p(e_i)c + z - D(0);$$ (2)

where $D(0)$ represents the damage level with $e_j = 0$.

If the bargaining breaks down, then the disagreement payoff for the firm is $(p(e_i)\pi - [\gamma(D(0) + F) + T] - g(e_i, 0))$; while for the NGO it is $(p(e_i)c - D(0) + [\gamma(D(0) + F) - A])$. A bargaining solution for the CSR investment z exists if the bargaining surplus of both the firm and the NGO is positive i.e. if the following inequality holds:

$$[\gamma(D(0) + F) - A] < z < [\gamma(D(0) + F) + T].$$ (3)

The Nash bargaining solution implies that the CSR investment without abatement, z_w, should be:

$$z_w = \gamma(D(0) + F) + \frac{(T - A)}{2}$$ (4)

which clearly satisfies the condition (3). Therefore, both parties prefer the VA outcome as compared to the disagreement one.

Now let us return to the start of the game, at $t = 1$, to understand the firm's choice of innovation effort e_i. Recall that the VA is offered only in the context of the NGO having discovered the damage. This means that in the probability $(1 - \beta)$ of non-discovery, the firm enjoys profit $[p(e_i)\pi - g(e_i, 0)]$ and the NGO receives $[p(e_i)c - D(0)]$. Incorporating this and substituting the value of z_w in equation (1) we obtain the reduced form expected profit function of the firm as:

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$$\hat{\pi}_w = p(e_i)\pi - \beta\gamma(D(0)+F) - \frac{\beta(T-A)}{2} - g(e_i,0). \tag{5}$$

At $t=1$, the firm maximizes $\hat{\pi}_w$ by choosing an appropriate value of $e_i \geq 0$. Given assumptions 1 and 2, the interior solution of the maximization problem, the innovation effort without abatement, e_i^w, exists satisfying the following conditions:

$$\frac{dp(e_i^w)}{de_i}\pi = \frac{\partial g}{\partial e_i}(e_i^w,0) \tag{6}$$

$$\beta \leq \frac{p(e_i^w)\pi - g(e_i^w,0)}{\gamma(D(0)+F) + \frac{T-A}{2}} \tag{7}$$

Since in the case of detection the firm has to pay an extra amount z_w for entering in VA, the higher value of β reduces firm's expected profit. Therefore, whenever the probability of detection of damage associated with an innovation, β, is very high such that inequality (7) is violated, the firm does not invest in innovation in the first place, i.e. $e_i = 0$; and the case for spending in community development does not arise

Substituting e_i^w in equation (1) and equation (2), we obtain the equilibrium payoffs of the firm and the NGO respectively as:

$$\pi_w^* = p(e_i^w)\pi - \gamma(D(0)+F) - \frac{(T-A)}{2} - g(e_i^w,0) \tag{8}$$

and,

$$\varphi_w^* = p(e_i^w)c + \gamma(D(0)+F) + \frac{(T-A)}{2} - D(0). \tag{9}$$

Since the equilibrium CSR contribution without abatement z_w^*, is independent of innovation effort e_i^w, it is given by the expression on the right hand side of equation (4). Assuming a utilitarian welfare function, the equilibrium societal welfare level S_w^*, is given by:

$$S_w^* = p(e_i^w)(\pi + c) - g(e_i^w, 0) - D(0). \tag{10}$$

Note that the CSR investment z_w^* does not influence social welfare, as it is a pure transfer from the firm to the NGO. Since both the parties are better off with the VA outcome, it is clear that society enjoys a higher welfare with a VA than without one.

2.2 VA WITH ABATEMENT

As in the preceding case, let us start by supposing that the NGO has discovered the damage associated with the innovation and the firm has decided to offer a VA with abatement, i.e. with $e_j > 0$. Assumption 1 implies that $D(e_j) < D(0)$ for all values of $e_j > 0$. At $t = 3$, if the bargaining over community development investment, z_a, is successful, the agreement payoff of the firm π_a, is given by:

$$\pi_a = p(e_i)\pi - z - g(e_i, e_j); \tag{11}$$

while that of the NGO is:

$$\varphi_a = p(e_i)c + z - D(e_j). \tag{12}$$

If the bargaining breaks down, then the firm gets $(p(e_i)\pi - [\gamma(D(e_j) + F) + T] - g(e_i, e_j));$ while the NGO gets $(p(e_i)c - D(e_j) + [\gamma(D(e_j) + F) - A]$. There exists a CSR abatement investment z acceptable to both parties if the bargaining surplus is positive for both of them, i.e. if the following inequality holds:

$$[\gamma(D(e_j) + F) - A] < z < [\gamma(D(e_j) + F) + T]. \tag{13}$$

Then the Nash bargaining solution z_a satisfying condition (13) is:

$$z_a = \gamma(D(e_j) + F) + \frac{(T - A)}{2}. \tag{14}$$

which clearly satisfies the condition (13). Therefore, both parties prefer the VA outcome as compared to the disagreement one.

Now let us again return to the start of the game. Recall that the VA is offered only if the damage is detected, i.e. with probability β. Otherwise, i.e. with probability $(1 - \beta)$ the firm enjoys a profit of $[p(e_i)\pi - g(e_i, e_j)]$ and the NGO receives $[p(e_i)c - D(e_j)]$. Integrating this fact and substituting the value of z_w in equation (11) we obtain the reduced form expected profit function of the firm as:

$$\hat{\pi}_a = p(e_i)\pi - \beta\gamma(D(e_j) + F) - \frac{\beta(T - A)}{2} - g(e_i, e_j). \tag{15}$$

At $t = 1$, therefore, the firm maximizes $\hat{\pi}_a$ by choosing an appropriate value of $\{e_i \geq 0, e_j \geq 0\}$ and given assumptions 1 and 2, the interior solution to the maximization problem $\{e_i^a, e_j^a\}$ exists satisfying the following equations:

$$\frac{dp(e_i^a)}{de_i}\pi = \frac{\partial g}{\partial e_i}(e_i^a, e_j^a); \tag{16}$$

$$-\beta\gamma\frac{dD(e_j^a)}{de_j} = \frac{\partial g}{\partial e_j}(e_i^a, e_j^a); \tag{17}$$

$$\beta \leq \frac{p(e_i^a)\pi - g(e_i^w, e_j^a)}{\gamma\left(D(e_j^a) + F\right) + \frac{T - A}{2}}. \tag{18}$$

In the VA with abatement also, higher the damage detection by the NGO, β, lower the firm's expected profit as the firm pays z_a for entering in the VA. Therefore if β is high enough and inequality (7) is violated, the firm will not even undertake innovation and there will be no negotiation over the community development expenditure.

Substituting e_i^a and e_j^a in equation (11) and equation (12) we can obtain the equilibrium payoffs of the firm and the NGO as:

$$\pi_a^* = p(e_i^a)\pi - \gamma(D(e_j^a) + F) - \frac{(T-A)}{2} - g(e_i^a, e_j^a);$$ (19)

and,

$$\varphi_a^* = p(e_i^a)c + \gamma(D(e_j^a) + F) + \frac{(T-A)}{2} - D(e_j^a).$$ (20)

Furthermore, from (14) the equilibrium CSR contribution with abatement z_a^*, can be calculated as:

$$z_a^* = \gamma(D(e_j^a) + F) + \frac{(T-A)}{2}.$$ (21)

At equilibrium, social welfare S_a^*, is given by:

$$S_a^* = p(e_i^a)(\pi + c) - g(e_i^a, e_j^a) - D(e_j^a).$$ (22)

Interestingly, S_a^* is independent of the CSR investment towards community development.

3. CSR CHOICES / INNOVATION STRATEGY AND IMPLICATIONS

Having characterized the CSR contributions of the firm under 'VA without abatement' and 'VA with abatement', in the previous section, we now identify the circumstances under which the firm will choose one or the other of the VA in its innovation process. Then, we examine the best outcomes of the innovation process from the perspective of the NGO and society. Finally, we locate the zones where the choices of the firm and the outcomes desired by other stakeholders do not match.

Before proceeding further, in order to ensure that the firm can consider either of the two innovation strategies we need to make the following last assumption.

$$\text{Assumption 5: } \beta < \min\left[\frac{p(e_i^w)\pi - g(e_i^w, 0)}{\gamma(D(0) + F) + \frac{T-A}{2}}, \frac{p(e_i^a)\pi - g(e_i^w, e_j^a)}{\gamma\left(D(e_j^a) + F\right) + \frac{T-A}{2}} \right],$$

Assumption 5 ensures that both of the equations (7) and (18) are satisfied at the same time and innovation is indeed untaken. This also leads us to the first proposition.

PROPOSITION 1: *The firm adopts the 'VA without abatement' as its innovation cum CSR strategy under one of two conditions:*

- *If $\gamma M + N \leq 0$; or*

- *If $\pi \geq \gamma M + N > 0$ where $M = \dfrac{D(0) - D(e_j^a)}{p(e_i^w) - p(e_i^a)}$ and $N = \dfrac{g(e_i^w, 0) - g(e_i^a, e_j^a)}{p(e_i^w) - p(e_i^a)}$.*

Proof. Due to the profit maximization objective of the firm, it chooses the 'VA without abatement' strategy over the 'VA with abatement' strategy if and only if $\pi_w^* \geq \pi_a^*$. Now, from equations (8) and (19) we obtain:

$$\pi_w^* - \pi_a^* = \pi[p(e_i^w) - p(e_i^a)] - \gamma[D(0) - D(e_j^a)] - [g(e_i^w, 0) - g(e_i^a, e_j^a)]. \tag{23}$$

Clearly $\pi_w^* \geq \pi_a^*$ if and only if:

$$\pi \geq \frac{\gamma\left[D(0) - D(e_j^a)\right] + \left[g(e_i^w, 0) - g(e_i^a, e_j^a)\right]}{p(e_i^w) - p(e_i^a)} = \gamma M + N. \tag{24}$$

We now show that while M is always positive, the value of N may be negative or positive.

Since by assumption 1, $\dfrac{dp(e_i)}{de_i} > 0$ for all $e_i \geq 0$, it follows that $[p(e_i^w) - p(e_i^a)] > 0$ if $e_i^a < e_i^w$. But this is always true. Given assumptions 1 and 2, by comparing equation (6) with equation (16) we can see that as the firm starts supplying abatement effort, its innovation effort falls i.e. $e_i^a < e_i^w$.

Similarly since $\dfrac{dD(e_j)}{de_j} < 0$ for all values of $e_j \geq 0$, $\left[D(0) - D(e_j^a)\right] > 0$. Therefore,

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$$M = \frac{D(0) - D(e_j^a)}{p(e_i^w) - p(e_i^a)} > 0 .$$

What about *N*? As the firm moves from the 'VA without abatement' strategy to the 'VA with abatement' strategy, e_i falls and e_j rises, and we do not have a straightforward conclusion as to whether it will increase the over-all costs of the firm or not, while comparing $g(e_i^w, 0)$ and $g(e_i^a, e_j^a)$. What is clear, however, is that if costs rise, i.e. if

$g(e_i^w, 0) < g(e_i^a, e_j^a)$, then $N = \dfrac{g(e_i^w, 0) - g(e_i^a, e_j^a)}{p(e_i^w) - p(e_i^a)}$ is negative. In this case, if it turns out

that ($\gamma M + N$) is negative, then since π is positive, inequality (24) is always satisfied and the proposition holds. However, if ($\gamma M + N$) is positive, then whenever inequality (24) is valid, the statement of the proposition again follows. □

What is the intuition behind proposition 1? The fact that the firm's investment in abatement reduces its innovation effort is the key to understanding. Whenever the firm undertakes abatement, there are three possible effects. First, the abatement may bring about a rise in the overall costs of the firm by $\left[g(e_i^a, e_j^a) - g(e_i^w, 0) \right]$. Second, since abatement effort also lowers the innovation effort, it reduces the expected innovation profit by $\pi[p(e_i^w) - p(e_i^a)]$. Third and in contrast to these negative effects, the abatement effort also has a positive impact on the firm's expected profit as it decreases outlays towards community development by $z_w^* - z_a^*$ as given below:

$$z_w^* - z_a^* = \gamma \left[D(0) - D(e_j^a) \right] . \tag{25}$$

Thus, the firm's preferred choice will depend on the magnitudes of the three effects on its expected profit: possible increase in over all costs, decrease in expected profit and decrease in CSR outlays. Here, proposition 1 predicts that if supplying abatement effort is very costly, the firm will not adopt the CSR strategy 'VA with abatement'. In particular, whenever the innovation profit is by itself low in the first place, as in incremental

innovations, the firm is likely to adopt the 'VA with abatement' strategy as the opportunity cost of losing out on innovation value is less. Otherwise, the firm's preferred choice will be the 'VA without abatement' strategy. For instance, if the innovation is radical with high expected profit, whatever the cost consequences of abatement, the firm will choose to supply CSR uniquely in the form of contributions to community development without abatement.

Now we turn to the implications of firm choice for the other stakeholders, namely the NGO and the State.

PROPOSITION 2: *If $c < (1-\gamma)M$ the NGO's payoffs are maximized, when the firm chooses 'VA with abatement'. However, if $c > (1-\gamma)M$ the NGO gains more if the firm chooses 'VA without abatement'.*

Proof. From equations (9) and (20) we have that the difference between the payoffs to the NGO when the firm chooses 'VA without abatement' and 'VA with abatement' is:

$$\varphi_w^* - \varphi_a^* = \left[p(e_i^w) - p(e_i^a) \right] \left[c - (1-\gamma) \frac{D(0) - D(e_j^a)}{p(e_i^w) - p(e_i^a)} \right] \tag{26}$$

Since $\dfrac{dp(e_i)}{de_i} > 0$ for all $e_i \geq 0$ by assumption 1, it follows $\left[p(e_i^w) - p(e_i^a) \right] > 0$. Now applying the definition of M from proposition 1 and by using the fact $M > 0$, the statement of the proposition follows from equation (26). $\square$

Note that when a firm chooses 'VA with abatement', it has a three-fold consequence on the NGO. On the positive side, there is a lowering of damage to the environment; but on the negative side, there is a lowering of consumer surplus as a part of the previous innovation effort is diverted to abatement and there is also a lowering of CSR outlays on community development. Thus, proposition 2 highlights the interesting point that the impact of the choice of the firm on the NGO is independent of firm profit, being a function of the returns to the

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community. Therefore, when c is low, the loss in the innovation benefit under the 'VA with abatement' strategy is inconsequential. Since, the CSR expenditure, z_a^*, is also less under the 'VA with abatement' equilibrium, much will depend on the magnitude of the reduction to environmental damage $\left[D(0) - D(e_j^a) \right]$. On the other hand, when c is high, under abatement, with the lowering of firm effort in innovation, the risk of loss of expected benefit from the innovation is higher. Therefore, the NGO prefers the firm to choose 'VA without abatement'.

Finally, we turn to the total welfare generated under the different scenarios, which should represent the preferences of the State.

PROPOSITION 3: *Social welfare is higher when the firm chooses 'VA without abatement',*

i.e. $S_w^* > S_a^*$ *if :*

  (i) $M + N < 0$; *or*

  (ii) $\pi + c > M + N$ *given* $M + N > 0$.

Proof. From equations (10) and (22) we can see that when the firm shifts from a 'VA without abatement' to a 'VA with abatement' strategy, social welfare changes as follows:

$$S_w^* - S_a^* = \left(\pi + c \right)[p(e_i^w) - p(e_i^a)] - [D(0) - D(e_j^a)] - [g(e_i^w, 0) - g(e_i^a, e_j^a)].$$

Clearly $S_w^* > S_a^*$ if and only if the following inequality is satisfied:

$$\pi + c \geq \frac{\left[D(0) - D(e_j^a) \right] + \left[g(e_i^w, 0) - g(e_i^a, e_j^a) \right]}{p(e_i^w) - p(e_i^a)} = M + N .$$

And the proposition follows with the same arguments as in proposition 1 applying to the values of M and N. □

The intuition behind proposition 3 is similar to the previous arguments. The societal value of an innovation or the 'innovation value' is defined as $(\pi + c)$ and the proposition

examines how this value evolves as the firm moves from 'VA without abatement' to 'VA with abatement' equilibrium. Again, the final outcome depends on the sum of three effects. As the firm adopts abatement, some of the innovation effort of the firm is channelled towards abatement and the expected innovation value falls and so does CSR allocated to community development. But, if the 'innovation value' is low enough, the loss in 'innovation value' is outweighed by the gain from reduced damage to the environment *i.e.* $\left[D(0) - D(e_j^a) \right]$ and society prefers the 'VA with abatement' adopted by the firm. However, if $\pi + c > M + N$ given $M + N > 0$, the expected loss associated with 'VA with abatement' strategy adopted by the firm outweighs the gain $\left[D(0) - D(e_j^a) \right]$ and society prefers the 'VA without abatement' to the 'VA with abatement' strategy.

Turning to the other side of the coin, there can also be contexts in which the firm prefers not to abate, but the State wants the same. The next proposition clarifies all these situations of conflict between the preference of the firm, the NGO and the State.

PROPOSITION 4:

(i) The innovation cum CSR strategy choice of the firm does not represent the best outcome for either the NGO or the State:

- *If $c < (1 - \gamma)M$ and $\pi \in \left[(\gamma M + N), (M + N - c) \right]$ the firm's innovation cum CSR strategy consists of 'VA without abatement' but this is not best outcome for either the State or the NGO.*

- *If $c > (1 - \gamma)M$ and $\pi \in \left[(M + N - c), (\gamma M + N) \right]$ the firm chooses 'VA with abatement', but this is not the best outcome for either the State or the NGO.*

(ii) The choice of the firm is the best outcome for the State but not the NGO:

- *If $c < (1 - \gamma) M$ and $\pi > M + N - c$, the firm chooses 'VA without abatement', which maximizes social welfare but is not best outcome for the NGO.*

- *If $c > (1 - \gamma) M$ and $\pi < M + N - c$, the firm chooses 'VA with abatement', which maximizes social welfare but is not best outcome for the NGO.*

(iii) The choice of the firm yields the best outcome for the State and the NGO in all situations other than those indicated in (i) and (ii).

Proof. The proofs can be derived easily. We detail it for the first statement of part (i) and other parts can be proved similarly. Note that if $c = (1 - \gamma) M$, then $\gamma M + N = M + N - c$. On the other hand, if $c < (1 - \gamma) M$, then $\gamma M + N < M + N - c$. Thereafter, the concerned statement follows directly from propositions 2, 3 and 4. Similar arguments lead to the proofs of the rest of the proposition. $\square$

Proposition 4 reflects the divergence of interest between the firm, the NGO and the State. While it is impossible to have a coalition of interests whereby the firm's choice is good for the NGO but not the State, other kinds of conflict of interests are possible. Why? When the firm innovates it cares only about its own profit π but not about the positive externality c it generates for the society through its innovation activity. The NGO on the other hand does not care about the firm's profit, focussing only on consumers and the environment. But the State cares about all stakeholders and the environment. If π and c are both very low such that the innovation value $(\pi + c)$ is also very low, the firm's preference, the NGO's preference and the society's preference coincide in favour of 'VA with abatement' because the consequent fall in the innovation effort does not imply a lot of sacrifice for any stakeholder. But, for innovations with low c but higher π, the firm may prefer to abandon abatement completely as the opportunity cost from forgone innovation profit rises; but $(\pi + c)$ may still be sufficiently low for the State to justify the lowering of innovation effort of the firm in order to preserve

the environment. Therefore, a conflict arises. But if π is very high such that $(\pi + c)$ is also high, the State also supports 'VA without abatement': the abandoning of abatement effort or damage to the environment is compensated by a higher generation of market profit and consumer surplus. However, since the NGO does not care about the firm's profit, here, a situation of conflict may arise between the preference of the NGO and the firm and even the State. Similarly, if c is high and π is low, the firm may prefer to undertake abatement, but if the innovation value $(\pi + c)$ is high enough, the State may not prefer the firm to continue with its abatement strategy as it reduces the expected gain from innovation. Furthermore, if c is very high and π is very low, the NGO may prefer the firm to practice 'VA without abatement' even if it is not in the best interest for both the firm and the society as a whole.

These results are summarized in table 1.

[Insert table 1 here]

3.1   ON INSTITUTIONAL CAPABILITIES AND CSR OUTCOMES

Recall that the entire model has been developed supposing the absence of effective monitoring by a regulator in an economy and with a NGO substituting the regulator in monitoring and looking after consumers' interest. But this leads to another question: is having a NGO replace a regulator necessarily a good thing? The answer according to our model is given below.

OBSERVATION 1: *In economies with weak regulatory structure and NGO activism, the form of CSR that emerges through voluntary agreement between firms and NGOs may not be the preferred outcome from the perspective of either of the NGOs or society as a whole. There are even situations where the preferences of the NGOs may go against the interest of society as a whole.*

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Proof. The above observation follows directly from Proposition 4. □

But the VA is enacted under the shadow of a legal system. How are the outcomes likely to change as γ which is the indicator of the credibility of the legal environment of a state rises?

OBSERVATION 2: *As the legal institutions become more effective, i.e. as γ rises,*

(i) *the amount paid in CSR through VA in both the types of equilibriums rises;*

(ii) *the abatement effort supplied by the firm rises*

(iii) *the likelihood that the firm chooses the 'VA with abatement' strategy increases;*

Proof. It is to be noted that part **2**(i) of the above observation can be easily derived from the expressions of z_w^* and z_a^* as in equations (4) and (21) respectively. □

As to 2(ii), from equations (16) and (17) we obtain:

$$\frac{\partial e_j^a}{\partial \gamma} = \frac{\beta\left(\dfrac{dD(e_j^a)}{de_j}\right)\left[\pi\left(\dfrac{d^2 p(e_i^a)}{de_i^2}\right) - \dfrac{\partial^2 g(e_i^a, e_j^a)}{\partial e_i^2}\right]}{\Delta};\tag{27}$$

where $\Delta = -\left[\pi\left(\dfrac{d^2 p(e_j^a)}{de_j^2}\right) - \dfrac{\partial^2 g(e_i^a, e_j^a)}{\partial e_i^2}\right]\left[\beta\gamma D(e_j^a) + \dfrac{\partial^2 g(.)}{\partial e_j^2}\right] - \dfrac{\partial^2 g(.)}{\partial e_i e_j}\dfrac{\partial^2 g(.)}{\partial e_j e_i}$.

From the second order condition of the solution to the firm's profit maximization problem in the case of 'VA with abatement', we see that $\Delta > 0$. Moreover, given the assumptions of the model, it follows that the numerator of the expression on the right hand side of equation (27) is positive. Therefore, $\dfrac{\partial e_j^a}{\partial \gamma} > 0$. □

Finally, observation 2(iii) issues from propositions 1 and 3. □

4. CONCLUSION

Firms can demonstrate their social responsibility either by 'doing more good' or 'doing less bad' or both. The economics literature has mainly examined these two paths as stand-alone options, with much more focus on the means to persuade the firm to do 'less bad' through appropriate regulatory instruments such as VA. Two other common features of the existing models are consideration of regions with efficient and capable regulators and firms in a post-innovation production phase, which can reduce environmental damage through investment in abatement. In contrast, in order to add more insight to the less studied contexts, the present paper has examined innovating firms which have to chalk out their abatement strategies before setting up the manufacturing units, via bargaining with an NGO, existing in lieu of a regulator.

In the game developed, the first mover, the firm, chooses its innovation effort in tandem with one of two alternative modes of CSR. Under the 'VA without abatement', the firm does not spend any amount *a priori* in abatement and bargains with the NGO over the amount of a lump sum payment towards community development; while under the 'VA with abatement', the firm decides the abatement effort unilaterally and then initiates the bargaining process with the NGO. The choice of the firm between a 'VA without abatement' and a 'VA with abatement' identified as a function of the parametric configurations reveals the rationale of the firm CSR strategy and permits an evaluation of outcomes also from the point of view of the NGO and the State.

Our model demonstrates that the choice of the firm about the type of VA hinges on the tradeoffs between appropriating the full innovation profit and paying a high lump sum towards community development or sacrificing some of the innovation profit by lowering innovation effort, but gaining in terms of paying a lesser amount towards community development. It indicates that if the innovation is radical with a high expected profit, the firm

is likely to offer a VA to spend on community development without investment in abatement. The NGO on the other hand evaluates outcomes according to the gains to consumers, while the State is concerned with maximization of social welfare. Through a series of propositions we showed that there are parameter configurations, where there is a similitude of interests, and others, where the interests of the stakeholders diverge. Thus, the model advocates a case by case consideration of CSR associated with contested innovations, without calling for general rules.

It has already been confirmed in the theoretical literature (see survey that Lyon and Maxwell, 2008) that requiring or even persuading firms to undertake abatement via VA may not always be in the interests of society. Our paper confirms this result in the context of innovation, where more than one kind of CSR option is possible. What is noteworthy is that even the preferences of NGO watch dogs may not be in the interests of society. This is particularly in the case of radical innovations which hold high profit potential for the firm but without commensurate surplus for the consumer. In this case, the State is willing to overlook the damage caused to the environment, and prefers to permit full innovation in return for lump sum compensation towards local community development. However, if the State (say of developing countries) invests in strengthening its regulatory capabilities, our paper indicates that not only will the probability of the firm opting for 'VA with abatement' increase, but the CSR investment towards community development will also increase under any kind of VA.

Finally, while the present paper has studied the interaction between a firm and an NGO via VA, the model developed can be extended to answer many important questions treated in the standard literature on VA interactions between firms and a regulator. For instance, we can probe deeper into what constitutes a better strategy for the regulator: is it negotiating over 'abatement' or 'non-abatement' CSR? What will be the firm's preference

over these options? What will happen if both are negotiated at the same time? Indeed, the exploration of such issues can be considered as agenda for research in the future.

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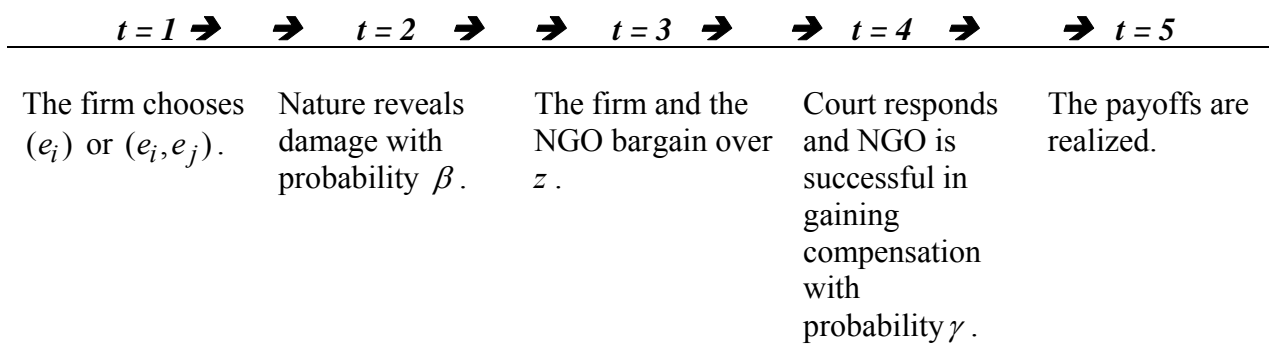
$t = 1$ ➜	➜	$t = 2$ ➜	➜	$t = 3$ ➜	➜	$t = 4$ ➜	➜	$t = 5$

The firm chooses (e_i) or (e_i, e_j).

Nature reveals damage with probability β.

The firm and the NGO bargain over z.

Court responds and NGO is successful in gaining compensation with probability γ.

The payoffs are realized.

FIGURE 1. SEQUENCE OF ACTIONS IN THE 'INNOVATION WITH CSR' GAME

TABLE 1. IMPLICATIONS OF THE FIRM'S INNOVATION CUM CSR STRATEGY FOR THE STATE AND THE NGO

	π low	π medium	π high
c low	The firm's choice of 'VA with abatement' yields the best outcome for both the NGO and the State.	Firm chooses 'VA without abatement'. But this is not the best outcome for NGO and society.	Firm chooses 'VA without abatement'. This is the best outcome for society but not NGO.
c high	Firm chooses 'VA with abatement'. This is the best outcome for society but not NGO.	Firm chooses 'VA with abatement'. But this is not the best outcome for NGO and society.	The firm's choice of 'VA without abatement' yields the best outcome for both the NGO and the State.

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