Corporate Social Responsibility and workers' motivation at the industry equilibrium

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Abstract

In this paper, we study CSR decisions by firms in the presence of morally motivated agents. In a context where both the type of the manager and the effort he may exert are not observable, firms may use costly CSR to incentivize as well as to screen responsible managers. The cost structure prevailing within the industry is derived from the endogenous contract choices made on the labor market. In turn, firms compete on the product market in a Salop-like model with cost heterogeneity. These two levels of interaction between firms allow us to identify a twofold relationship between CSR efforts and competition. We show that an increase in social awareness may exhibit non-monotonic effects on the overall level of CSR meanwhile an exogenous shock on competition may affect positively or negatively the corporate social performance depending on the proportion of morally motivated agents.

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JEL Codes: D64; D86; L13; M14; Q50.

1 Introduction

More than ever, companies dedicate important resources to socially responsible activities, well beyond the requirements of the law. Examples of such philanthropy include *Walt Disney* which chooses to commit itself to protecting the environment and to plant trees in the rain forest; Starbucks supporting Ethos Water, which provides safe water to billion of people; *Pfizer* participating to the MAM program, which goal is to encourage malaria prevention and provide access to early anti-malaria treatments; *Microsoft* implementing its annual Employee Giving Campaign in order to raise funds for non-profit organizations. The unprecedented development of these business practices

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has given rise to a growing interest in the determinants of firms' investments in Corporate Social Responsibility (CSR).[1] Nowadays, the strategic view of CSR constitutes the main line of explanation that has been put forward to figure out why firms embrace CSR. Along this line, CSR is often pointed out as a mean to boost consumer's willingness to pay for the firm products (Bagnoli and Watts 2003 or Fisman et al. 2006), to preempt future activists' actions (Baron 2001) or to foretell the scope and the stringency of new regulations (Maxwell et al. 2000 or Maxwell and Decker 2006). One additional business reward firms can potentially expect from their investment in CSR relies on the intrinsic motivations that some employees may have for addressing social or environmental issues. A recent body of papers have found empirical support for the idea that socially responsible firms can pay lower wages while attracting more motivated (productive) employees (see Nyborg and Zhang 2013, Lanfranchi and Pekovic 2014, Newman et al. 2016, the discussion in Brekke and Nyborg 2008 as well as the experimental papers by Fehrler and Kosfeld 2014, Koppel and Regner 2014 and Brekke et al. 2011). At the same time, a rapidly growing literature incorporates behavioral considerations in agency problems, offering theoretical tools to analyze labor contracts and incentives schemes when employees may be morally motivated, i.e. exhibit intrinsic motivations to work hard when employed in an organization pursuing social goals (see Akerlof and Kranton 2005, Benabou and Tirole 2010, Besley and Ghatak 2005, Brekke and Nyborg 2008, Delfgaauw and Dur 2007 and 2008 or Francois 2000). These tools have been mostly applied to justify the designs of optimal incentive schemes in non-profit *vs.* for-profit firms (or private *vs.* public sectors).

The first contribution of the present paper is to build a bridge between this theoretical literature on morally motivated agents and the strategic view of CSR. Indeed, a firm that voluntarily reduces harmful polluting emissions, ensures that subcontractors do not exploit child labor or contributes to charities may be perceived as pursuing social goals by its employees even if this firm belongs to the for profit sector. These CSR endeavors are deliberately made and, by the way, it constitutes a key difference with regards to the previously cited literature, where firms' goals (or missions) are considered as exogenously given and cannot be manipulated by employers.[2] While the role played by CSR in the formation of a corporate culture enhancing employees' motivation has been put forward by several studies in the business and management literature[3], to our knowledge, our paper constitutes a first attempt to formalize this idea. Our second major contribution consists in reassessing the relationship between CSR and competition in the presence of morally motivated agents. An important literature has recently developed on the CSR-competition nexus (see Fernandez-Kranz and Santalo 2010 and references therein). Compared to this body of research, our framework has

1. The vitality of this field or research is attested by the large number of recent surveys devoted to such issues both in the economics and business literature (see, among others, Margolis and Walsh 2003, McWilliams et al. 2006, Kitzmueller and Shimshack 2012, Crifo and Forget 2015 or Schmitz and Schrader 2015).

2. There are a few noticeable exceptions that will be discussed in our review of the related literature.

3. See Branco and Rodrigues (2006), Collier and Esteban (2007), Hansen et al. (2011), Kim et al. (2011) or Mozes et al. (2011).

the advantage to simultaneously emphasize two natural dimensions through which firms interact: the labor market where they compete for motivated employees and the product market where they sell their goods. This allows us to highlight a two-way relationship between CSR and the toughness of competition.

In order to figure out the mechanisms at stake, let us briefly sketch the main ingredients of our model. The economy comprises a large number of firms, each one produces a variety of a horizontally differentiated good and has to hire one employee in order to manage the production process. Production costs are negatively related to a non-contractible effort chosen by the employee. Two types of employee co-exist: Socially responsible or not. Non-responsible employees have standard pecuniary preferences while responsible ones enjoy non-pecuniary benefits when working hard for a firm pursuing social goals. In order to attract and to motivate responsible employees, firms may invest in costly CSR activities. The marginal benefits that those employees associate with high effort are positively related with the intensity of this CSR investment.

In the following, we will refer to responsible employees as "green" and non-responsible ones as "brown" while CSR activities will be, most of the time, termed "abatement". This terminology is adopted for the sake of realism since environmentally friendly actions are big part of overall CSR initiatives. Obviously, our framework applies for all other aspects of CSR .

Internally, each individual firm faces both a moral hazard and an adverse selection problem. At the labor market level, firms compete by using abatement in order to screen and incentivize green employees. Then, we show that the design of the labor contracts crucially depends on the incremental benefits associated with high efforts. If these benefits are sufficiently large, a separating equilibrium exists in which some firms do not invest in abatement and are managed by non-motivated (brown) employees while the remaining fraction of firms attract green managers by investing in CSR. Importantly, the intensity of this investment is positively related to the incremental benefits associated with high efforts. Indeed, green firms must respond to an increase in their profits by rising abatement in order to keep the wages they propose sufficiently low to discourage brown employees to apply to the jobs they offer. Hence, even if ex-ante all-firms are identical, they become heterogenous ex-post since a firm managed by a hard-working (green) manager displays lower production costs than the one managed by brown employees. Finally, the cost structure (captured by the proportion of low-cost firms) is shaped by CSR strategies, which ultimately depend on the profit differential between high-cost and low-cost firms - directly related to the incremental benefits.

At the product market level, we consider a Salop-like model of monopolistic competition with cost heterogeneity where the profit differential between high-cost and low-cost firms is crucially affected by the cost structure within the industry (see Aghion and Schankerman 2004). At the industry equilibrium, the cost structure derived from labor contract choices made by firms, in particular choices related to the intensity of CSR activities, must be consistent with the profit dif-

ferential derived from pricing strategies on the product market. Then we characterize this industry equilibrium and we focus on the corporate social performance and the Herfindhal-Hirschman Index (HHI) of concentration at the industry level. In particular, we investigate how these two variables vary with two key exogenous parameters, which are the proportion of morally motivated employees and a measure of competition on the product market (the transport cost parameter). We obtain interesting and testable results briefly described now.

First, the corporate social performance may evolve in a non-monotonic way with the spread of an environmental awareness among the managers. This comes from that changes in the aggregate level of CSR may be driven by two opposite effects: an extensive margin effect (a change in the number of firms who do invest in abatement) and an intensive-margin one (a change in the intensity of the investment for each given firm). At the separating equilibrium, when the proportion of green managers increases, the extensive margin effect is mechanically positive. However, the rise in the proportion of low-cost firms, involved by the increase in the proportion of green workers, makes the cost competition tougher on the product market. This translates into a reduction of the incremental benefits associated with hard-working such that, the level of abatement required to screen green workers is depressed. In some configurations, this negative intensive margin effect overcomes the extensive margin one.

Second, we show that a decrease in transport costs may either enhance or depress the aggregate effort of CSR. The existing theoretical literature on the market competition - CSR nexus has found conflicting results regarding the sign of the linkage.[4] This is not surprising since each of the existing papers focuses on one particular effect of market competition (see the enlightening discussion in Fernandez-Kranz and Santalo 2010). Instead, our model encompasses different effects of competition, offering a unified framework to understand the ambiguous results regarding the outcome of competition on CSR. In particular, we distinguish: i) a rent dissipation effect that reduces the profit margin for all firms but disproportionately affects the low-costs ones; and ii) a market selection effect that increases the market shares of low-costs firms while it reduces the market shares of high-costs ones. The overall effect on the profit differential between the two types of firms turns out to be crucially affected by the degree of cost competition which, at the separating equilibrium, directly depends on the proportion of morally motivated workers. More precisely, an increase in competition boosts abatement if the proportion of green employees is high while the relationship may be reversed if it is low.

Our comparative statics provide some interesting insights for empirical studies devoted to the competition-CSR linkage. Basically, these papers consist in estimating the impact of changes in HHI on indexes of social performance or measures of pro-social activities (see, for instance, Fernandez-Kranz and Santalo 2010, Gupta and Krishnamurti 2016 or Simon and Prince 2016). Our results

4. For instance, Bagnoli and Watts (2003) conclude to a negative relationship while in Fisman et al. (2006), the link is positive.

highlight that such kind of studies should be interpreted with caution due to the endogenous nature of concentration indexes with respect to CSR. Indeed, i) the causality (form competition to social performances) could go the other way around; and ii) the impact of sectoral changes in the HHI on corporate social performances crucially depends on the origins of those changes.[5] Some studies attempt to overcome these difficulties by identifying some exogenous changes in competition (as import penetration in Fernandez-Kranz and Santalo 2010 or import tariff reductions in Flammer 2015). Our analysis indicates that the impact of those exogenous changes (proxied by changes in the transport cost parameter) may depend on other characteristics of the industry as the proportion of responsible managers or the relative size of the product market *vs.* the managerial labor market.

Our article is related to two main strands of the economic literature. First, we are in line with a growing body of papers dealing with agency problems when agents do not only respond to standard pecuniary incentives but also to non-monetary aspects of their jobs.[6] Most of these papers consider those aspects as given while, in our set-up, CSR is a strategic variable used by the principal as both a screening and an incentive device.[7] In that respect, our work could also be related to Akerlof and Kranton (2005) who consider that a firm may socialize their employees to a corporate identity that leads them to behave more or less aligned with the profit maximizing goals of the firm. The analyze by Akerlof and Kranton (2005) remains at the firm level but Hiller and Verdier (2014) proposes a simple framework to integrate such kinds of corporate culture choices by firms to a monopolistic competition model. The present paper differs from the one by Hiller and Verdier (2014) along two main lines: i) instead of a fixed investment allowing to inculcate the corporate identity for sure, we consider socially responsible activities taking the form of a continuous variable, the firm being free to choose the intensity of these activities; and ii) in Hiller and Verdier (2014) there is no heterogeneity between employees and consequently no adverse selection issue. As far as we know, Brekke and Nyborg (2008) is the unique paper that considers CSR investments as a mean to attract and incentivize morally motivated agents. However, there is no strategic CSR since firms' types (green or brown) are exogenously given. Moreover, Brekke and Nyborg (2008) do not tackle the issue of the CSR - competition nexus. To that extent, our article is related to a second strand of the literature, which deals with the strategic CSR and its relationship with competition (see Bagnolli and Watts 2003 or Fisman et al. 2006). Nevertheless, none of these articles consider CSR as a mean to attract motivated employees. In addition, they take the competitive structure as given while, in our framework, the HHI is endogenous and the relationship between CSR and competition goes in the two ways. One noticeable exception is García-Gallego and Georgantzís

5. In our comparative statics, sectoral variations in HHI may come from differences in the proportion of green managers or in the transport cost parameter.

6. See Benabou and Tirole (2010), Besley and Ghatak (2005), Brekke and Nyborg (2008), Delfgaauw and Dur (2007, 2008) or Francois (2000).

7. Besley and Ghatak (2005) propose an extension where mission choice is endogeneized. However, there is no explicit screening issue in their model.

(2009) who theoretically investigate the impact of a change in consumers' social responsibility on the market structure. However, they focus on discrete changes in the market structure (monopoly / duopoly with incomplete coverage of the market / duopoly with complete coverage of the market) while we are able to compute a continuous measure of the competitive pressure, the HHI, which is also commonly used in empirical studies.

The remainder of the paper is organized as follows. Section 2 presents a simple asymmetric information model where CSR may allow to screen motivated agents. Section 3 embeds the screening model of Section 2 into a model of product market competition and characterizes the equilibrium of the industry. Section 4 discusses comparative statics. Finally, Section 5 concludes.

2 A hidden information model with CSR and socially responsible employees

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In this section, we develop a hidden information model in which firms compete for employees (managers), some of whom being socially responsible and may invest in CSR in order to screen and motivate them. The economy comprises a large number (N) of potentially active firms (the principal or she hereafter) and a large number (M) of managers (the agent or he hereafter) with $N > M$. In order to produce, each firm has to hire one manager. Once employed, each manager exerts a costly action (effort) $e \in \{e^L, e^H\}$ that parametrizes the probability distribution over outputs (benefits) $\pi \in \{\pi^A, \pi^B\}$ with $\pi^A > \pi^B$.[8] For ease of presentation, e^L is normalized to 0 whereas $e^H > 0$. The output is high (π^A) with probability $\lambda(e) \in (0,1)$, which is increasing in e. The expected benefits of a firm conditional to the effort e provided by the manager writes as:

$$\bar{\pi}(e) \equiv \lambda(e)\pi^A + (1 - \lambda(e))\pi^B \tag{1}$$

Finally, we define $\bar{\pi}^H \equiv \bar{\pi}(e^H)$, $\bar{\pi}^L \equiv \bar{\pi}(e^L)$, $\lambda^H \equiv \lambda(e^H)$ and $\lambda^L \equiv \lambda(e^L)$ as well as the (expected) incremental benefits associated with high effort as follows:

$$\Delta\bar{\pi} \equiv \bar{\pi}^H - \bar{\pi}^L = (\lambda^H - \lambda^L)(\pi^A - \pi^B) \tag{2}$$

We suppose that managerial efforts are not measurable and the contribution of this effort to the total output of the firm hard to figure out, such that this contribution cannot be part of a formal compensation scheme (a similar assumption is adopted in Brekke and Nyborg, 2008 or Benabou and Tirole, 2015). This assumption may be justified by the fact that managers usually have

8. In this section, benefits π^A and π^B are exogenous. Further, in Section 3.1, we propose a model of product market competition where π^A and π^B are endogenized.

more freedom in the way things are done within a firm relative to other types of employees and are involved in long-term project. This can explain the lack of a precise measure of success. In addition, this assumption allows us to drastically simplify the moral hazard side of the model.[9] In this set-up, wages are only used to ensure the participation of managers.

2.1 Preferences

Two types of managers co-exist: the responsible (so-called *green*, indexed by g) and the none responsible ones (*brown*, indexed by b). Brown managers are considered to be standard *homo economicus*: They are only interested in the income (y) they earn and the effort (e) they spent:

$$U_b(y, e, a) = y - e \tag{3}$$

Green managers may exhibit some intrinsic motivations to exert extra efforts if the firm is deemed to be sufficiently socially responsible. Formally, the intensity of CSR activities (captured by a level of pollution abatement, chosen by the principal and denoted by a)[10] affects the disutility that a green manager associates with hard working:

$$U_g(y, e, a) = y - e + v(e, a) \tag{4}$$

with $v(0, a) = 0$, $v'_e(e, a) > 0$, $v'_a(e, a) > 0$, $v''_{aa}(e, a) < 0$ and $v''_{ea}(e, a) \geq 0$. The function $v(e, a)$ accounts for the fact that a green agent's effort is entirely driven by his intrinsic motivation. Our crucial assumption lies in the fact that this intrinsic motivation is increasing with the level of abatement chosen by the principal.

The idea according to which some workers, in specific contexts, may enjoy exerting effort, has been already putted forward by Benabou and Tirole (2003) or Delfgauuw and Dur (2007, 2008). In Delfgauuw and Dur (2007, 2008), this intrinsic motivation effect interacts with the type of job or the sector (public *vs.* private)[11] just as it interacts with abatement in our framework. Indeed, we consider that, by investing in abatement, firms tend to achieve socially oriented missions aligned with the own goals of a responsible agent. One important point of departure between our set-up and the models proposed by Delfgauuw and Dur (2007, 2008) or Besley and Ghatak (2005) lies in

9. In particular, whenever the managerial effort may be related to the firm's output, it becomes relevant to introduce monetary incentives in order to solve the moral hazard problem. The existing trade-off between monetary and non-monetary incentives is clearly beyond the scope of the present paper (on that issue, see Hiller and Verdier, 2014).

10. Some firms, like General Electric, DuPont or Unilever have made tackling environmental wastes as a key economic driver. Early, DuPont committed itself to cutting down greenhouse gaz emissions (GEG) by 65 % in ten years prior to 2010; Toyota succeeded in reducing emissions per manufactured vehicle by 47 % between 2001 and 2012; General Electric committed to reduce the energy intensity of its operations by 50 up to 2015; Walmart made a pledge to cut total carbon emissions by 20 metric tons by 2015.

11. Similarly, in Besley and Ghatak (2005), some agents value their personal contribution to the output of the firm when their preferences are aligned with the mission of the organization they work for.

the fact that CSR intensity is a choice variable while the firm cannot manipulated its mission, type of job or sector. The utility function for a green manager (4) can also be compared to the theoretical framework offered by Akerlof and Kranton (2005) who argue that people may get satisfaction when their actions conform the identity that the person aspires to. In our model, we could imagine that the ideal action of a manager belonging to a green identity is to commit itself to work hard within an organization engaged in environmentally friendly actions.

As for the principal, CSR activities are costly. The costs induced by a level of abatement a are denoted $\phi(a)$, with $\phi'(a) > 0$ and $\phi''(a) \geq 0$. Abatement are fixed costs, disconnected with the firm's production level, which may encompass many types of CSR practices. Examples include planting trees in the rain forest or investing to preserve the coral reef, cleaning-up coastal areas and the like.

The profits of a firm choosing the abatement level a, proposing the wage rate w and hiring a manager who chooses a level of effort e are:

$$\Pi(w, e, a) = \bar{\pi}(e) - w - \phi(a) \tag{5}$$

Finally, the proportion of green managers is denoted q and we assume that firms know this proportion but cannot observe the precise type of the manager they hire. Then, the game between firms and managers may be decomposed into three steps: First, firms who enter the market simultaneously announce the contract they wish to offer to managers. As neither the effort nor the output are contractible, a contract is simply a pair *wage rate / abatement level* denoted (w, a). Then, given the offers made by firms, managers choose whether to accept a contract or not and, if so, which one.[12] Finally, managers choose their level of effort, output is realized and wages are paid.

In the following, we analyze the solution of the game when principals do not observe the exact type of the agent they employ. However, for ease of clarity, let us first study the case where types are observable.

2.2 Equilibrium contracts with observable types

When types are observable, in the first stage of the game, firms are able to propose a specific contract to each type of manager. Let us denote by (w_i, a_i) the contract designed for a manager of type $i \in \{g, b\}$ and by $e_i(w_i, a_i)$ the effort chosen by a manager of type i who has accepted the contract (w_i, a_i). Let us define $\bar{a}$, a threshold on abatement effort, such that green managers are indifferent between e^H and e^L:

$$v(e^H, \bar{a}) = e^H \tag{6}$$

12. If a manager is indifferent between the contracts proposed by several firms, he accepts each firm's offer with equiprobability.

Put differently, $\bar{a}$ corresponds to the level of abatement such that the intrinsic motivation effect exactly compensates the disutility of effort for green managers. A simple inspection of (3) and (4) leads to

$$e_b(w_b, a_b) = 0 \qquad \text{and} \qquad e_g(w_g, a_g) = \begin{cases} 0 & \text{if} \quad a_g < \bar{a} \\ e^H & \text{if} \quad a_g \geq \bar{a} \end{cases} \tag{7}$$

Let us also define $\Pi_i(w_i, a_i) \equiv \Pi(w_i, e_i(w_i, a_i), a_i)$ as the expected profits associated with the contract (w_i, a_i). It directly comes from (5) and (7) that:

$$\Pi_b(w_b, a_b) = \bar{\pi}^L - w_b - \phi(a_b) \tag{8}$$

$$\Pi_g(w_g, a_g) = \begin{cases} \bar{\pi}^L - w_g - \phi(a_g) & \text{if} \quad a_g < \bar{a} \\ \bar{\pi}^H - w_g - \phi(a_g) & \text{if} \quad a_g \geq \bar{a} \end{cases} \tag{9}$$

The level of abatement a_i is chosen by firms in order to maximize the expected profits $\Pi_i(w_i, a_i)$ for a given value of w_i. Then, as managers are on the short side of the market, wages adjust to ensure that the zero-profit condition is satisfied. Through equation (3), the utility of a brown manager does not depend on the abatement effort, meanwhile it is costly for a firm (see equation (9)), thus firms choose $a_b = 0$. When focusing on green managers, the problem may be decomposed into two cases: *i)* if $a_g < \bar{a}$, green managers behave as brown ones such that $a_g = 0$; and *ii)* if $a_g \geq \bar{a}$, green workers choose e^H. In that configuration, firms adjust the wage they offer (w_g) until the participation constraint binds and then they choose a_g in order to minimize the difference between abatement costs and intrinsic motivation: $\phi(a_g) - v(e^H, a_g)$. Let us define $a^\star$, the value of a_g such that the marginal cost of abatement exactly equals the marginal utility of abatement for a hard working green manager:

$$\phi'(a^\star) = v'_a(e^H, a^\star) \tag{10}$$

The optimal level of abatement for a firm willing to induce a green manager to work hard is obviously $a_g = a^\star$ if $a^\star \geq \bar{a}$ and $\bar{a}$ otherwise. Let us denote a^* the optimal level of CSR:

$$a^* = \max\{a^\star, \bar{a}\}$$

and define

$$\phi^* \equiv \phi(a^*) > 0 \qquad \text{and} \qquad \nu^* \equiv v(e^H, a^*) - e^H \geq 0$$

Hence, the level of abatement proposed to green managers may exceed $\bar{a}$. Indeed, an increase in CSR does not only motivate green employees, this also relaxes their participation constraint.

It remains to determine in which configuration the principal chooses to incentivize a green manager (choosing $a_g = a^*$) or not (choosing $a_g = 0$) and to deduce the associated wage. The following lemma describes the set of equilibrium contracts when information is symmetric and free

entry pins down expected profits to zero.

Lemma 1 *When the type of managers is observable, a unique competitive equilibrium exists where firms propose the contract* $(w_b^*, a_b^*) = (\bar{\pi}^L, 0)$ *to brown managers who accept it and the contract*

$$(w_g^*, a_g^*) = \begin{cases} (\bar{\pi}^L, 0) & \text{if} \quad \Delta\bar{\pi} < \phi^* - \nu^* \\ (\bar{\pi}^L, 0) \cup \left(\bar{\pi}^H - \phi^*, a^*\right) & \text{if} \quad \Delta\bar{\pi} = \phi^* - \nu^* \\ \left(\bar{\pi}^H - \phi^*, a^*\right) & \text{if} \quad \Delta\bar{\pi} > \phi^* - \nu^* \end{cases}$$

to green managers who accept it.

Proof. See Appendix A ■

As claimed in Lemma 1 firms choose to incentivize green managers if and only if the incremental benefits associated with high effort ($\Delta\bar{\pi}$) overcomes the cost (net of social benefits) of abatement a^* ($\phi^* - \nu^*$).

2.3 Equilibrium contracts with unobservable types

When types are unobservable, firms cannot propose a specific contract to each type of manager. Following Rotshild and Stiglitz (1976), we assume that each firm can offer a specific contract that could be dedicated to green or brown managers respectively and let workers self-select themselves. In our setting, this implies that some firms may choose to invest in CSR in order to screen responsible managers.

The contract designed for a manager of type i is still denoted by (w_i, a_i). Each type of manager chooses the contract designed for him if the two incentive compatibility constraints are satisfied:

$$V_g(w_g, a_g) \geq V_g(w_b, a_b) \tag{11}$$

$$V_b(w_b, a_b) \geq V_b(w_g, a_g) \tag{12}$$

where $V_i(w_i, a_i) \equiv U_i(w_i, e_i(w_i, a_i), a_i)$. Simple inspections of $V_b(w_b^*, a_b^*)$, $V_g(w_b^*, a_b^*)$, $V_b(w_g^*, a_g^*)$ and $V_g(w_g^*, a_g^*)$ allow us to conclude that the set of equilibrium contracts when types are observable (w_i^*, a_i^*) also satisfies the two incentives compatibility constraints (11) and (12) if and only if $\Delta\bar{\pi} \leq \phi^*$. Hence, as long as $\Delta\bar{\pi}$ is lower than ϕ^*, firms propose the same contracts as in the previous configuration and managers self-select the contract designed for them.[13]

It remains now to explore the case where $\Delta\bar{\pi} > \phi^*$. In such a configuration, a screening problem arises. When the first best contracts (w_b^*, a_b^*) and (w_g^*, a_g^*) are offered, brown managers choose the contract dedicated to green ones. Since our set-up is in direct line with Rotshild and Stiglitz (1976) in their seminal paper on insurance market with adverse selection, we obtain similar results. First

13. Notice that when $\Delta\bar{\pi} < \phi^* - \nu^*$ firms offer a pooling contract: $(w_b^*, a_b^*) = (w_g^*, a_g^*) = (\bar{\pi}^L, 0)$; While when $\Delta\bar{\pi} \in (\phi^* - \nu^*, \phi^*]$ they offer separating contracts $(w_b^*, a_b^*) = (\bar{\pi}^L, 0) \neq (w_g^*, a_g^*) = \left(\bar{\pi}^H - \phi^*, a^*\right)$.

of all, any equilibrium has to be a separating equilibrium. Second, since brown managers cannot be incentivized, a_b must still be equal to 0 and, through the zero-profit condition, $w_b = \bar{\pi}^L$. Third, the contract proposed to responsible managers must be such that brown ones are not tempted to accept it. To ensure the separability property, the wage proposed to green managers w_g should be set to $\bar{\pi}^L$. Then, the optimal abatement level is deduced from the zero-profit condition and equals $\phi^{-1}(\Delta\bar{\pi})$. Let us emphasize that, the parametric condition $\Delta\bar{\pi} > \phi^*$ implies that $\phi^{-1}(\Delta\bar{\pi}) > a^*$. Indeed, if the level of abatement a^* were to be proposed to green managers, the zero-profit condition would yield $w_g = \bar{\pi}^H - \phi^*$ which is strictly higher than $\bar{\pi}^L$ since $\Delta\bar{\pi} > \phi^*$. Obviously, such a configuration could lead brown managers to cheat and accept a "green job". Hence, in order to ensure separability as well as zero-profits, the level of abatement has to increase sufficiently to pin-down w_g to $\bar{\pi}^L$. Finally, it is worth noticing that a separating equilibrium may not exist for all values of q, the proportion of green managers. In particular, we can define a threshold $\hat{q}$ such that, when $q > \hat{q}$ such an equilibrium does not exist anymore.[14]

All those results are summarized in the following proposition:

Proposition 1 *At the competitive equilibrium (when it exists), firms propose two types of contract* $\{(\hat{w}_b, \hat{a}_b), (\hat{w}_g, \hat{a}_g)\}$ *with*

$$(\hat{w}_b, \hat{a}_b) = (\bar{\pi}^L, 0) \tag{13}$$

$$(\hat{w}_g, \hat{a}_g) = \begin{cases} (\bar{\pi}^L, 0) & \text{if} \quad \Delta\bar{\pi} < \phi^* - \nu^* \\ (\bar{\pi}^L, 0) \cup \left(\bar{\pi}^H - \phi^*, a^*\right) & \text{if} \quad \Delta\bar{\pi} = \phi^* - \nu^* \\ \left(\bar{\pi}^H - \phi^*, a^*\right) & \text{if} \quad \Delta\bar{\pi} \in (\phi^* - \nu^*, \phi^*] \\ \left(\bar{\pi}^L, \phi^{-1}\left(\Delta\bar{\pi}\right)\right) & \text{if} \quad \Delta\bar{\pi} > \phi^* \end{cases} \tag{14}$$

Green workers choose $(\hat{w}_g, \hat{a}_g)$ *while brown ones choose* $(\hat{w}_b, \hat{a}_b)$*. Finally, there exists a* $\hat{q} \in (0, 1)$ *such that, when* $\Delta\bar{\pi} > \phi^*$ *and* $q > \hat{q}$*, the competitive equilibrium no longer exists.*

Proof. See Appendix B ■

As claimed in Proposition 1, in some configurations, the game between firms and managers does not admit any competitive equilibrium. Nevertheless, as it will become clear in the next section, some parameters condition may ensure that this case never arises at the industry equilibrium. Then, we investigate the case where a competitive equilibrium exists.

The relationship between the equilibrium level of pollution abatement of green firms ($\hat{a}^g$) and the incremental benefits $\Delta\bar{\pi}$ described in Proposition 1 is also depicted in Figure 1 below. This is obviously globally increasing but its precise shape informs us about the dual purpose of CSR. First, it is beneficial for firms to induce high effort through abatement if and only if the incremental benefits overcome the net costs of abatement ($\Delta\bar{\pi} \geq \phi^* - \nu^*$). At this point, $\hat{a}_g$ jumps to the optimal

14. The precise expression of $\hat{q}$ is provided in Appendix B.

level of abatement a^* which is independent of $\Delta\bar{\pi}$. However, as the latter increases further (so that $\Delta\bar{\pi}$ becomes higher than ϕ^*), CSR takes on an additional role. It allows to screen green managers by discouraging brown ones to select a contract dedicated to the former. Indeed, for a given level of abatement, zero profit conditions for both types of firms imply that the wage gap between green and brown firms is linearly increasing in $\Delta\bar{\pi}$. Hence, following an increase in $\Delta\bar{\pi}$, $\hat{a}_g$ must adjust upward in order to pin down w_g to $\bar{\pi}^L$.

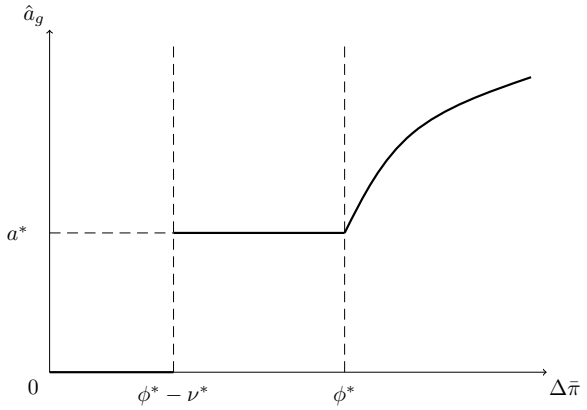


Fig. 1. *Evolution of CSR activities as a function of* $\Delta\bar{\pi}$

Finally, the equilibrium levels of effort for green and brown managers respectively ($\hat{e}_g$ and $\hat{e}_b$) expressed as a function of $\Delta\bar{\pi}$ may be directly deduced from Proposition 1:

$$\hat{e}_b = 0 \qquad \text{and} \qquad \hat{e}_g = \begin{cases} 0 & \text{if} \quad \Delta\bar{\pi} < \phi^* - \nu^* \\ 0 \cup e^H & \text{if} \quad \Delta\bar{\pi} = \phi^* - \nu^* \\ e^H & \text{if} \quad \Delta\bar{\pi} > \phi^* - \nu^* \end{cases} \tag{15}$$

As shown in Proposition 1, the set of labor contracts that is offered by firms and, in particular, the intensity of CSR activities crucially depend on the incremental benefits associated with high effort ($\Delta\bar{\pi}$). Up to now, $\Delta\bar{\pi}$ has been considered as exogenously given. In order to tackle the issue of the CSR-competition relationship we propose a simple set-up to endogenize $\Delta\bar{\pi}$ and relate it with competitive conditions at the product market level. The next section analyzes the industry equilibrium in this framework.

3 Industry equilibrium

We consider that firms compete at two levels: in the labor market to attract managers (see the previous section) and in the product market to sell their products. In order to make the link between these two levels of interaction, we consider that the unit cost of production of a firm depends on the effort spent by the manager employed in that firm. More formally, at the product market level,

a firm may be one of two types $j \in \{A, B\}$ and c^j denotes the unit production cost of a firm of type j. Firms of type A are assumed to be more efficient (low-cost firms) than firms of type B (high-cost firms) such that $c^A < c^B$. The degree of cost asymmetry is denoted $\Delta c \equiv c^B - c^A$. The probability for a given firm to be of type A is denoted by $\rho \in [0, 1]$. This cost-structure parameter, which captures the intensity of cost competition in the industry, is considered as given by firms when competing on the product market. In fact, it is endogenous since it depends on incentives given to managers (see Section 2).

The precise timing of the events is as follows:

i Firms simultaneously decide to enter.

ii Firms who enter the market propose a labor contract, *i.e.* a pair (*wage / abatement*), to managers. Given the offers he receives, each manager chooses whether to accept or not a contract and, if so, which one.

iii Managers choose their level of effort and production costs are revealed.

iv Active firms compete in price. Wages are paid to managers.

We solve the model backward. Notice that stages i, ii and iii (labor market level) have been already solved for given values of π^A and π^B. In fact those benefits are endogenous: π^i are the benefits of a firm with unit costs c^i at the equilibrium of the price competition stage. The pattern of competition on the product market is described in section 3.1. In this section, we also solve the stage iv, the distribution of production costs (cost structure) as given. In section 3.2, we analyze how the competition at the labor market level interacts with the competition at the product market level and we characterize the equilibrium of the industry.

3.1 A horizontal product differentiation model with cost heterogeneity

In this section we present the price competition stage taking the number of firms and the cost structure as given. We consider a Salop-like model of monopolistic competition where L consumers are uniformly located on a circle of length one. When n firms are active in the industry, they are equidistantly distributed on the unit circle, and thus the distance between two firms equals $1/n$. The location of a firm corresponds to the specific variety of the good that she produces. Consumers wish to buy one unit of good exactly and derive a utility v from this consumption, this utility being high enough to ensure that all consumers purchase the good. The individual surplus of a consumer who buys a unit of the good to firm i located at a distance x from his ideal variety equals $v - p_i - xd$, with p_i the price chosen by the firm i. The parameter d accounts for the distaste of the consumer when moving away form his ideal variety. It can also be interpreted as a measure of the product market competition.

We depart from the standard circular model of spatial differentiation since we introduce cost heterogeneity. Each firm as a probability $\rho \in [0,1]$ to be highly efficient (with low costs c^A) and a probability $1-\rho$ to be poorly efficient (with high costs c^B). In order to ensure that, at the equilibrium, both types of firms are active we assume that the cost differential (Δc) is small enough. Formally, the following condition must hold:

Assumption 1 $\Delta c < \frac{2d}{n}$

Once they know and their own unit cost of production, firms compete in price. Adopting the framework proposed by Aghion and Schankerman (2004), we determine the Nash equilibrium in price under the following assumptions:[15]

i When choosing their price, firms know their own type and the distribution of types (ρ) but do not know the precise type of her neighbors.

ii We restrict our attention to the symmetric equilibrium of the game: All firms of a same type j charge the same price p^j at the equilibrium.

For any symmetric equilibrium and due to Assumption 1, a firm i has two relevant competitors: Her immediate left-hand side neighbor $i-1$ and her immediate right-hand side neighbor $i+1$, each of whom are charging a price p_{i-1} and p_{i+1} respectively. Let us define $\tilde{x}_{i-1}$ and $\tilde{x}_{i+1}$ the distance between the firm i and the consumer who is indifferent between consuming the good produced by i and $i-1$ and $i+1$, respectively: $p_i+d\tilde{x}_{i-1} = p_{i-1}+d(1/n-\tilde{x}_{i-1})$ and $p_i+d\tilde{x}_{i+1} = p_{i+1}+d(1/n-\tilde{x}_{i+1})$. The demand for firm i can be expressed as:

$$D(p_i; p_{i-1}, p_{i+1}) = L\left[\tilde{x}_{i-1} + \tilde{x}_{i+1}\right] = L\left[\frac{1}{n} + \frac{p_{i-1}+p_{i+1}}{2d} - \frac{p_i}{d}\right] \tag{16}$$

When choosing p_i, the firm i does not observe p_{i+1} and p_{i-1}. However, as we focus on symmetric equilibria, we can derive the expression of the expected demand[16] of firm i as a function of p_i:

$$\bar{D}(p_i) = \rho^2 D(p_i; p^A, p^A) + (1-\rho)^2 D(p_i; p^B, p^B) + 2\rho(1-\rho)D(p_i; p^A, p^B) \tag{17}$$

Finally, the expected benefits of firm i (equal to profits when abstracting from the costs associated with the remuneration of the manager and CSR activities) stands to be: $\pi_i(c^j) = (p_i - c^j)\bar{D}(p_i)$.

15. See Aghion and Schankerman (2004) for an extensive discussion of these assumptions. Note that, in their baseline model, Aghion and Schankerman (2004) consider the cost structure (c^A, c^B and ρ) as given. In an extended version of their framework they endogenize c^A and c^B by assuming that firms can engage cost-reduction investments before the price competition stage. In the present model, we propose an alternative way to endogenize the cost structure since we consider that the probability ρ to be a low-cost firm depends on the incentive scheme chosen by firms.

16. To the extent that the number of managers, and thus active firms, is finite, the expression of the expected demand is an approximation. It is nonetheless accurate for a large enough managerial market size.

Differentiating $\pi_i(c^j)$ with respect to p_i yields the following pricing rule:

$$p_i(c^j) = \frac{1}{2}\left[\frac{d}{n} + \rho p^A + (1-\rho)p^B + c^j\right] \tag{18}$$

From now on, we neglect the index i when referring to prices and profits since we focus on the symmetric equilibrium. It also comes that $p(c^A) = p^A$ and $p(c^B) = p^B$ that yields, after some algebra:

$$p^A = \frac{d}{n} + c^A + \frac{1-\rho}{2}\Delta c \tag{19}$$

$$p^B = \frac{d}{n} + c^B - \frac{\rho}{2}\Delta c \tag{20}$$

Through Assumption 1, both p^A and p^B are positive. Replacing those equilibrium prices (19) and (20) into equation (17), we obtain the expected demand for firms of type A and B, respectively:

$$D^A \equiv \bar{D}(p^A) = L\left[\frac{1}{n} + \frac{1-\rho}{2d}\Delta c\right] \tag{21}$$

$$D^B \equiv \bar{D}(p^B) = L\left[\frac{1}{n} - \frac{\rho}{2d}\Delta c\right] \tag{22}$$

Let us notice that the expected demand addressed to a firm i is linear in the unit margin of that firm: $D^j = L(p^j - c^j)/d$. Then, we deduce the expected benefits (benefits conditional to the expected demand):

$$\pi^A = d(D^A)^2 = \frac{L}{4dn^2}\left[2d + (1-\rho)n\Delta c\right]^2 \tag{23}$$

$$\pi^B = d(D^B)^2 = \frac{L}{4dn^2}\left[2d - \rho n\Delta c\right]^2 \tag{24}$$

and the expected profit differential between a low-cost and a high-cost firm:

$$\pi^A - \pi^B = d\left[(D^A)^2 - (D^B)^2\right] = \frac{L}{n}\Delta c + \frac{L}{4d}(1-2\rho)(\Delta c)^2 \tag{25}$$

The equilibrium profit of each type of firm is the product of the profit margin d and the squared market share D^j. In particular, it can be expressed as a function of ρ and we can denote: $\pi^A = \pi^A(\rho)$ and $\pi^B = \pi^B(\rho)$. An increase in ρ reduces the profit for both types of firms, but this reduction is proportional to the market share. Hence, low-cost firms suffer more from an increase in competition and the profit differential is decreasing in the share of efficient firms (see equation (25)).

As previously discussed, at the product market level, the cost structure is considered as given by firms who compete in price. However, the parameter ρ turns out to be endogenous, depending on the incentive contract proposed by firms to managers. In the next section, we analyze how ρ is shaped by the competition on the managerial labor market.

3.2 Characterization of the industry equilibrium

First of all, the labor market clearing condition for managers requires that the equilibrium number of active firms in the industry is given by $n = M$. Second, the cost structure in the industry is directly related to the competitive equilibrium reached at the labor market level. From (15), we obtain the following expression for the probability ρ of being a low-cost firm:

$$\rho \begin{cases} = \lambda^L & \text{if} \quad \Delta\bar{\pi} < \phi^* - \nu^* \\ \in [\lambda^L, q\lambda^H + (1-q)\lambda^L] & \text{if} \quad \Delta\bar{\pi} = \phi^* - \nu^* \\ = q\lambda^H + (1-q)\lambda^L & \text{if} \quad \Delta\bar{\pi} > \phi^* - \nu^* \end{cases} \tag{26}$$

When the incremental benefits are small, firms do not have any incentive to invest in CSR and thus, a unique contract is offered to both types of manager: $(\bar{\pi}^L, 0)$. Managers do not provide any extra effort and the probability to be a low-cost firms is pinned-down to λ^L. When the incremental benefits overcome the net cost of CSR, it becomes profitable to induce green managers to work hard. Firms propose an incentive contract to green managers such that the latter chooses e^H (see Proposition 1). Then, a proportion q of firms has a probability λ^H to be efficient while a proportion $1-q$ of firms has a probability λ^L to exhibit low production costs. When $\Delta\bar{\pi}$ exactly equals $\phi^* - \nu^*$, firms are indifferent between investing in CSR or not: Some of them propose the contract $(\bar{\pi}^L, 0)$ that does not incentivize green managers and the residual fraction offers the contract $(\bar{\pi}^H - \phi^*, a^*)$ that does encourage responsible employees to work hard. Consequently, the proportion of low-cost firms belongs to the interval $[\lambda^L, q\lambda^H + (1-q)\lambda^L]$.

Third, $\bar{\pi}^H$, $\bar{\pi}^L$ and $\Delta\bar{\pi}$ are determined on the product market and are the result of the price-competition stage. As already discussed, these variables crucially depend on the endogenous cost structure parameter ρ, which value is deduced from labor market competition. Combining expressions (23), (24) with expressions (1) and (2) yields:

$$\bar{\pi}^H = \frac{L}{4dM^2}\left[4d^2 + (\lambda^H(1-2\rho) + \rho^2)M^2(\Delta c)^2 + 4dM(\lambda^H - \rho)\Delta c\right] \equiv \bar{\pi}^H(\rho) \tag{27}$$

$$\bar{\pi}^L = \frac{L}{4dM^2}\left[4d^2 + (\lambda^L(1-2\rho) + \rho^2)M^2(\Delta c)^2 + 4dM(\lambda^L - \rho)\Delta c\right] \equiv \bar{\pi}^L(\rho) \tag{28}$$

$$\Delta\bar{\pi} = \frac{L(\lambda^H - \lambda^L)\Delta c}{4dM}\left[(1-2\rho)M\Delta c + 4d\right] \equiv \Delta\bar{\pi}(\rho) \tag{29}$$

At the industry equilibrium, the values of $\bar{\pi}^H$, $\bar{\pi}^L$ and $\Delta\bar{\pi}$ must be consistent with the equilibrium set of contracts $\{(\hat{w}_b, \hat{a}_b), (\hat{w}_g, \hat{a}_g)\}$ and accordingly with the probability for a given firm to be highly efficient, ρ. Formally, the competitive equilibrium of the industry may be defined as follows:

Definition 2 *An industry equilibrium is a list* $(\bar{\pi}^H, \bar{\pi}^L, \Delta\bar{\pi}, \{(\hat{w}_b, \hat{a}_b), (\hat{w}_g, \hat{a}_g)\}, \rho)$ *that solves (13), (14), (26), (27), (28) and (29).*

In order to characterize that equilibrium, let us assume that the two following conditions apply:

Assumption 2 $\nu^* \leq \frac{(\lambda^H-\lambda^L)^2 L(\Delta c)^2}{2d}$

Assumption 3 $\phi^* \in [\Delta\bar{\pi}(\lambda^H)+\nu^*, \Delta\bar{\pi}(\lambda^L)]$

Assumptions 2 and 3 are made in order to abstract from irrelevant cases for our purpose and to ensure the co-existence of the two types of firms at the equilibrium.[17] Typically we rule out the case where no firm invests in CSR. In addition, we also define:

$$\tilde{\rho} = \frac{1}{2} + \frac{2d}{M\Delta c} - \frac{2d(\phi^*-\nu^*)}{L(\lambda^H-\lambda^L)(\Delta c)^2} \qquad \text{and} \qquad \tilde{q} = \frac{\tilde{\rho}-\lambda^L}{\lambda^H-\lambda^L} \tag{30}$$

$$\overline{\rho} = \frac{1}{2} + \frac{2d}{M\Delta c} - \frac{2d\phi^*}{L(\lambda^H-\lambda^L)(\Delta c)^2} \qquad \text{and} \qquad \overline{q} = \frac{\overline{\rho}-\lambda^L}{\lambda^H-\lambda^L} \tag{31}$$

The thresholds $\tilde{\rho}$ and $\overline{\rho}$ correspond to the value of ρ such that $\Delta\bar{\pi}(\tilde{\rho}) = \phi^* - \nu^*$ and $\Delta\bar{\pi}(\overline{\rho}) = \phi^*$, respectively. Then, we can claim that:

Proposition 2 *Under Assumptions 1-3 and for M low enough, an industry equilibrium exists, is unique, and is characterized by:*

$$\rho = \begin{cases} q\lambda^H + (1-q)\lambda^L & \text{if} \quad q < \tilde{q} \\ \tilde{\rho} & \text{if} \quad q \geq \tilde{q} \end{cases} \tag{32}$$

$$\Delta\bar{\pi} = \begin{cases} \Delta\bar{\pi}\left(q\lambda^H + (1-q)\lambda^L\right) & \text{if} \quad q < \tilde{q} \\ \phi^* - \nu^* & \text{if} \quad q \geq \tilde{q} \end{cases} \tag{33}$$

$$\bar{\pi}^L = \begin{cases} \bar{\pi}^L\left(q\lambda^H + (1-q)\lambda^L\right) & \text{if} \quad q < \tilde{q} \\ \bar{\pi}^L(\tilde{\rho}) & \text{if} \quad q \geq \tilde{q} \end{cases} \tag{34}$$

$$\bar{\pi}^H = \begin{cases} \bar{\pi}^H\left(q\lambda^H + (1-q)\lambda^L\right) & \text{if} \quad q < \tilde{q} \\ \bar{\pi}^H(\tilde{\rho}) & \text{if} \quad q \geq \tilde{q} \end{cases} \tag{35}$$

$$(\hat{w}_b, \hat{a}_b) = (\bar{\pi}^L, 0) \tag{36}$$

$$(\hat{w}_g, \hat{a}_g) = \begin{cases} \left(\bar{\pi}^L, \phi^{-1}\left(\Delta\bar{\pi}\right)\right) & \text{if} \quad q < \overline{q} \\ \left(\bar{\pi}^H - \phi^*, a^*\right) & \text{if} \quad q \in [\overline{q}, \tilde{q}) \\ (\bar{\pi}^L, 0) \cup \left(\bar{\pi}^H - \phi^*, a^*\right) & \text{if} \quad q \geq \tilde{q} \end{cases} \tag{37}$$

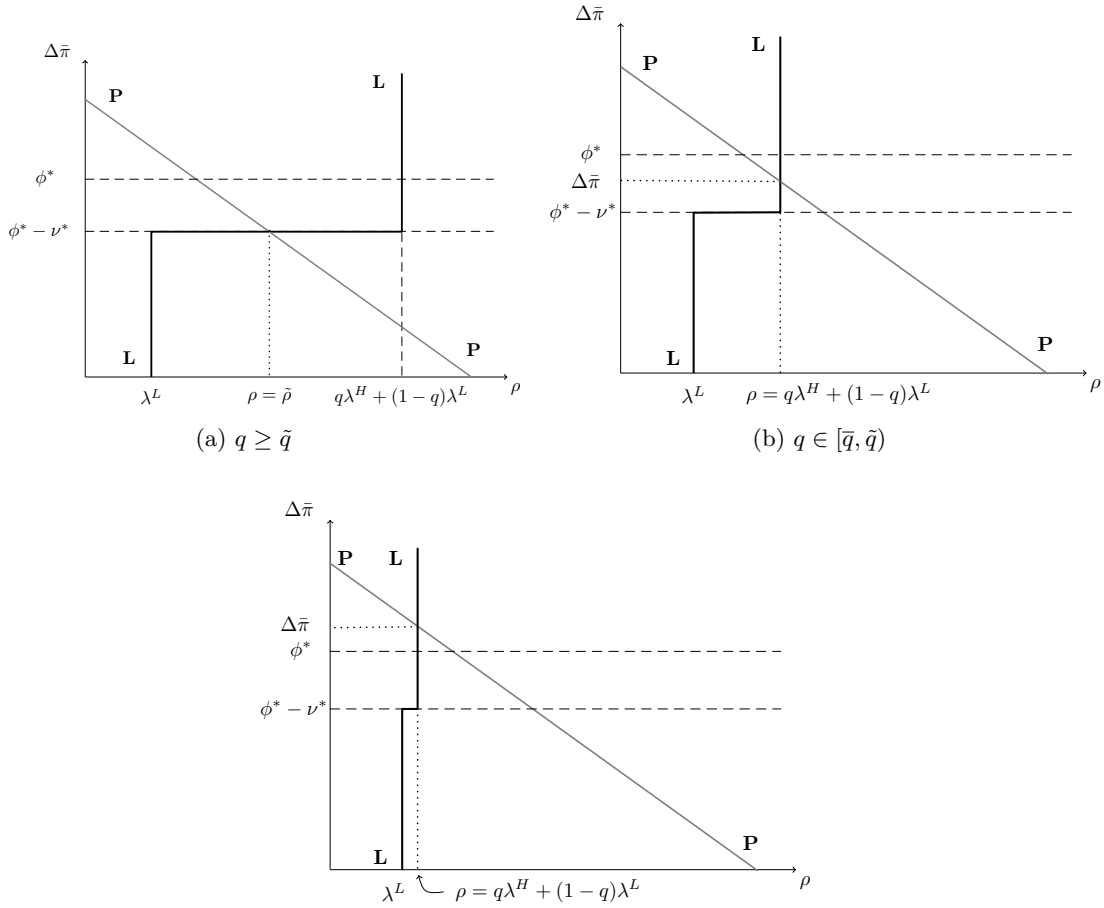
Proof. See Appendix C ■

The industry equilibrium is merely defined by the fact that the incremental benefits associated with hard working ($\Delta\bar{\pi}$) must be consistent with the probability to be a highly efficient firm (ρ).[18]

17. Note that Assumption 2 ensures that $\nu^* \leq \Delta\bar{\pi}(\lambda^L) - \Delta\bar{\pi}(\lambda^H)$. Hence, this is a necessary condition for Assumption 3.

18. Once $\Delta\bar{\pi}$ and ρ have been determined, the equilibrium values of $\bar{\pi}^L$ and $\bar{\pi}^H$ may be deduced based on the equilibrium values of ρ (see equations (27) and (28)); While the menu of contracts proposed by firms fully depends on $\Delta\bar{\pi}$, $\bar{\pi}^L$ and $\bar{\pi}^H$.

We draw on Figure 2, in the plan $(\rho, \Delta\bar{\pi})$, the two equilibrium relationships given by equations (26) and (29), each of them representing the functioning of the managerial labor market (**LL** curve) and the product market (**PP** curve) respectively. The industry equilibrium corresponds to the crossing points between these two curves.



(a) $q \geq \tilde{q}$ (b) $q \in [\overline{q}, \tilde{q})$

(c) $q < \overline{q}$

Fig. 2. *The industry equilibrium*

When $q \geq \tilde{q}$ (Figure 2(a)), a fully separating equilibrium, where all green managers are incentivized, cannot exist because cost competition would have been too harsh thereby discouraging firms to invest in CSR: $\Delta\bar{\pi}\left(q\lambda^H + (1-q)\lambda^L\right) < \phi^* - \nu^*$. Then some firms must propose the contract $(\bar{\pi}^L, 0)$ to responsible managers. This fraction of firms adjusts until $\Delta\bar{\pi}(\rho)$ exactly equals $\phi^* - \nu^*$ making firms indifferent between the two contracts $(\bar{\pi}^L, 0)$ and $(\bar{\pi}^H - \phi^*, a^*)$. We refer to this situation as a *mixed equilibrium*.

Conversely, when q is below the threshold $\tilde{q}$, $\Delta\bar{\pi}\left(q\lambda^H + (1-q)\lambda^L\right) > \phi^* - \nu^*$, such that a fully separating equilibrium is sustainable and ρ exactly equals $q\lambda^H + (1-q)\lambda^L$. In this configuration, the contract proposed to green managers differs according to the precise value of q (see expression (37)).

In particular, if $q \in [\overline{q}, \tilde{q})$ the contract dedicated to green managers proves to be $\left(\bar{\pi}^H - \phi^*, a^*\right)$ since the equilibrium value of $\Delta\bar{\pi}$ belongs to the interval $(\phi^* - \nu^*, \phi^*]$ (see Figure 2(b)). The sole role of CSR is to provide the right incentives to green managers. If $q < \overline{q}$, the toughness of competition at the product market level is quite low, the equilibrium incremental benefits get larger and the wage gap on the labor market widens. As a direct consequence, brown managers may be tempted to pick the contract $\left(\bar{\pi}^H - \phi^*, a^*\right)$ in order to benefit from the higher wage offered. Hence, green firms optimally choose to propose a higher level of abatement $\hat{a}_g = \phi^{-1}(\Delta\bar{\pi})$ in order to lower wages and to discourage brown managers. In that case, CSR is both a screening and a motivation device.

It remains to deal with the existence of the industry equilibrium in our framework. As claimed in Proposition 1 such an equilibrium may fail to exist when $q > \hat{q}$ and $\Delta\bar{\pi} > \phi^*$. Nevertheless, we know from Proposition 2 that $\Delta\bar{\pi}$ overcomes ϕ^* if and only if $q < \overline{q}$. Hence, a sufficient condition for the equilibrium to exist is that $\overline{q} \leq \hat{q}$. As shown in the proof of Proposition 2 this condition is satisfied for low enough values of M.

3.3 Equilibrium levels of Corporate Social Performance and Herfindhal-Hirschman Index

Through the interplay between the labor and the product markets, CSR activities and the market structure are jointly determined. This leads us to draw some interesting conclusions on the nature of the CSR-competition nexus. In particular, we obtain analytical expressions for the equilibrium Corporate Social Performance (CSP) and the Herfindhal-Hirschman Index (HHI), which are standard measures of CSR outcomes and competition degree of the industry. **[examples]**

First, we provide the expression of the aggregate CSP.[19]

Corollary 3 *Under Assumptions 1-3 and for M low enough, the aggregate level of abatement (A) is given by:*

$$A = \begin{cases} \Psi(q) & \text{if} \quad q \leq \overline{q} \\ qa^* & \text{if} \quad q \in (\overline{q}, \tilde{q}) \\ \tilde{q}a^* & \text{if} \quad q \geq \tilde{q} \end{cases} \tag{38}$$

with

$$\Psi(q) \equiv q\phi^{-1}\left(\Delta\bar{\pi}\left(\lambda^L + q[\lambda^H - \lambda^L]\right)\right)$$

At the industry level, the CSP depends on two components: the number of firms who do engage in CSR (*extensive margin*) and the intensity of their investment (*intensive margin*). On the one hand, the extensive margin equals either q at the fully separating equilibrium or $\tilde{q}$ when the economy belongs to the mixed regime. On the other hand, the intensive margin equals either a^* when

19. The proofs of Corollaries 3 and 4 are omitted since they can directly be derived from Proposition 2.

abatement is only used as a motivation device or $\phi^{-1}\left(\Delta\bar{\pi}\left(\lambda^L + q[\lambda^H - \lambda^L]\right)\right)$ when CSR also plays the role of a screening device.

Second, we determine the equilibrium concentration of the economy and denote by H the HHI, defined as the sum of the squared market shares: $H = n\rho(D^A)^2 + n(1-\rho)(D^B)^2$. Using (21) and (22), we express the HHI as a function of ρ.

$$H(\rho) = \frac{L}{n}\left[1 + \left(\frac{n\Delta c}{2d}\right)^2 \rho(1-\rho)\right] \tag{39}$$

We can now deduce the equilibrium value of H:

Corollary 4 *Under Assumptions 1-3 and for M low enough, the HHI (H) of the industry is given by:*

$$H = \begin{cases} \frac{L}{M}\left\{1 + \left(\frac{M\Delta c}{2d}\right)^2 [\lambda^L + q(\lambda^H - \lambda^L)][1 - \lambda^L - q(\lambda^H - \lambda^L)]\right\} & \text{if} \quad q < \tilde{q} \\ \frac{L}{M}\left\{1 + \left(\frac{M\Delta c}{2d}\right)^2 \tilde{\rho}(1-\tilde{\rho})\right\} & \text{if} \quad q \geq \tilde{q} \end{cases} \tag{40}$$

In the next section we investigate how those two indexes (CSP and HHI) vary with the distribution of managers in the labor market (q). Then we focus on A and explore the impact of an exogenous variation of the competitive environment like a change in transport cost parameter d.

4 Comparative statics

4.1 Changes in managers' social responsibility

Through Corollary 3, we immediately see that, in the mixed regime ($q \geq \tilde{q}$), the proportion of green firms as well as the individual level of CSR in those firms are invariant and therefore A is independent of q. When $q \in (\overline{q}, \tilde{q})$, only the extensive margin is affected and A is linearly increasing in q: Each additional green manager, matched with a firm, naturally pushes up the aggregate level of abatement. When $q \leq \overline{q}$ an intensive margin effect of q is added. On the labor market, CSR investments are strategically used as a screening device and thus grow with the incremental benefits ($\Delta\bar{\pi}$). However, each additional motivated manager exacerbates competition on the product market which, in turns, reduces $\Delta\bar{\pi}$. Hence, the individual effort of CSR decreases with q. Formally, in this configuration, and using equation (38), the differentiation of A with respect to q yields:

$$\Psi'(q) = \phi^{-1}(\cdot) + q\frac{\partial\phi^{-1}(\cdot)}{\partial\Delta\bar{\pi}}\frac{\partial\Delta\bar{\pi}(\cdot)}{\partial q} \tag{41}$$

The first term in the RHS of equation (41) accounts for the extensive margin effect and is positive while, the second one, that captures for the intensive margin effect, is negative. To determine in which configuration one effect dominates the other, let us express the sign of $\Psi'(q)$ by emphasizing

the two levels of interaction (both on the product and labor markets):[20]

$$\text{sign } \Psi'(q) = \text{sign } (|\epsilon_{\phi,a}(q)| - |\epsilon_{\Delta\bar{\pi},q}(q)|) \tag{42}$$

where we denote by $\epsilon_{x,y}(q)$ the elasticity coefficient between x and y expressed as a function of q. On the product market, the sensitivity of the incremental benefits to the arrival of an additional green manager is measured by $|\epsilon_{\Delta\bar{\pi},q}(q)|$. These reduced incremental benefits lower the effort of abatement proposed by green firms on the labor market, all the more that $|\epsilon_{\phi,a}(q)|$ is small. Indeed, if abatement costs are weakly sensitive to changes in a, a large drop in CSR is required to ensure that the equality $\Delta\bar{\pi} = \phi(a)$ is still satisfied. Overall, if $|\epsilon_{\Delta\bar{\pi},q}(q)| > |\epsilon_{\phi,a}(q)|$, the drop in the abatement at the individual-firm level (*intensive margin effect*) overcomes the abatement involved by a the arrival of an additional green firm (*extensive margin effect*). We can now summarize the global effect of a change in q on the CSP of the industry:

Proposition 3 *Under Assumptions 1-3 and for M low enough, we have:*

i when $\epsilon_{\phi,a}(\overline{q}) \geq \frac{\Delta\bar{\pi}(\lambda^L)-\phi^*}{\phi^*}$*: A is monotonously increasing in q;*

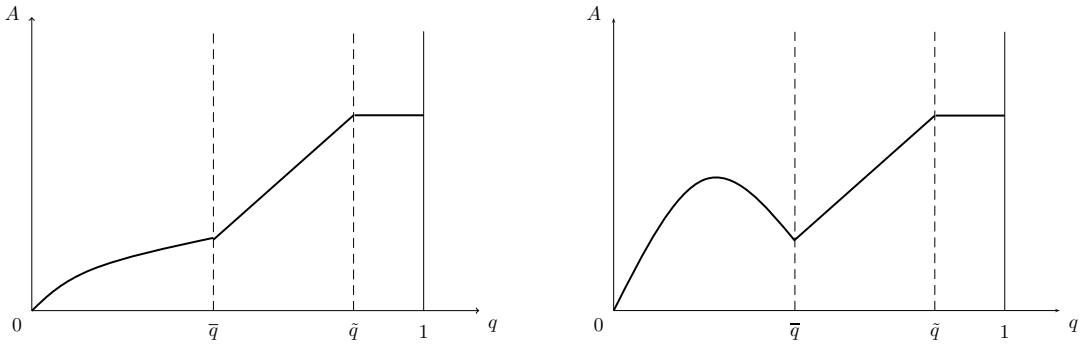
ii when $\epsilon_{\phi,a}(\overline{q}) < \frac{\Delta\bar{\pi}(\lambda^L)-\phi^*}{\phi^*}$*: A is a N-shaped function of q.*

Proof. See Appendix E ■

We already know that when $q > \bar{q}$, the CSP is weakly increasing in q through the extensive margin effect only. For smaller values of q, an intensive margin effect also arises. According to Proposition 3, the latter may always be dominated by the extensive margin effect (point i). In that case (Figure 3(a)) the aggregate CSP increases when q rises. Conversely, it could be the case that the intensive margin effect overcomes the extensive margin one when q becomes sufficiently close to $\overline{q}$ (point ii).[21] In this last configuration (Figure 3(b)), the aggregate effort of abatement turns out to be a N-shaped function of q. In order to give insights to this pattern, let us underline that an increase in q weakens the extensive margin effect while strengthening the intensive margin one. To see this, let us recall that, as q grows, each green firm invests a smaller amount in CSR. Thus, the marginal impact of an additional green manager on aggregate abatement is decreasing in q. Moreover, since abatement costs are convex, the fall in a required to compensate for a given reduction in $\Delta\bar{\pi}$ is increasing in q. Note that, this latter (intensive margin) effect is magnified when the elasticity of the elasticity of the abatement costs function is low. It explains why the N-shaped pattern arises only for small values of $\epsilon_{\phi,a}(\overline{q})$.

20. This result is derived in Appendix D.

21. We demonstrate in Appendix E that the condition $\epsilon_{\phi,a}(\overline{q}) < \frac{\Delta\bar{\pi}(\lambda^L)-\phi^*}{\phi^*}$ may be satisfied for parameters values compatible with Assumptions 1-3. To ensure that the alternative configuration (point i) is satisfied we could consider an isoelastic cost function characterized by a sufficiently high elasticity parameter.



(a) $\epsilon_{\phi,a}(\overline{q}) \geq \frac{\Delta\bar{\pi}(\lambda^L)-\phi^*}{\phi^*}$ (b) $\epsilon_{\phi,a}(\overline{q}) < \frac{\Delta\bar{\pi}(\lambda^L)-\phi^*}{\phi^*}$

Fig. 3. *Evolution of A as a function of q*

Let us turn now to the impact of a change in q on the HHI of the industry. It directly comes from expression (39) that $H(\rho)$ is an inverted U-shaped function reaching a maximum at $\rho = 1/2$. This non-monotonic effect of ρ is driven by two opposite forces. First, a rise in ρ induces to an increase in the proportion of low-cost firms who have larger market shares. Second, it exacerbates competition, reducing market shares for both types of firm. Since the HHI is the sum of the squared market shares, the first (positive) effect dominates when ρ is low while the reverse is true when ρ is high. Having this in mind, the relationship between the equilibrium concentration index and the proportion of responsible managers may easily be figured out. Formally, we can define $\tilde{M}$ as the value of M such that $\tilde{\rho} = 1/2$:

$$\tilde{M} \equiv \frac{L(\lambda^H - \lambda^L)\Delta c}{\phi^* - \nu^*}$$

and we claim the following:

Proposition 4 *Under Assumptions 1-3 and for M low enough, H is independent of q on the interval $[\tilde{q}, 1]$ while for $q \in [0, \tilde{q})$ we have:*

i when $M \geq \tilde{M}$: H is monotonously increasing in q;

ii when $M < \tilde{M}$: H is an inverted U-shaped function of q.

The proof goes as follows: At the mixed equilibrium, the probability to be a low-cost firm equals $\tilde{\rho}$ thereby H is independent of q. At the separating equilibrium, this probability equals $q\lambda^H + (1-q)\lambda^L$, which is monotonously increasing in q. Then, if $M \geq \tilde{M}$, ρ is necessarily lower than $1/2$. Thus, H is monotonously increasing in q. If $M < \tilde{M}$, $\rho < 1/2$ (resp. $\rho \geq 1/2$) for $q \in \left[0, \frac{1/2-\lambda^L}{\lambda^H-\lambda^L}\right)$ (resp. $q \in \left[\frac{1/2-\lambda^L}{\lambda^H-\lambda^L}, \tilde{q}\right)$) such that H is first increasing and then decreasing in q.

In this section, we have emphasized interesting configurations with regards to the impact of q on the aggregate CSP. In particular, we show that the spread of green consciousness among

managers may exhibit unexpected outcome on the aggregate effort of CSP. Say differently, more green consciousness may not be a good news for the environment (point *ii* of Propositions 3). This result relies on the existing interactions between the labor and the product markets: An increase in q, by intensifying cost competition on the product market, affects the equilibrium labor contracts (each green firm reduces the level of abatement proposed to responsible managers).

In addition, our framework allows us to assess the impact of the share of responsible managers on the competitive pressure in the industry. Most of the existing papers dealing with the impact of a change in social consciousness on CSR in a competitive environment focus on the social consciousness of consumers. Moreover, they either consider an exogenous market structure or do not provide an explicit measure of the competitive pressure. Instead, we show that managers' social responsibility interacts, in a complex way with competition, so that the relationship between q and the HHI might be non-monotonic (point *ii* of Propositions 4).

Finally, we shed a new light on the CSR-competition nexus. Empirical studies mainly assess this relationship by estimating the impact of the HHI on the CSP at the sectoral level. However, this should be cautiously interpreted as a causal relationship from competition to CSP. Indeed, the link between the HHI and the CSP might transit through other channels. We argue that the positive relationship between CSP and HHI highlighted in cross-sectoral data may stem from sector-specific differences in the proportion of green managers even though those sectors evolve in similar competitive environments. It is for instance the case for parametric conditions simultaneously satisfying points *i* of Propositions 3 and 4, such that q displays a positive impact on both A and H.

4.2 Changes in transport costs

In this section, we explore the impact of a change in transport costs (d) on aggregate abatement A. To do so we assess, in a first step, how the CSP vary with the incremental benefits and, in a second step, how $\Delta\bar{\pi}$ is impacted by an exogenous shock on the degree of competition.

As already discussed in Section 2.3, a rise in the incremental benefits induces firms to invest more in CSR such that A should be positively related to $\Delta\bar{\pi}$. This positive link may either transit through an adjustment of the extensive margin when $q \geq \tilde{q}$;[22] or an adjustment of the intensive margin when $q \leq \overline{q}$.[23] It is interesting to note that the adjustment of the extensive margin comes from the effect of CSR on responsible employee's motivation while the adjustment of the intensive margin is more directly related to the role of CSR as a screening device. Indeed, when $q \geq \tilde{q}$, an increase in $\Delta\bar{\pi}$ makes more profitable the hiring of motivated agents and thus the proportion of

22. At the mixed equilibrium, firms must be indifferent between investing in CSR or not such that $\Delta\bar{\pi}$ must equal $\phi^* - \nu^*$. Then, as $\Delta\bar{\pi}$ is decreasing in ρ, an exogenous increase in $\Delta\bar{\pi}$ must be compensated by a rise in $\tilde{\rho}$, which is the result of an increase in $\tilde{q}$.

23. When $q \in (\overline{q}, \tilde{q})$, A is independent of $\Delta\bar{\pi}$.

green firms rises; while, when $q \leq \overline{q}$, each individual green firm chooses to invest more in CSR in order to discourage non-responsible employees to apply.

It remains for us to analyze the impact of our parameter of interest (d) on the incremental benefits $\Delta\bar{\pi}$. Using expressions (25) and (2), the differentiation of $\Delta\bar{\pi}$ with respect to d yields:

$$\frac{\partial \Delta\bar{\pi}}{\partial d} = (\lambda^H - \lambda^L) \left\{ \underbrace{(D^A)^2 - (D^B)^2}_{\textbf{(1)}} + \underbrace{2d \left[\frac{\partial D^A}{\partial d} D^A - \frac{\partial D^B}{\partial d} D^B \right]}_{\textbf{(2)}} \right\} \tag{43}$$

The decrease in d affects $\Delta\bar{\pi}$ through two channels:

(1) *Rent dissipation effect*: The profit margin reduces for both types of firms, but proportionally to the demand. As a consequence, the effect on low-cost firms is larger and $\Delta\bar{\pi}$ goes down.

(2) *Selection effect*: More competition allows efficient firms to capture a larger part of the product market. Then, the market share of each low-cost firm increases while the one of each high-cost firm reduces and $\Delta\bar{\pi}$ increases.

Through a simple inspection of equation (2), we conclude that the selection (resp. rent dissipation) effect dominates when $\rho < 1/2$ (resp. $\rho > 1/2$). Thus, a fall in d involves an increase in $\Delta\bar{\pi}$ when $\rho < 1/2$ and a decrease when $\rho > 1/2$. As claimed in the following Proposition, the configuration that arises at the equilibrium depends on market conditions:

Proposition 5 *Under Assumptions 1-3 and for M low enough, we have:*

i If $M > \tilde{M}$: A is (weakly) decreasing in d;

ii If $M \leq \tilde{M}$: A is (weakly) increasing in d when $q \geq \frac{1/2-\lambda^L}{\lambda^H-\lambda^L}$; while it is (weakly) decreasing when $q < \frac{1/2-\lambda^L}{\lambda^H-\lambda^L}$.

Proof. See Appendix F. ■

In the first case (point i), the managerial labor market size M is high with regards to the product market size L and benefits associated with CSR remain limited ($\Delta\bar{\pi}$ is low). Hence, the equilibrium probability to be highly efficient is small (lower than $1/2$). In that case, the selection effect dominates and an increase in competition enhances the CSP of the industry. When $M \leq \tilde{M}$ (point ii), at the mixed equilibrium, the probability to be highly efficient ($\tilde{\rho}$) is higher than $1/2$ and CSP is positively related to d. Nevertheless, in that configuration, the equilibrium value of ρ may be lower than $1/2$ when q is low ($q < \frac{1/2-\lambda^L}{\lambda^H-\lambda^L}$). Indeed, in that case, the economy belongs to the fully separating equilibrium (each green manager is employed in a green firm) and the proportion of green managers is small. Then, a cut in transport costs increases aggregate abatement.

In the theoretical literature, the impact of an exogenous rise in the competitive pressure on CSP is either always positive (Fisman et al. 2003) or always negative (Bagnoli and Watts 2003). Our framework justifies the existence of the two opposite results by distinguishing the rent dissipation and the selection effects of competition. We show that the impact of a fall in transport costs on the CSP of the industry crucially depends on the prevailing level of cost competition (proportion of low-cost firms), which in turn, is related to the proportion of green managers but also to market conditions captured by the ratio between the number of competitors and the number of consumers M/L.

5 Conclusion

More and more firms make efforts, sometimes heavily costly, in order to appear socially responsible. The present paper contributes to our understanding of CSR decisions at two levels. At the firm level, we propose to integrate CSR investments in a simple model with morally motivated agents. In our view, CSR becomes a crucial component of the non-pecuniary aspects of a job. Then, by choosing the intensity of their CSR investment, employers shape the extent to which some employees, the responsible ones who care about those aspects of the job, identify with the firms' objectives. Hence, CSR decisions constitute a mean to attract and to motivate those employees. At the industry level, we provide a framework in which CSR investments and the competitive structure are jointly determined, allowing to shed a new light on the CSR-competition nexus. Based on this framework, we assess the impact of a change in the social consciousness of employees and in the degree of product differentiation on both the CSP and the HHI of an industry.

The results we obtain along this line may give birth to interesting insights for the empirical analysis of the CSR-competition relationship. One first implication of our model is that the relationship between the HHI and the CSP might transit through other channels implying that studies based on the estimation of the impact of changes in HHI on CSP indexes should be interpreted carefully. Furthermore, our theoretical framework allows us to re-visit this endogeneity issue. In particular, we emphasize the role played by social consciousness of the workforce as a determinant of both the HHI and the CSP of an industry. Some empirical studies of the CSR-competition relationship overcome the endogeneity issue thanks to exogenous variations in the competitive environment (Fernandez-Kranz and Santalo 2010 and Flammer 2015). Our framework is also well suited for analyzing the effect of this kind of exogenous variation (through a change in the transport cost parameter). In particular we find that this effect dramatically depends on the other characteristics of the industry like the proportion of responsible managers or the relative size of the product market *vs.* the managerial labor market. These results deserve to be empirically investigated.

The framework we propose can be extended in several directions. The first one, related to the firm level, could be the introduction of monetary incentives in addition of those already exploited

in the model. It could allow us to take into account the trade-off between pecuniary and non-pecuniary (CSR) incentives and analyze how this trade-off is affected by the market structure. The second, at the industry level, would be to consider that a fraction of consumers are also socially responsible. It would enable to assess the joint impact of social consciousness of both consumers and managers on firms CSR performances.

Appendices

A Proof of Lemma 1

The expression of w_g^* is directly derived from the zero profit condition. Let us show that $(\bar{\pi}^L, 0)$ is the unique equilibrium contract proposed to green workers when $\Delta\bar{\pi} < \phi^* - \nu^*$. By contradiction, assume that there is a profitable deviation such that a firm chooses the level of abatement a^* and reduces the wage, thus proposing the contract: $(\bar{\pi}^L - \epsilon, a^*)$. Profits for the deviating firm must be:

$$\bar{\pi}^H - (\bar{\pi}^L - \epsilon) - \phi^* = \Delta\bar{\pi} + \epsilon - \phi^*$$

Moreover, such a contract would attract a green manager if and only if: $\bar{\pi}^L - \epsilon + \nu^* \geq \bar{\pi}^L$ implying $\epsilon < \nu^*$. Then under the condition $\Delta\bar{\pi} < \phi^* - \nu^*$ the deviating firm makes negative profits and the deviation cannot be profitable. A symmetric reasoning applies for the case $\Delta\bar{\pi} > \phi^* - \nu^*$.

B Proof of Proposition 1

If $\Delta\bar{\pi} \leq \phi^*$ we already know that the first best contracts (w_b^*, a_b^*) and (w_g^*, a_g^*) described in Lemma 1 is the unique competitive equilibrium when types are unobserved. Otherwise we can claim the following: When $\Delta\bar{\pi} > \phi^*$,

i. there exists no pooling equilibrium;

ii. in any separating equilibrium, brown managers receive the contract: $(\bar{\pi}^L, 0)$;

iii. in any separating equilibrium, green managers receive the contract: $(\bar{\pi}^L, \phi^{-1}(\Delta\bar{\pi}))$;

iv. a separating equilibrium exists whenever $q < \hat{q}$ and does no longer exist when $q > \hat{q}$.

We now successively prove the points listed above.
i. Suppose that there is a pooling equilibrium contract (w^p, a^p) such that green workers choose the high effort e^H. The zero-profit condition writes:

$$q\bar{\pi}^H + (1-q)\bar{\pi}^L - w^p - \phi(a^p) = 0 \tag{B.1}$$

We deduce the labor income $w^p = q\Delta\bar{\pi} + \bar{\pi}^L - \phi(a^p)$. Suppose that a firm deviates by proposing the following contract $(w^p - \epsilon, a^p + \eta)$, with $\epsilon, \eta > 0$ and such that the two following conditions are satisfied:

$$\epsilon < v(e^H, a^p + \eta) - v(e^H, a^p) \tag{B.2}$$

$$\phi(a^p + \eta) - \phi(a^p) < (1 - q)\Delta\bar{\pi} + \epsilon \tag{B.3}$$

The first condition induces that the deviating firm attracts a green manager and the second one implies that when it is the case, the deviating firm exhibits positive profits. Let us set η small enough such that $\phi(a^p + \eta) - \phi(a^p) < (1 - q)\Delta\bar{\pi}$. Then, condition (B.3) is satisfied and, for a small enough value ϵ, condition (B.2) also holds. Hence, there is a profitable deviation.

ii. Suppose a separating equilibrium where the contract (w_b, a_b), with $a_b > 0$, is proposed to brown managers. Suppose that a firm deviates by proposing the following contract $(w_b + \epsilon, 0)$ so that she reduces the abatement effort and simultaneously increases wages. For $\epsilon < \phi(a_b)$, this deviation is profitable as the firm attracts a brown manager and derives positive profits. Hence, at the equilibrium, a_b must equal 0 and the zero-profit condition yields to $w_b = \bar{\pi}^L$.

iii. Let us define a contract $(\tilde{w}_g, \tilde{a}_g) = (\bar{\pi}^L, \phi^{-1}(\Delta\bar{\pi}))$, where $V_b(\bar{\pi}^L, 0) = V_b(\bar{\pi}^H - \phi(\tilde{a}_g), \tilde{a}_g)$. By contradiction, suppose a separating equilibrium where the contract $(w_g, a_g) \neq (\tilde{w}_g, \tilde{a}_g)$ is proposed to green managers. The zero-profit condition yields: $w_g = \bar{\pi}^H - \phi(a_g)$, with $w_g < \bar{\pi}^L = \tilde{w}_g$, otherwise the equilibrium looses its separating property. In addition, it implies that $a_g > \tilde{a}_g$ and further $a_g > \tilde{a}_g > a^*$ since $\phi(\tilde{a}_g) = \Delta\bar{\pi} > \phi^* = \phi(a^*)$.

Suppose now that a firm deviates by proposing $(w_g + \epsilon, a_g - \eta)$, with $\epsilon, \eta > 0$ and such that: (i) the firm attracts a green manager; (ii) no brown manager accepts this contract; (iii) the firm exhibits positive profits, so that the deviation is profitable. Item (i) is verified if $V^g(w_g + \epsilon, a_g - \eta) > V^g(w_g, a_g)$. It involves:

$$\epsilon > v(e^H, a_g) - v(e^H, a_g - \eta) \tag{B.4}$$

Item (ii) holds when $w_g + \epsilon < \bar{\pi}^L$. Using the zero profit condition, it yields:

$$\phi(a_g) - \phi(\tilde{a}_g) > \epsilon \tag{B.5}$$

Item (iii) induces that $\bar{\pi}^H - \phi(a_g - \eta) - (w_g + \epsilon) > 0$ and the zero profit condition yields:

$$\phi(a_g) - \phi(a_g - \eta) > \epsilon \tag{B.6}$$

Let us set a small enough value of η. It follows that $\phi(a_g - \eta) > \phi(\tilde{a}_g)$. Moreover, since $a_g > a_g^*$, $\phi'(a_g) > v'_a(e^H, a_g)$ and $\phi(a_g) - \phi(a_g - \eta) > v(e^H, a_g) - v(e^H, a_g - \eta)$. Then, we can choose a value

of ϵ satisfying the following inequalities:

$$\phi(a_g) - \phi(a_g - \eta) > \phi(a_g) - \phi(\tilde{a}_g) > \epsilon > v(e^H, a_g) - v(e^H, a_g - \eta) \tag{B.7}$$

such that conditions (B.4), (B.5) and (B.6) simultaneously hold.

iv. Suppose a separating equilibrium where the contract $(\tilde{w}_g, \tilde{a}_g)$ is proposed to green managers and consider the following deviation: $(\tilde{w}_g + \epsilon, \tilde{a}_g - \eta)$. This new contract obviously attracts brown managers. It also attracts green managers, who choose to exert high effort, if:

$$\epsilon > v(e^H, \tilde{a}_g) - v(e^H, \tilde{a}_g - \eta) \tag{B.8}$$

Hence, the firm exhibits positive profits if:

$$\epsilon < q\phi(\tilde{a}_g) - \phi(\tilde{a}_g - \eta) \tag{B.9}$$

These two inequalities may be simultaneously satisfied if and only if:

$$q > \frac{\phi(\tilde{a}_g - \eta)}{\phi(\tilde{a}_g)} + \frac{v(e^H, \tilde{a}_g) - v(e^H, \tilde{a}_g - \eta)}{\phi(\tilde{a}_g)} \equiv q(\eta) \tag{B.10}$$

To ensure that green managers choose high effort η must belong to $(0, \tilde{a}_g - a^*]$ so that $q'(\eta) < 0$. We define $\hat{q} = q(\tilde{a}_g - a^*)$:

$$\hat{q} \equiv \frac{\phi^* + v(e^H, \phi^{-1}(\Delta\bar{\pi})) - v(e^H, a^*)}{\Delta\bar{\pi}} \in (0, 1) \tag{B.11}$$

If $q \leq \hat{q}$, $q \leq q(\eta)\ \forall\ \eta \in (0, \tilde{a}_g - a^*]$ and there is no profitable deviation. If $q > \hat{q}$, there exists a value of η close enough to $\tilde{a}_g - a^*$ such that $q(\eta) < q$. This concludes the proof.

C Proof of Proposition 2

Characterization. The equilibrium values of ρ and $\Delta\bar{\pi}$ are simply given by the crossing points between the curves respectively described by equations (26) and (29). Through (29), $\Delta\bar{\pi}$ is linearly decreasing in ρ while through (26) ρ is a step function equals to λ^L when $\Delta\bar{\pi} < \phi^* - \nu^*$, $q\lambda^H + (1-q)\lambda^L$ when $\Delta\bar{\pi} > \phi^* - \nu^*$ and any value between the two when $\Delta\bar{\pi} = \phi^* - \nu^*$. Moreover, according to Assumption 3, $\Delta\bar{\pi}(\lambda^L)$ is above $\phi^* - \nu^*$ while $\Delta\bar{\pi}(\lambda^H)$ is below $\phi^* - \nu^*$. Finally, $\tilde{q}$ is defined as the value of q such that $\Delta\bar{\pi}(q\lambda^H + (1-q)\lambda^L)$ exactly equals $\phi^* - \nu^*$. Hence, if $q > \tilde{q}$, $\Delta\bar{\pi}(q\lambda^H + (1-q)\lambda^L) < \phi^* - \nu^*$ such that the two curves cross in $\tilde{\rho} = \tilde{q}\lambda^H + (1-\tilde{q})\lambda^L$ and $\Delta\bar{\pi} = \phi^* - \nu^*$. Otherwise $\Delta\bar{\pi}(q\lambda^H + (1-q)\lambda^L) > \phi^* - \nu^*$ such that the two curves cross in $\rho = q\lambda^H + (1-q)\lambda^L$. The equilibrium values of $\bar{\pi}^L$ and $\bar{\pi}^H$ are obtained by putting the equilibrium

value of ρ into expressions (27) and (28).

As for the equilibrium contracts, we apply the results obtained in Proposition 1 using the fact that, under Assumption 3, $\overline{q}$ (defined as the value of q such that $\Delta\bar{\pi}(q\lambda^H + (1-q)\lambda^L) = \phi^*$) is positive. Hence, when $q < \overline{q}$, the equilibrium value of $\Delta\bar{\pi}$ is above ϕ^*.

Existence. As claimed in Proposition 1 such an equilibrium may fail to exist when $q > \hat{q}$ and $\Delta\bar{\pi} > \phi^*$. Nevertheless, we know from Proposition 2 that $\Delta\bar{\pi}$ overcomes ϕ^* if and only if $q < \overline{q}$. Hence, a sufficient condition for the industry equilibrium to exist is $\overline{q} \leq \hat{q}$. Let us first show that $\hat{q}$ is decreasing in $\Delta\bar{\pi}$. Since $\hat{a}^g = \phi^{-1}(\Delta\bar{\pi})$ it is sufficient to show that $\hat{q}$ is decreasing in $\hat{a}^g$. The differentiation of (B.11) with respect to $\hat{a}^g$ yields:

$$\frac{\partial \hat{q}}{\partial \hat{a}^g} = \frac{v'_a(e^H, \hat{a}^g)\phi(\hat{a}^g) - \phi'(\hat{a}^g)[\phi^* + v(e^H, \hat{a}^g) - v(e^H, a^*)]}{\phi(\hat{a}^g)^2} \tag{C.1}$$

Hence, $\frac{\partial \hat{q}}{\partial \hat{a}^g} < 0$ if the numerator $H(\hat{a}^g) \equiv v'_a(e^H, \hat{a}^g)\phi(\hat{a}^g) - \phi'(\hat{a}^g)[\phi^* + v(e^H, \hat{a}^g) - v(e^H, a^*)]$ is negative. As $\Delta\bar{\pi} > \phi^*$ it must be the case that $\hat{a}^g > a^*$. Yet, $H(a^*) = \phi^*(v'_a(e^H, a^*) - \phi'(a^*)) \leq 0$. Then, we can easily see that $H'(\hat{a}^g) < 0$. Putting those elements together, we conclude that $H(\hat{a}^g) < 0$, for all relevant values of $\hat{a}^g$, such that $\hat{q}$ is decreasing in $\Delta\bar{\pi}$. As a consequence, we can define $\hat{q}_{\min}$ as the value of $\hat{q}$ such that $\Delta\bar{\pi} = \Delta\bar{\pi}(\lambda^L)$.

Differentiating $\hat{q}_{\min}$ with respect to a^*, we obtain:

$$\frac{\partial \hat{q}_{\min}}{\partial a^*} = \frac{\phi'(a^*) - v'_a(e^H, a^*)}{\Delta\bar{\pi}(\lambda^L)} \geq 0 \tag{C.2}$$

such that $\hat{q}_{\min}$ is increasing in a^*. Hence it is sufficient to show that $\overline{q} \leq \hat{q}_{\min}$ when $\phi^* = \Delta\pi(\lambda^H) + \nu^*$. In that case, after some algebra, we obtain the following expression for $\overline{q}$:

$$\overline{q} = 1 - \frac{2d\nu^*}{L(\lambda^H - \lambda^L)^2(\Delta c)^2}$$

Then, the condition $\bar{q} \leq \hat{q}_{\min}$ may be rewritten as:

$$v(e_H, \phi^{-1}(\Delta\bar{\pi}(\lambda^L)) - e_H \geq \frac{(\lambda^H - \lambda^L)^2 L(\Delta c)^2}{2d} - \frac{[(1-2\lambda^L)M\Delta c + 4d]\nu^*}{2M\Delta c}$$

Since $\phi^{-1}(\Delta\bar{\pi}(\lambda^L)) > a^* \geq \bar{a}$, the LHS of this expression is positive. Moreover, the RHS is negative for $M \leq \bar{M}$ with:

$$\bar{M} \equiv \frac{4d^2\nu^*}{\Delta c[(\lambda^H - \lambda^L)^2 L(\Delta c)^2 - (1-2\lambda^L)d\nu^*]}$$

Under Assumption 2, $\bar{M} > 0$ such that the existence of the industry equilibrium is ensured when M is low enough.

D Derivation of the sign of $\Psi'(q)$

Through expression (41) and since $\frac{\partial \Delta\bar{\pi}}{\partial q} < 0$, $\Psi'(q)$ is positive if and only if:

$$\frac{\partial \phi^{-1}(\cdot)}{\partial \Delta\bar{\pi}} \frac{\Delta\bar{\pi}(\cdot)}{\phi^{-1}(\cdot)} < -\frac{\frac{\Delta\bar{\pi}(\cdot)}{q}}{\frac{\partial \Delta\bar{\pi}(\cdot)}{\partial q}} \qquad \Leftrightarrow \qquad -\epsilon_{\Delta\bar{\pi},q}(q) < \frac{1}{\epsilon_{\phi^{-1},\Delta\bar{\pi}}(q)} \tag{D.1}$$

By the properties of the inverse function and since $\epsilon_{\Delta\bar{\pi},q}(q) < 0$ while $\epsilon_{\phi,a}(q) > 0$, the latter condition may be rewritten as:

$$|\epsilon_{\Delta\bar{\pi},q}(q)| < |\epsilon_{\phi,a}(q)| \tag{D.2}$$

E Proof of Proposition 3

We already know that for $q \geq \tilde{q}$, A is constant, for $q \in [\overline{q}, \tilde{q})$, A is linearly increasing. Let us focus on the case $q < \overline{q}$ in which $A = \Psi(q)$. By (41) we must have $\Psi'(0) = \phi^{-1}(.) > 0$ and

$$\Psi''(q) = 2\frac{\partial \phi^{-1}(\cdot)}{\partial \Delta\bar{\pi}} \frac{\partial \Delta\bar{\pi}(\cdot)}{\partial q} + q\frac{\partial^2 \phi^{-1}(\cdot)}{\partial \Delta\bar{\pi}^2} \left(\frac{\partial \Delta\bar{\pi}(\cdot)}{\partial q}\right)^2 \tag{E.1}$$

which is negative since $\phi^{-1}(.)$ is increasing and concave in $\Delta\bar{\pi}$ while $\Delta\bar{\pi}$ is linearly decreasing in q. Hence, on the interval $[0, \overline{q})$, $\Psi'(q)$ is either always positive or firstly positive and then negative. The latter case occurs if and only if the inequality (D.2) is satisfied in $\overline{q}$. Moreover, by definition of $\overline{q}$, we must have $\Delta\bar{\pi}(\lambda^L + \overline{q}(\lambda^H - \lambda^L)) = \phi^*$, such that:

$$-\epsilon_{\Delta\bar{\pi},q}(\overline{q}) = \frac{\frac{L}{2d}(\lambda^H - \lambda^L)^2(\Delta c)^2}{\phi^*/\overline{q}} = \frac{\Delta\bar{\pi}(\lambda^L) - \phi^*}{\phi^*}$$

Putting these elements together we obtain the results stated in Proposition 3.

Finally, let us show some conditions, compatible with Assumptions 1-3 and $M \leq \bar{M}$, ensuring that the relationship between A and q is N-shaped. To that end, let us consider the case where the function $\phi(\cdot)$ is isoelastic (the elasticity coefficient being denoted $\epsilon_{\phi,a}$). The condition $\epsilon_{\phi,a} < \frac{\Delta\bar{\pi}(\lambda^L) - \phi^*}{\phi^*}$ may be compatible with Assumptions 2 and 3 if and only if $\Delta\bar{\pi}(\lambda^L) > (1 + \epsilon_{\phi,a})\Delta\bar{\pi}(\lambda^H)$. The latter condition may be rewritten as:

$$\Delta c > \left(\frac{2d}{M}\right) \frac{2\epsilon_{\phi,a}}{2[(1 + \epsilon_{\phi,a})\lambda^H - \lambda^L] - \epsilon_{\phi,a}} \tag{E.2}$$

which is compatible with $M \leq \bar{M}$ if:

$$\frac{d\nu^*}{(\lambda^H - \lambda^L)^2 L(\Delta c)^2 - (1 - 2\lambda^L)d\nu^*} > \frac{\epsilon_{\phi,a}}{2[(1 + \epsilon_{\phi,a})\lambda^H - \lambda^L] - \epsilon_{\phi,a}}$$

The LHS is increasing in ν^* while the RHS is decreasing in $\epsilon_{\phi,a}$. Let us consider the highest value of ν^* compatible with Assumption 2 and $\epsilon_{\phi,a}$ close to one (since $\phi(\cdot)$ is convex). The above inequality reduces to $\lambda^H > \lambda^L + 1/2$. Moreover, condition (E.2) is compatible with Assumption 1 if and only if $\epsilon_{\phi,a} < \frac{2(\lambda^H - \lambda^L)}{3-2\lambda^H}$. This inequality is satisfied for $\epsilon_{\phi,a}$ and λ^H sufficiently close to one.

F Proof of Proposition 5

Let us successively address the two points of Proposition 5:

i If $M > \tilde{M}$: $\tilde{\rho} < 1/2$ such that $\tilde{q} < \frac{1/2-\lambda^L}{\lambda^H-\lambda^L}$. Hence, at the mixed equilibrium ($q \geq \tilde{q}$), the equilibrium level of ρ (equal to $\tilde{\rho}$) is lower than $1/2$. At the fully separating equilibrium, $q < \overline{q} < \tilde{q} < \frac{1/2-\lambda^L}{\lambda^H-\lambda^L}$ such that the equilibrium level of ρ (equal to $q\lambda^H + (1-q)\lambda^L$) is also lower than $1/2$. To complete the proof, let us recall that when $\rho < 1/2$ a rise in d decreases $\Delta\bar{\pi}$ such that A is depressed.

ii If $M \leq \tilde{M}$: $\tilde{\rho} \geq 1/2$ such that $\tilde{q} \geq \frac{1/2-\lambda^L}{\lambda^H-\lambda^L}$. When the economy belongs to the mixed equilibrium ($q \geq \tilde{q} \geq \frac{1/2-\lambda^L}{\lambda^H-\lambda^L}$), the equilibrium value of ρ is higher than $1/2$. While, when $q < \overline{q}$, the equilibrium value of ρ is higher than $1/2$ when $q \geq \frac{1/2-\lambda^L}{\lambda^H-\lambda^L}$ while it is lower than $1/2$ when this condition is not satisfied. To complete the proof, let us recall that when $\rho < 1/2$ (resp. $\rho > 1/2$) a rise in d decreases (resp. increases) $\Delta\bar{\pi}$ while A is positively related to $\Delta\bar{\pi}$.

References

[1] Aghion, P. and Schankerman, M. (2004) "On the welfare effects and political economy of competition-enhancing policies", *The Economic Journal*, 114, 800-824.

[2] Akerlof, G. and Kranton, R. (2005) "Identity and the Economics of Organizations", *The Journal of Economic Perspectives*, 19, 9-32.

[3] Bagnoli, M. and Watts, S.G. (2003) "Selling to socially responsible consumers: Competition and the private provision of public goods", *Journal of Economics & Management Strategy*, 12, 419-445.

[4] Baron, D. (2001) "Private Politics, Corporate Social Responsibility, and Integrated Strategy", *Journal of Economics & Management Strategy*, 10, 7-45.

[5] Benabou, R. and Tirole, J. (2003) "Intrinsic and extrinsic motivation", *Review of Economic Studies*, 70, 489-520.

[6] Benabou, R. and Tirole, J. (2010) "Individual and corporate social responsibility", *Economica*, 77, 1-19.

[7] Benabou, R. and Tirole, J. (2015) "Bonus culture: Competitive pay, screening, and multitasking", *Journal of Political Economy*, 124, 305-370.

[8] Besley, T. and Ghatak, M. (2005) "Competition and incentives with motivated agents", *The American Economic Review*, 95, 616-636.

[9] Branco, M.C. and Rodrigues, L.L. (2006) "Corporate Social Responsibility and Resource-Based Perspectives", *Journal of Business Ethics*, 69, 111-132.

[10] Brekke, K.A. and Nyborg, K. (2008) "Attracting responsible employees: Green production as labor market screening", *Environmental and Resources Economics*, 30, 509-526.

[11] Brekke, K.A., Hauge, K.E., Lind, J.T. and Nyborg, K. (2011) "Playing with good guys: A public good game with endogenous group formation", *Journal of Public Economics*, 95, 1111-1118.

[12] Collier, J. and Esteban, R. (2007) "Corporate social responsibility and employee commitment", *Business Ethics: A European Review*, 16, 19-33.

[13] Crifo, P. and Forget, V.D. (2015) "The economics of corporate social responsibility: A firm-level perspective survey", *Journal of Economic Survey*, 29, 112-130.

[14] Delfgaauw, J. and Dur, R. (2007) "Signaling and screening of workers' motivation", *Journal of Economic Behavior & Organization*, 62, 605-624.

[15] Delfgaauw, J. and Dur, R. (2008) "Incentives and Workers? Motivation in the Public Sector", *The Economic Journal*, 525, 171-191.

[16] Fehrler, S. and Kosfled, M. (2014) "Pro-Social Missions and Worker Motivation: An Experimental Study", *Journal of Economic Behavior & Organization*, 100, 99-110.

[17] Fernandez-Kranz, D. and Santalo, J. (2010) "When necessity becomes a virtue: The effect of product market competition on corporate social responsibility", *Journal of Economics & Management Strategy*, 12, 419-445.

[18] Fisman, R., Heal, G. and Nair, V.B. (2006) "A model of corporate philanthropy", Columbia University and University of Pennsylvania.

[19] Flammer, C. (2015) "Does Product Market Competition Foster Corporate Social Responsibility? Evidence from Trade Liberalization", *Strategic Management Journal*, 36, 1469-1485.

[20] Francois, P. (2006) "Public service motivation as an argument for government provision", *Journal of Public Economics*, 78, 275-299.

[21] García-Gallego, A. and Georgantzís, N. (2009) "Market Effects of Changes in Consumers' Social Responsibility", *Journal of Economics & Management Strategy*, 12, 419-445.

[22] Gupta, K. and Krishnamurti, C. (2016). Product Market Competition and Corporate Environmental Performance. In: Ramiah, V., Gregoriou, G.N. (Eds.), Handbook of Environmental and Sustainable Finance, Elsevier.

[23] Hansen, S.D., Dunford, B.B., Boss, A.D., Boss, R.W. and Angermeier, I. (2011) "Corporate Social Responsibility and the Benefits of Employee Trust: A Cross-DisciplinaryPerspective", *Journal of Business Ethics*, 102, 29-45.

[24] Hiller, V. and Verdier, T. (2014) "Corporate Culture and Identity Investment in an Industry Equilibrium", *Journal of Economic Behavior & Organization*, 103, 93-112.

[25] Kim, H.-R., Lee, M. and Kim, N.-M. (2010) "Corporate Social Responsibility and Employee-Company Identification", *Journal of Business Ethics*, 95, 557-569.

[26] Kitzmueller, M. and Shimshack, J. (2012) "Economic perspectives on corporate social responsibility", *Journal of Economic Literature*, 50, 51-84.

[27] Koppel, H. and Regner, T. (2014) "Corporate Social Responsibility in the work place - Experimental evidence from a gift-exchange game", *Experimental Economics* 17, 347-370.

[28] Lanfranchi, J. and Pekovic, S. (2012) "How green is my firm? Workers' attitudes and behaviors towards job in environmentally-related firms", *Ecological Economics*, 100, 16-29.

[29] Margolis, J.D. and Walsh, J.P. (2003) "Misery loves compagnies: Rethinking social initiatives by business", *Administrative Science Quarterly*, 48, 268-305.

[30] Maxwell, J.W. and Decker, C. (2006) "Voluntary environmental investment and responsive regulation", *Environmental and Resource Economics*, 33, 425-439.

[31] Maxwell, J.W., Lyon, T.P. and Hackett, S.C. (2000) "Self-regulation and social welfare: The political economy of corporate environmentalism", *The Journal of Law and Economics*, 43, 583-618.

[32] McWilliams, A., Siegel, D.S. and Wright, P.M. (2006) "Corporate Social Responsibility: Strategic Implications", *Journal of Management Studies*, 43, 1-18.

[33] Mozes, M., Josman, Z. and Yaniv, E. (2011) "Corporate social responsibility organizational identification and motivation", *Social Responsability Journal*, 7, 310-325.

[34] Newman, C., Rand, J., Tarp, F. and Trifkovic, N. (2016) "Corporate Social Responsibility in a Competitive Business Environment", WIDER Working Paper, No. 2016/7.

[35] Nyborg, K. and Zhang, T. (2013) "Is corporate social responsibility associated with lower wages?", *Environmental and Resource Economics*, 55, 107-117.

[36] Rothschild, M. and Stiglitz, J. (1976) "Equilibrium in competitive insurance markets: An essay on the economics of imperfect information", *The Quarterly Journal of Economics*, 90, 629-649.

[37] Salop, S. (1979) "Monopolistic competition with outside goods", *Bell Journal of Economics and Management Science*, 10, 141-156.

[38] Simon, D.H. and Prince, J.T. (2016) "The effect of competition on toxic pollution releases", *Journal of Environmental Economics and Management*, 79, 40-54.

[39] Schmitz, J. and Schrader, J. (2015) "Corporate Social Responsability: A Microeconomic Review of the Literature", *Journal of Economic Survey*, 29, 27-45.