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# The Greenwashing Machine: Is CSR More Than Communication? \*

Rémi BAZILLIER<sup>†</sup> and Julien VAUDAY<sup>‡</sup>

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## Abstract

Corporate Social Responsibility (CSR) and advertising are strategic complements. If a claim about the environmental or social benefits of a product is unsubstantiated or misleading, this practice is known as greenwashing (GW). The model clearly identifies some “usual suspects” that will prefer GW over CSR. We then carry out an empirical analysis using CSR data, economic data on the 500 largest European firms, and proxies for green communication to test the predictions. Several instruments are used to estimate the propensity to prefer GW. We show that “hard greenwashing”, i.e. active communication with no CSR at all, is not always a credible strategy, and highlight the concept of “light greenwashing”. It may have two dimensions: either it can be a response to the presence of greenwashing firms or it can be due to the simple possibility of advertising. Both possibilities are verified empirically, thus confirming the changing nature of greenwashing practices.

*J.E.L.*: M14, M37, L15, D83

Key-words: Corporate Social Responsibility, Greenwashing, Communication.

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# 1 Introduction

*“Seems like anything and everything has “gone green” these days. Airlines, car companies, retailers, restaurants - heck, even networks and stadiums. Thankfully, more often than not, that’s a good thing. It’s only bad if it’s greenwashing - that’s bad for the environment, consumers, and, ultimately, for the very businesses doing the greenwashing - whether they mean to or not.”*, said the promoters of the Greenwashing Index.<sup>1</sup> The rise of environmental concerns and the development of Corporate Social Responsibility (CSR) have led to a boom in green or social advertising. The strong emphasis on communication contributes to skepticism in the civil society about the reality of the social and environmental commitments of firms. *“The image of multinational companies working hard to make the World a better place is often just that - an image”*, said a report from the British NGO ChristianAid (2004). This skepticism may be explained by the greenwashing phenomenon.

Greenwashing took root in the 1970s concurrently with the emergence of environmental movements. It is defined by Greenpeace as *“the act of misleading consumers regarding the environmental<sup>2</sup> practices of a company or the environmental benefits of a product or service”*.<sup>3</sup> A direct consequence of greenwashing is skepticism towards the ability of Corporate Social Responsibility to bring effective changes. When studying the economic effects of CSR, it is therefore crucial to take this problem of greenwashing into account, and to understand its implications. This paper investigates the extent to which firms use “green” communication as a substitute for or complement to CSR. To the best of our knowledge, it is the first economic analysis of greenwashing providing empirical evidence on a large sample of firms.

According to Nelson (1970, 1974), a communication/advertising strategy depends on the nature of the good itself. For *search goods* (whose quality can be known before purchasing them), advertising should bring direct information on the characteristics of the product, while

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<sup>1</sup><http://www.greenwashingindex.com/>

<sup>2</sup>In this paper, we will broaden the definition of greenwashing by including social practices. The concept of “social washing” is sometimes evoked.

<sup>3</sup>see [www.stopgreenwash.org](http://www.stopgreenwash.org), the Greenpeace website dedicated to greenwashing.

for *experience goods* (whose quality can only be assessed by trying them), advertising aims at improving the general reputation of the firm. Because CSR can also have an impact on the reputation of a firm, McWilliams and Siegel (2001) consider that CSR attributes are more likely to be associated with experience goods than search goods. Siegel and Vitalino (2007) confirm this intuition by testing the determinants of CSR empirically. But as such, it is very difficult to assess the social or environmental quality of a product even after having consumed it. A product containing a social or an environmental claim can therefore be considered as a *credence good* (Darby and Karni, 1973), which means that the consumer will have trouble guessing the utility derived from this product, even after having consumed it. For such goods, a communication strategy which aims at improving the reputation of the firm is even more important. CSR and green communication can be used by firms as strategic tools to reach this goal.

The literature highlights the theoretical mechanisms which explain why firms can invest in CSR either aggressively, to increase the reputation of the firm in a broader communication strategy, or defensively, to avoid a loss of reputation due to the threat of NGOs or other activists (Baron, 2001, 2007, 2009). However, it ignores the capacity of a firm to communicate on a non-existing or limited level of CSR. If CSR is mainly determined by the capacity to maintain or increase their reputation, firms may be tempted to minimize their investment in CSR and to focus on green communication. This is when greenwashing may appear. Lyon and Maxwell (2010) model this greenwashing strategy by using a persuasion game. They define as a greenwasher a firm that selectively discloses good news while retaining bad news. Grubb (2011) also shows how a reputation strategy can be built in order to establish a “cover” for nondisclosure in the future. Our approach differs from that of these two papers. We argue that the nature of greenwashing has changed and our paper sheds some light on the new practices of greenwashers. Here, greenwashing will be characterized as a situation in which firms decide to over-communicate regarding their real level of CSR. It is not as such a situation in which firms are retaining bad news, but a situation in which firms deliberately send non-verifiable information to mislead consumers. Our approach is therefore complementary to that of Lyon and Maxwell (2010) since it explains another dimension of greenwashing.

Our paper makes a number of contributions to the literature. We propose a theoretical framework based on Dewatripont and Tirole (2005). This model studies different modes of communication between a sender (in our case, a firm) and a receiver (a consumer). There are two levels of communication: the cue, which is a non-verifiable information, and the hard information which is verifiable by the consumer but at a higher cost. We study the probability of selling a product containing social or environmental claims based on different levels of cues (the non-verifiable green communication) and hard information (the verifiable green communication). We show that three types of greenwashing may appear: “hard greenwashing”, “constrained light greenwashing” and “ad light greenwashing”. In the first case, firms will only send cues without investing a single penny in CSR. In the last two cases, firms may reduce their optimal investments in CSR either because of the presence of greenwashers, or because they can communicate on a non-verifiable CSR claim. We then propose an original estimation of the determinants of CSR-related communication for the 595 biggest European firms. In this respect, we provide original data measuring the level of CSR, the level of cues and the hard information. The first one is proxied by an original index built from Vigeo data. The level of (non-verifiable) green communication is approximated by different measures of sustainable development *reporting*, while the hard information is proxied by the external certification of such reports. We find that for a given level of CSR, the higher the level of green communication, the lower the probability of asking for an external certification. When there is more CSR and more communication, the incentives are lower for firms to improve the verifiability of their communication. We also show a non-linear relation between the level of green communication and CSR, which allows us to identify some “usual suspects” with a higher probability of greenwashing.

The paper is organized as follows. Section 2 briefly exposes what aspects of greenwashing have changed. In section 3, we present the setup of the model. In section 4, we introduce the sequence of play and look at the equilibrium. We present the three sets of data we use in this paper in section 5. In section 6, we show empirically when CSR and communication are substitutes or complements. Finally, we conclude in section 7.

## 2 The Changing Nature of Greenwashing

In their seminal paper on greenwashing, Lyon and Maxwell (2010) refer to a report issued by TerraChoice on greenwashing practices (TerraChoice, 2007). This report highlights that the sin which can be overwhelmingly found is the “sin of the hidden trade-off”. This sin consists in arguing on a very precise and anecdotal environmental quality of a product without mentioning all the other environmental aspects that are at stake in its production process.

Lyon and Maxwell (2010) propose a model that deals with this issue. In their paper, a greenwasher is a firm that selectively discloses good news (on the anecdotal aspect), while retaining bad news (on the most important aspects). Since an activist punishes a firm that greenwashes, they study the optimal reaction of a firm facing such an activist’s behavior.

TerraChoice issued a new greenwashing report in 2010 (TerraChoice, 2010) that, among other things, sheds some light on the evolution of greenwashing practices. They show that the occurrence of the “sin of the hidden trade-off” has dropped from 100% in 2007 to 27% in 2010. Over the same period, two other sins have grown significantly: the “sin of no proof” and the “sin of vagueness”. The former refers to “an environmental claim that cannot be substantiated by easily accessible information or by a reliable third-party certification” (see [www.sinsofgreenwashing.org](http://www.sinsofgreenwashing.org)) and the latter is defined as “every claim that is so poorly defined or broad that its real meaning is likely to be misunderstood”. The occurrence of the “sin of no proof” was 70% in 2010 (45% in 2007) and that of the “sin of vagueness” was around 65% in 2010 (15% in 2007).<sup>4</sup> This clearly indicates that there is a dual communication strategy by firms that may simultaneously have a claim with only poor hard information and add to this claim other broad, vague claims in order to increase their supposed credibility as green firms.<sup>5</sup>

The framework adopted in this paper refers to these two sins. Indeed, a firm may send more or less (even not any) hard information and soft information, whereas it can freely announce a level of CSR that the product contains directly or indirectly. Hard information aims at substantiating

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<sup>4</sup>In the report, they underline that their definition has changed slightly. This may partly explain the decrease in the sin of the hidden trade-off and the rise in the sins of no proof and vagueness. However, as they argue, the magnitude of the evolution does indeed highlight a change in greenwashing practices.

<sup>5</sup>As the sum of both percentages exceeds 100%, at least 35% of firms have committed both sins.

a claim as it is true by definition; any absence of such hard information is a sin of no proof. In parallel, soft information is comparable to vagueness because it aims at increasing the reputation of the firm without verifiable claims on its real commitment.

The aim of this paper is therefore to study the reputation effect and the relationship between the firm and a consumer who questions more or less the CSR incorporated in the product. The key element is whether the information is verifiable or not. As a consequence, in our paper, a greenwasher is a priori a firm that has sent soft information to reduce the level of hard information sent, in order to hide that it has not invested in CSR or has invested less than indicated by the price of the product.

### 3 The Setup of the Model

Dewatripont and Tirole (2005) (D & T 05 hereafter) introduce two types of relations between a sender and a receiver. The sender may exert an effort to send information in order to convince the receiver (who may also exert an effort to assimilate the information) to choose action A. The action A which we consider in this paper is buying a more expensive product because it may contain CSR. This product is considered as a *credence good* (Darby and Karni, 1973). Social and environmental claims are unobservable. The sender is a firm (F) and the receiver is a consumer (C). The information transmission is considered as green communication.

#### 3.1 Communication

We build on the model developed in D & T 05 that involves cue communication. The consumer and the firm exchange hard and/or soft information (issue-relevant and cue messages, respectively), the former being verifiable information on the CSR investment, whereas the latter only provides non-verifiable information aimed at increasing the credibility of the firm.

The effort of the firm to communicate hard information (HI) is therefore comparable to a verifiable certification of the CSR content of the firm, by an independent agency for instance.<sup>6</sup>

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<sup>6</sup>See section 5 for discussion.

The cues convey no hard information on the CSR content, but may convey information on the type of the sender, or the firm. “Better news” is expected to raise the *congruence* between the consumer and the firm. This congruence has to be understood here as an *a priori* convergence of interest.<sup>7</sup> A good quality cue is therefore a good green communication strategy. The higher it is, the better the quality of the advertising communication.

In order to modify the ex-ante decision that depends on the ex-ante probability<sup>8</sup>, both actors, the firm and the consumer, may also make an effort in order to communicate and assimilate hard information. These efforts, labeled  $x$  and  $y$  for the firm and the consumer, respectively, are costly.<sup>9</sup> Their costs  $F(x)$  and  $C(y)$  are increasing and differentiable. As in D & T 05, we assume that the communication efforts by the consumer and the firm are strategic complements.<sup>10</sup> So the probability that the consumer will assimilate the hard information is  $p = xy$ . If the firm (the consumer) does not make any effort, the consumer (the firm) will not be able to successfully communicate (assimilate) the information.

We build our model starting from a case that is not developed in D & T 05: when cues coexist with the fact that the firm knows the consumer payoffs.<sup>11</sup> In addition, we consider that firms endogenously set the level of the cues they send and that they may freely announce the supposed level  $r_h$  which the product contains (sections 4.1 and 4.2). A last aspect we add is that firms also endogenously set the level of CSR which they want to invest in (section 4.3).

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<sup>7</sup>The “*a priori*” is important as it allows us to draw a parallel between cues and advertising.

<sup>8</sup>See the next section for the formal definition of the ex-ante probability.

<sup>9</sup>Asking for an external certification is costly for the firm. But there is also a cost for the consumer to assimilate the information. He must make an effort, spending some time searching for information and verifying it, or financing a consumer organization to do so.

<sup>10</sup>Strategic complements are decisions made by two or more players which mutually reinforce each other (Bulow et al., 1985).

<sup>11</sup>In their article, they consider that the sender is unaware of the receiver payoffs when a cue coexists with hard information.



## 3.2 Representative Consumer and Firm

### 3.2.1 Consumer (C, he)

We assume that C's payoff under the status quo is 0. The consumer will then choose action A only if he thinks that the product contains CSR. Thus, the consumer derives a higher indirect utility from consuming a good that contains CSR, even though the price is higher.<sup>12</sup> For the sake of simplicity, we assume that he derives an indirect utility  $r_h$  from consuming a product that contains a level  $r_h$  of CSR, thus  $p_h < r_h$  in this case.

A risk-neutral consumer establishes an ex-ante probability that the firm selling the product<sup>13</sup> has invested in CSR accordingly to the announced level  $r_h$ . Similarly to D & T 05, this ex-ante probability is such that the lowest probability above which the consumer expects a positive revenue from taking action A is

$$\alpha^* = \frac{-(r_l - p_h)}{r_h - p_h - (r_l - p_h)} = \frac{p_h}{r_h} \quad (1)$$

where  $r_l$  is the low indirect utility ; we assume that  $r_l = 0$ . Buying a product that contains no CSR at all at price  $p_h$  yields a loss. The consumer does not know if the product "contains" CSR since CSR is not in itself in the product, as it is a credence good.

Formally, the consumer's utility function if the product contains CSR is given by

$$U_C = xy(r_h - p_h)\alpha - C(y) \quad (2)$$

Finally, we need to define another value  $\alpha^{max}$  that is a value such that the suspicious consumer will buy the product even if he has looked for hard information and has not found it:

$$\alpha^{max} = \frac{p_h - C(y^*)}{(1 - p)r_H + p_h} \quad (3)$$

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<sup>12</sup>This assumption is consistent with experimental studies showing the willingness to pay for ethical products. (See Dickson 2001; Pelsmacker et al. 2001, or MORI 2000).

<sup>13</sup>In the remainder of the paper, we will refer to products that "contain" CSR. However, in most cases, the CSR itself is not incorporated in the product.

There are two types of consumer, those who are gullible and those who are suspicious. This distinction is close to the one found in Gabaix and Laibson (2006) that also introduces two types of consumer, the sophisticated ones and the unsophisticated ones. The former are aware of the existence of high add-on prices, contrary to the latter who are myopic in this respect.

When  $\alpha^{max} > \alpha^*$  (the case we consider in this paper), the suspicious consumer will search for hard information if the cue he receives, denoted  $\tilde{\alpha}$ , is lower than  $\alpha^{max}$ . The suspicious consumer does not buy the product if he fails in assimilating the hard information. The gullible consumer never looks for hard information (HI) when  $\tilde{\alpha} > \alpha^*$  and we assume that if he had to choose between two products supposed to have the same  $r_h$ , then he would choose the product associated with the highest cue. Finally, both types of consumer rubber-stamp the recommendation that they buy the product<sup>14</sup> if the cue is at least equal to  $\alpha^{max}$ . A consumer that has to choose between two products associated with the same level of cue buys one of them with a probability of 1/2.

### 3.2.2 Firms (F, she)

Firms sell their product (supposed to contain a level  $r_h$  of CSR) at a price  $p_h(r_h)$ . The price is assumed to be increasing and concave with  $p_h(0) = 0$ . Hence  $p_h$  is here the reward for selling the product. Firms know how consumers value the CSR content.

The payoff/utility of the firm is:

$$U_f = p * p_h - F(x^*) - F_a(\tilde{\alpha}) - F_{CSR}(r_h) \quad (4)$$

Where  $\tilde{\alpha}$  is the level of cue/advertising the firm sends,  $F(\cdot)$  is the HI cost function,  $F_a(\cdot)$  is the cue-cost function and  $F_{CSR}(\cdot)$  is the CSR cost function. Also, the probability that the HI is assimilated is  $p = x * y'(\alpha)$  where  $y'(y, \alpha)$  is the effort which the firm expects the consumer to make. This expected effort depends on the real effort,  $y$  (not observed, she assumes it is multiplicative), and on the effect which advertising (the cue) has on the effort the consumer may

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<sup>14</sup>This means that green advertising is convincing enough for consumers to buy the product.

make (the firm forms this expectation thanks to previous marketing studies<sup>15</sup> for instance).

The maximization yields the following equations:

$$y' * p_h = F'(x) \tag{5}$$

$$x \frac{\partial y'}{\partial \alpha} p_h = F'_a(\tilde{\alpha}) \tag{6}$$

Hence both  $x$  and  $\tilde{\alpha}$  are increasing in  $r_h$ . Since the cost of sending  $\tilde{\alpha}$  is increasing and convex, as that of sending the HI, at some point, an equilibrium is reached. Indeed, the marginal cost of sending both the cue and the HI becomes too high compared to the marginal gain through the increased probability that the consumer will assimilate the information. This is due to the complementarity of the efforts by the firm and the consumer. Hence, increasing  $\tilde{\alpha}$  increases the cost  $F_a$  directly and also increases  $x^*$  indirectly through its effect on  $y^*$ .

## 4 Sequence of Play and Equilibrium

The sequence of play is as follows: first, the firm decides on the level of investment in CSR. Second, she chooses the level of both types of communication, soft and hard information. Then, the consumer observes the cue and decides whether to make an effort to assimilate the hard information. Finally, he decides whether to buy the product or not. The communication efforts are set non-cooperatively.

We first study the endogenous choice of the communication level with the consumer's decision to buy the product or not. Then we endogenize the level of investment in CSR. It is important to notice that exogenous CSR and endogenous CSR cases correspond to two different situations for firms. Either they have already absorbed the cost of CSR but want to communicate about it, or they decide whether (and how much) to invest in CSR by taking their future communication strategy into account in the decision process.

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<sup>15</sup>This refers in a way to the goodwill effect in the advertising literature that states that past advertising strategies influence today's consumer behavior.

## 4.1 Endogenous Choice of the Cue and the HI

In this section, we consider that the level of CSR is given and that the firm has to choose its communication strategy. Hence, for the moment, we do not study the first step of the timing of the event. The firm that has a positive level of CSR may send any level of cue and accordingly can make an effort  $x^*$  to convey hard information. The No-CSR firm must send a cue which is either superior or equal to  $\alpha^*$  or to  $\alpha^{max}$ , depending on her prior on the type of the consumer. The No-CSR firm does not send any HI. A communication strategy is an  $(\tilde{\alpha}, x^*)$  couple. Both firms establish a prior about the type of the consumer: the probability that the consumer is suspicious is  $\delta_i \in [0, 1]$  for  $i = CSR, No - CSR$ .

As a reminder, if  $\tilde{\alpha} < \alpha^*$ , both types of consumer look for HI. If  $\tilde{\alpha} \in [\alpha^*, \alpha^{max}]$ , the suspicious consumer looks for HI, whereas the gullible one buys the product. Finally, if  $\tilde{\alpha} > \alpha^{max}$ , both types buy the product. When a consumer looks for HI but does not assimilate it, he does not buy the product.

### 4.1.1 CSR-Firm: Hard Information Communication

A CSR-firm willing to send hard information may send  $\tilde{\alpha} \in [0, \alpha^{max}[$  and hard information according to her real level of CSR. In this case, she will send a combination  $(\tilde{\alpha}, x^*)$  that maximizes her expected payoff. We know that the consumer's incentive to make an effort to assimilate the HI increases on an interval with a higher  $\tilde{\alpha}$ .<sup>16</sup> In such a situation, the firm has an incentive to increase  $\alpha$ .

Two possibilities are then available: sending  $(\tilde{\alpha} \geq \alpha^*, x^*)$  or  $(\tilde{\alpha} < \alpha^*, x^*)$ . The strategy which consists in sending  $(\tilde{\alpha} \geq \alpha^*, x^*)$  yields the following expected payoff:

$$\begin{aligned} & \delta_{CSR}[p * p_h - F(x^*) - F_a(\tilde{\alpha})] + (1 - \delta_{CSR})[p_h - F(x^*) - F_a(\tilde{\alpha})] \\ & = p_h[\delta_{CSR}p + (1 - \delta_{CSR})] - F(x^*) - F_a(\tilde{\alpha}) \end{aligned} \quad (7)$$

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<sup>16</sup>The interval is either  $[0, \alpha^*]$  if he is gullible or  $[0, \alpha^{max}]$  if he is suspicious.

This equation says that the CSR-firm has to bear the costs of sending both types of information. Then, if the consumer is gullible, since  $\tilde{\alpha} > \alpha^*$ , he rubber-stamps the action of buying the product. If the consumer is suspicious, he decides to look for HI and with a probability  $p$  succeeds in assimilating it and then buys the product.  $x^*$  and  $\tilde{\alpha}$  come from the maximization program of the firm (see section 3.2.2).

The strategy which consists in sending  $(\tilde{\alpha} < \alpha^*, x^*)$  yields:

$$p * p_h - F(x^*) - F_a(\tilde{\alpha}) \quad (8)$$

Hence, gullible or not, the consumer looks for HI and buys the product with a probability  $p$ .

#### 4.1.2 CSR-Firm/No CSR-Firm

Another possible strategy is not to send any hard information. This strategy is available to both types of firm.

A No-CSR firm never sends any HI since if the consumer succeeds in assimilating it, he will discover that the price is too high compared to the CSR content of the product. She will either send  $(\alpha^*, 0)$  or  $(\alpha^{max}, 0)$  according to her prior on the type of the consumer. CSR-firms do not have to send their true  $r_h$ . Since these strategies imply that they will not send any HI, they will choose to announce an  $r_h$  considering the cue cost function  $F_a(\cdot)$  and the price function  $p_h(\cdot)$ .

Hence, the No-CSR firm and the CSR-firm behave similarly when they send an  $r_h$  which is different from the real level of CSR they have: both greenwash. However, sending their true  $r_h$  can also be a good strategy. In this case, the CSR-firm does not necessarily greenwash since the  $r_h$  announced is the real one. She simply prefers to only send soft information.

First, the firm can decide to send  $\tilde{\alpha} = \alpha^*$  without hard information. If the firm decides to send  $(\alpha^*, 0)$  it yields:

$$(1 - \delta_{CSR})p_h - F_a(\alpha^*) \quad (9)$$

Hence, if the consumer is gullible, he buys the product and if he is not, he does not.<sup>17</sup>

Second, sending  $(\alpha^{max}, 0)$  yields :

$$p_h - F_a(\alpha^{max}) \tag{10}$$

Here, when  $\tilde{\alpha} = \alpha^{max}$ , the type of the consumer does not matter and he buys the product.

Given the four strategies above, we can show that:

**Lemma 1** *For both types of firm:*

*For a not too convex cue cost function and a not too concave price function,  $(\alpha^{max}, 0) \succ (\alpha^*, 0) \succ (\tilde{\alpha}, x^*)$  and a high  $r_h$  is announced.*

*For a low  $\delta_i$  and a steep cue cost function, a flat price function,  $(\alpha^*, 0)$  is preferred.*

*Hence, for these two corner solutions: 1/ If both types of firm prefer  $(\alpha^{max}, 0)$ , the No-CSR firm and the CSR-firm announce a high  $r_h$  and each one has one chance out of two of selling her product.*

*2/ If the CSR-firm prefers  $(\alpha^*, 0)$ , the No-CSR firm and the CSR-firm announce a low  $r_h$  and each one has one chance out of two of selling her product.*

*For all other situations, the CSR-firm:*

*3/ If she prefers the  $(\tilde{\alpha}, x^*)$  strategy, she has to announce her true  $r_h$ .*

*This forces No CSR-firms to decrease the announced  $r_h$  so that they may prefer  $(\alpha^*, 0)$  if  $\delta_{No-CSR}$  is low.<sup>18</sup>*

Importantly, announcing a high  $r_h$  does not increase the incentive to prefer  $(\alpha^{max}, 0)$  to  $(\tilde{\alpha}, x^*)$ .

Thus, CSR-firms may choose one or the other. This also underlines that a CSR-firm may well send  $(\alpha^{max}, 0)$  with her true  $r_h$ .

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<sup>17</sup>Of course, the assumption that the suspicious consumer does not buy the product if he fails in assimilating the HI has consequences since it makes the probability of selling the product for No CSR-firms a lot lower: it drops from  $(1 - \delta_{GW}) + \delta_{GW}(1 - p)$  to  $(1 - \delta_{GW})$ . However, qualitatively, this does not change the results.

<sup>18</sup>See proof in appendix.

This lemma also underlines that  $(\alpha^{max}, 0)$  is a better strategy than  $(\alpha^*, 0)$  if sending  $\alpha^{max}$  is not too costly, because the latter implies taking a risk: if the consumer is not gullible, he will not buy the product.

CSR-firms will prefer the  $(\tilde{\alpha}, x^*)$  strategy of dual communication modes (which in this case are therefore complements, whereas the cue crowds out the HI in the other cases) for a given  $r_h$  if the associated probability of selling the product is high, if  $p_h(r_h)$  is low, if  $\delta_{CSR}$  is low and of course if the cue cost function is very convex, contrary to the HI cost function. A surprising aspect is the low  $\delta_{CSR}$  condition. It states that CSR-firms prefer the  $(\alpha^{max}, 0)$  cue communication strategy when their prior about the probability that the consumer is suspicious is high. This is due to the fact that a higher  $\delta_{CSR}$  increases the weight of the less profitable part of equation (7). On the contrary, a low  $\delta_{CSR}$  implies that there is a high probability of selling the product for sure, despite the waste corresponding to the useless HI which the firm has sent.

## 4.2 Optimal Strategies of No-GW Firms When Facing GW-Firms

We now explicitly introduce greenwashing firms (GW-firms), which by definition cannot send hard information. They can be of two types. First, she can have  $r_l$ , i.e. be a No CSR-firm, and try to convince the consumer that  $r_h > 0$ . Second, she may have a level  $r_h > 0$  and try to make the consumer believe that  $r_h$  is even higher, i.e. this is a CSR-firm that prefers  $(\alpha^{max}, 0)$  or  $(\alpha^*, 0)$ .<sup>19</sup>

Hence GW-firms can either be CSR-firms and No-CSR firms (first subsection: all considered firms are GW-firms) or solely No-CSR firms (second subsection: there is at least one CSR-firm that plays a No-GW strategy). GW-firms play either  $(\alpha^{max}, 0)$  or  $(\alpha^*, 0)$  and No-GW firms play either  $(\tilde{\alpha} < \alpha^*, x^*)$  or  $(\tilde{\alpha} > \alpha^*, x^*)$ .

**Definition 1** *Let us define hard greenwashing as an  $(\alpha^{max}, 0)$  or  $(\alpha^*, 0)$  strategy where*

- (i) a No-CSR firm sells her product at a price  $p_h$ , claiming it contains  $r_h$ , or*
- (ii) a CSR-firm claims that the CSR-content in her product is higher than the one it has.*

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<sup>19</sup>Announcing  $r_h$  is free, so it can be a lie. However, all firms that prefer these two strategies are not necessarily lying.

There are four situations to take into account in order to determine whether there is a dominant strategy for CSR-firms:

- (i) GW-firm sends  $(\alpha^*, 0)$  and the consumer is gullible
- (ii) GW-firm sends  $(\alpha^{max}, 0)$  and the consumer is gullible
- (iii) GW-firm sends  $(\alpha^*, 0)$  and the consumer is not gullible
- (iv) GW-firm sends  $(\alpha^{max}, 0)$  and the consumer is not gullible

We start with two peripheral cases for which the CSR-firm plays either  $(\alpha^{max}, 0)$  or  $(\alpha^*, 0)$ .

#### 4.2.1 The CSR-Firm Sends $(\alpha^{max}, 0)$ or $(\alpha^*, 0)$

The GW-firm sends either  $(\alpha^{max}, 0)$  or  $(\alpha^*, 0)$  according to her prior. Both firms are certain that they will sell the product if  $\delta_{CSR} = \delta_{GW} = 0$ . Consequently, they should choose  $(\alpha^*, 0)$  which is less costly. However, we can show that this strategy is always dominated for the CSR-firm given the behavior of the GW-firm.

**Result 1** *Even if  $\delta_{CSR} = 0$ , the dominant strategy for the CSR-firm is to play  $(\alpha^{max}, 0)$  if  $F_a(\cdot)$  is not too convex and  $p_h(\cdot)$  not too concave.*

*Hence, if both firms send  $(\alpha^{max}, 0)$ ,  $p_s^{CSR} = p_s^{No-CSR} = 1/2$ , with  $p_s^i$  for  $i = CSR, No-CSR$  the probability that the firm of type  $i$  sells her product.*

*Otherwise, they should stick to their first-best strategy. If  $(\alpha^*, 0)$ , the CSR-firm solely sells her product (with a probability 1/2) if (i) the GW-firm has also sent  $(\alpha^*, 0)$  and (ii) the consumer is gullible.<sup>20</sup>*

Thus, when the CSR-firm takes the strategy of the GW-firm into account, she will always play  $(\alpha^{max}, 0)$  if the cost of sending  $\alpha^{max}$  is not too high. As a consequence, both types of firm are merged and the hard greenwashing strategy is playable by the No-CSR firm and the CSR-firm.

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<sup>20</sup>See proof in appendix.



### 4.2.2 The CSR-Firm Plays $(\tilde{\alpha}, x^*)$

The  $(\tilde{\alpha} > \alpha^*, x^*)$  strategy is a good strategy only for situation (i): if the consumer is not gullible, facing a GW-firm implies that she succeeds in selling her product solely when she sends  $(\tilde{\alpha} < \alpha^*, x^*)$ .

When considering all strategies available to GW-firms and the possibility of facing either a gullible or a suspicious consumer, one obtains the following proposition.

**Proposition 1 (Hard greenwashing)** *If  $F_a(\alpha^{max})$  is low enough, it is in the interest of the CSR-firm and the No-CSR firm to choose  $(\alpha^{max}, 0)$  and  $p_s^{CSR} = p_s^{GW} = 1/2$ .*

*Otherwise, the CSR-firm may choose  $(\tilde{\alpha} > \alpha^*, 0)$  or  $(\tilde{\alpha} < \alpha^*, x^*)$  where  $x^*$  and  $\tilde{\alpha}$  are determined by equations (5) and (6).<sup>21</sup>*

There is no dominant strategy for the No-GW firm. Hence, when CSR-firms have internalized the cost of the CSR, their strategic behavior does not allow to rule out the hard greenwashing strategy, except when the consumer is not gullible and she has sent  $(\tilde{\alpha} < \alpha^*, x^*)$ . Hence, hard greenwashing may even be a good strategy with  $(\alpha^*, 0)$ : even a wise consumer cannot discriminate between both types of firm given their advertising strategies.

In terms of probability of selling the product, the  $(\alpha^{max}, 0)$  strategy weakly dominates  $(\alpha^*, 0)$  for GW-firms. However, as the former is more expensive than the latter, there is no strategy that dominates.

As a consequence, the hard greenwashing strategy cannot be excluded and may be profitable in some situations. Either the consumer will end up with a CSR-product that has less CSR than the price indicates, or he will buy a No-CSR product at a prohibitive price. The  $(\tilde{\alpha} > \alpha^*, x^*)$  strategy is not of interest and becomes  $(\tilde{\alpha} > \alpha^*, 0)$ . We will see that when one considers that the choice to invest in CSR is costly, then the firm can avoid this strategy. That is, a CSR-firm whose first-best would be sending  $(\tilde{\alpha} > \alpha^*, x^*)$  for the optimal level of CSR she chooses will either turn to greenwashing,  $(\tilde{\alpha} > \alpha^*, 0)$ , or to less cue communication,  $(\tilde{\alpha} < \alpha^*, x^*)$ .

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<sup>21</sup>See proof in appendix.

### 4.3 Endogenous CSR

Now, we reintroduce the first step of the timing of the event: firms first choose their level of CSR before defining their communication strategies. When a firm chooses its level of CSR endogenously, a firm sending  $\alpha^{max}$  is necessarily a no-CSR firm. The reason is simple: a firm that plans to send  $\alpha^{max}$  knows that the consumer will rubber-stamp action A without looking for HI. The only reason for investing in CSR is the need to send hard information (which is obviously impossible if there is nothing to show). As a consequence, this strategy is ruled out as the consumer knows this.<sup>22</sup>

It is worth pointing out that if CSR is endogenous, it is not optimal to invest in CSR and send an untrue  $r_h$ . This would simply be a pure waste. If the consumer is suspicious and seeks HI, either he will assimilate the HI and refuse to buy the product because it is too expensive considering its CSR content, or he will not assimilate it and will then refuse to buy the product. If the consumer is gullible, then sending HI is either useless or will have the same consequence as for the suspicious consumer if  $\tilde{\alpha} < \alpha^*$ .

A last remark is that the  $(\alpha^*, 0)$  strategy remains possible, hence hard greenwashing is not totally ruled out. Moreover, the fact it is not ruled out is the reason why firms that plan to invest in a positive amount of CSR may switch from their first-best strategy to their second-best strategy.

#### 4.3.1 How the Presence of GW-Firms Modifies the Strategy of CSR-Firms

Now, an equilibrium is defined by  $(r_i, \tilde{\alpha}, x^*)$  for  $i = l, h$ . As argued before, a first-best strategy involving  $(r_h, \tilde{\alpha} > \alpha^*, x^*)$  is a risky behavior since it is mostly dominated (see proof of proposition 1). Now that the CSR is an endogenous choice, a firm may avoid this issue by choosing a second-best solution. The firm may then choose to underinvest in CSR so that the equilibrium solution becomes  $(r'_h < r_h, \tilde{\alpha} < \alpha^*, x^*)$ . She may prefer the greenwashing strategy. Finally, she may decide not to do anything and will then produce a normal product with no CSR claim.

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<sup>22</sup>We consider that even a gullible consumer is aware of this.

Interestingly, firms that have quite a competitive cost function both in terms of CSR and communication are not necessarily those that will *in fine* opt to invest in CSR. Indeed, their favorable cost function for cue communication may lead them to prefer to greenwash, although they would otherwise have chosen a quite high  $r_h$  with an  $(r_h, \tilde{\alpha} > \alpha^*, x^*)$  strategy.

Concretely, we now take the cost of “producing” CSR,  $F_{CSR}(r_h)$ , into account. Not surprisingly, when investing in CSR is costly, a firm is less likely to prefer a strategy involving the two types of communication.

A firm thinking that  $\delta_i$  is rather high should prefer to choose  $r_h$  such that  $\tilde{\alpha} < \alpha^*$ . Indeed, in such a case, she should rule out the greenwashing strategy because a suspicious consumer will undoubtedly always prefer to choose the product that contains CSR. That is, the suspicious consumer will choose to look for HI for the poorly advertised product which by definition will be sold solely if the consumer has found the hard information sent.

The following proposition sums up the consequences of the (possible) presence of GW-firms on the market. That is, how a future No-GW firm prefers her second-best strategy in order to increase the probability of selling her product in the presence of GW-firms.

**Proposition 2 (Constrained light greenwashing)** *Due to the presence of GW-firms, firms whose first-best is  $(r_h, \tilde{\alpha} > \alpha^*, x^*)$  may reduce their optimal investment in CSR to their second-best  $(r'_h < r_h, \tilde{\alpha} < \alpha^*, x^*)$  or turn to greenwashers.*

*If (i)  $\frac{\partial \alpha^*}{\partial r_h} < 0$ , (ii)  $\partial y' / \partial \alpha$  is large and (iii)  $\partial p_h / \partial r_h$  is small, then  $\tilde{\alpha}$  does not decrease much, and  $x^*$  is very likely to also decrease in this situation. However, the decrease in  $r_h$  is moderate.*

*If (i)  $\frac{\partial \alpha^*}{\partial r_h} > 0$ , (ii)  $\partial y' / \partial \alpha$  is small and (iii)  $\partial p_h / \partial r_h$  is large, then  $\tilde{\alpha}$  decreases sharply and  $x^*$  may increase, or at least decrease less. However, the decrease in  $r_h$  is rather important.*

*If  $F_a(\alpha)$  is not too convex, then she chooses to greenwash.<sup>23</sup>*

This proposition underlines that the consequences of the presence of GW-firms are twofold, according to the type of potential CSR-firms they face. It could increase the number of GW-firms. It could also induce a decrease in both the optimal  $r_h$  and the level of cue communication. This

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<sup>23</sup>See proof in appendix.

last case corresponds to constrained light greenwashing. We define constrained light greenwashing as reducing the optimal level of  $r_h$  compared to a first-best strategy in response to the competition from GW-firms, combined with a low decrease in cue communication and a decrease in HI communication. Thus, interestingly, the presence of GW-firm may or may not lead the firm to constrained light greenwashing. However, when it does not, the result is a strong decrease in the level of CSR. Firms that have a low  $\delta_i$  may prefer to send  $(\tilde{\alpha} > \alpha^*, 0)$ , i.e. to greenwash even more.

When CSR-firms make very optimistic projections on the efficiency of a communication campaign and/or when  $p_h$  is moderately influenced by  $r_h$ , then the decrease in CSR, as well as in cue communication, is moderate. On the contrary, HI communication is very likely to decrease. If  $r_h$  has a strong positive effect on  $p_h$ , then  $\frac{\partial \alpha^*}{\partial r_h} > 0$ , so condition (ii) is not fulfilled. If the effect is small, then condition **\*\* il manque qqch ici \*\*** does not hold. We can conclude that this situation happens in very inelastic or elastic markets.

Alternatively, a potential CSR-firm may reduce its optimal investment in CSR sharply, but green advertising will also be strongly reduced and her efforts in communicating HI may even increase. On moderately price-elastic markets, this situation is more likely to occur.

CSR-firms whose first-best strategy is  $(r_h, \tilde{\alpha} < \alpha^*, x^*)$  play their first-best strategy. These are firms that do not expect advertising to be very effective on the effort which the consumer may make to get HI and/or firms that have a cue cost function such that  $\partial^2 F_a(\alpha)/\partial^2 \alpha \gg \gg 0$ .

### 4.3.2 Does the Possibility of Advertising Modify the Strategy of CSR-Firms?

We now want to know whether the possibility of sending a cue reduces the optimal level of CSR which the firm chooses. Let us compare models with and without the possibility of sending a cue in which firms can commit to  $r_h$  if CSR is practiced and see the relative incentives of firms willing to practice CSR. As argued previously, the possibility of revealing  $r_h$  does not suppress all incentives to send cues. Moreover, if cues are relatively cheap compared to the investment in CSR, the firm may prefer a quite low level of  $r_h$  and send a high cue. Hence, the possibility of sending a cue, everything else being equal, helps to sell her product with a lower level of CSR.

Two opposed effects are at work when the possibility of sending cues is introduced. According to the effect that dominates, this will increase or decrease the optimal investment in CSR by the firm. Cues and CSR may either be complements or substitutes. In case of substitution, we call this ad light greenwashing and this is the second strategy we will seek to identify empirically.

**Proposition 3 (Ads light greenwashing)** *If  $r_h$  is continuous and endogenous, then the possibility of sending cues may reduce the optimal level of CSR.*

*In this case, the effort made by the firm to communicate hard information increases.*<sup>24</sup>

We call this ad light greenwashing because firms keep investing in CSR, yet less so than without cues. However, contrary to constrained light greenwashing, in this case it is the mere possibility of communicating through green advertising that reduces the incentive to invest in CSR. In the previous situation, greenwashing was a constrained behavior. Here, it is a purely voluntary behavior, and as such more condemnable. The investment in green advertising and the efficiency of advertising in convincing consumers reduce the amount a firm is willing to invest in CSR.

Finally, we have to note that the effort made by the firm to communicate hard information increases if she reduces the optimal level of CSR.

To sum up the theoretical part, we have determined three cases of greenwashing. First, when firms have internalized their investment in CSR, the possibility of what we have labeled hard greenwashing is absolutely not ruled out. Firms that have a comparative advantage in sending soft information will be those that opt for the hard greenwashing strategy. Beyond the trivial effect of the relative advantage associated with sending hard information that will govern firms that have a positive level of CSR in choosing between a greenwashing strategy and an “honest” one, the degree of complementarity between the consumer and the firm on the communication of hard information is important. A firm that is more scrutinized by consumer groups or NGOs is likelier to send hard information and less likely to greenwash.

The other two cases of greenwashing are labeled light greenwashing as they involve an investment in CSR; however, this investment is smaller than without greenwashing. First, ad

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<sup>24</sup>See proof in appendix.

light greenwashing encompasses firms which reduce their optimal level of CSR because they can advertise for their green products. However, these firms increase their effort in the communication of hard information. Second, constrained light greenwashing is found when the presence of greenwashers leads a firm that has invested in CSR to reduce her amount of CSR investment.

Greenwashing can be considered either as resulting in a limited decrease in advertising or a sharp decrease in the level of CSR investment. Choosing one or the other interpretation of what greenwashing is will have an impact on the conclusions which can be drawn. Although a strong decrease in CSR may not be a desirable situation, one could argue that it is more relevant to consider that greenwashing means relatively high advertising, with a decrease of hard information communication. This corresponds to the consumer forming a positive reaction to the ex-ante probability that there is a high level of CSR, combined with a high predicted effectiveness of green advertising and a small price elasticity of the product to its level of CSR.

Based on proposition 2, two types of firm may be of interest. Either a firm can exhibit a low level of CSR, a low level of soft information communication and a relatively high level of hard information communication, or she can exhibit high levels of CSR and cues with a low level of hard information. Based on proposition 3, firms will exhibit low levels of CSR, with high levels of soft and hard information. Hence, if we go back to the TerraChoice terminology, this indicates that the sins of no proof and of vagueness, in the case of constrained light greenwashing, are complementary, which explains why they have increased simultaneously. Conversely, these two sins are substitutes in the case of ad light greenwashing, which explains why the sin of vagueness has grown more quickly in recent years. We now turn to empirics to assess whether the predictions of the theoretical model are confirmed by the data.

## 5 Data

According to the model, we need three sets of information : (i) the effective level of social responsibility for the firms, (ii) the “hard information” which is a reliable certification provided by the firm in order to give consumers a clear assessment of the CSR level, and (iii) the “cues”,

that is non-verifiable information or communication related to CSR provided by the firm, which can also be seen as advertising.

## 5.1 CSR, Cues and Hard Information

The CSR level will be approximated by the extra-financial rating provided by Vigeo for European firms. Vigeo’s ratings are used by SRI funds in order to choose the firms that meet given ethical criteria. In our view, these data provide the most reliable estimation of the effective level of CSR.<sup>25</sup> Igalens and Gond (2005) showed the relevance of Vigeo-ARESE<sup>26</sup> data: “*a proxy that is particularly suitable for Corporate Social Performance, at least from a theoretical point of view*”<sup>27</sup>. It is noteworthy that the Vigeo ranking is not public and therefore cannot be used by firms as a way to increase the congruence between firms and consumers, as advertising or cue messages. Furthermore, Vigeo ranks all firms which are included in the Dow Jones Stoxx 600 index, and not only voluntary firms. This excludes the risk of a possible selection bias. Consumers do not know the Vigeo ranking for each firm, they can only observe their level of “soft” and “hard information”.

The most difficult challenge is to find an acceptable proxy for greenwashing and communication related to CSR. Unfortunately, firms do not have a specific budget for “CSR advertising”.

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<sup>25</sup>Cochran and Wood (1984) argued that there are two generally accepted measures of CSR: the reputation index (Moskowitz, 1975) and content analysis (such as the data we use here). They found advantages and drawbacks to both methods. Tsoutsoura (2004) criticized reputation indexes stating that “*it is unclear exactly what these indicators measure*”. Igalens and Gond (2005) added three other measures: measurements based on analyzing the content of annual reports, pollution indices, and perceptual measurements derived from questionnaire-based surveys. Waddock and Graves (1997) drew upon the Kinder Lydenberg Domini (KLD) rating system and used these data to measure CSR. Tsoutsoura (2004) or Siegel and Vitalino (2007) used these measurements. Vigeo can be considered as the European counterpart to KLD with comparable methods. Igalens and Gond (2005) compared KLD and Vigeo-ARESE data and noted some distinctions which are mainly explained by different cultural sensitivities. Methodologically, they found that the scoring-quality proxy is always more favorable to the Vigeo-ARESE data (see Mattingly and Greening (1999) for a detailed analysis of KLD data.). More recently, some authors have proposed new tools for measuring corporate contributions to sustainability: sustainable value-added (Figge and Hann, 2001), but there is no consensus on the relevance of such a measurement (Korhonen, 2003)

<sup>26</sup>The analysis was carried out on the French extra-financial rating agency ARESE which merged with Vigeo in 2002. We assume that former ARESE data and Vigeo data are similar as the same methodology applies.

<sup>27</sup>However, they insist on the nuances introduced by the observation of the different sub-components of the index.

The alternative would be to use the general advertising budget, but this strategy will not be satisfactory as we cannot distinguish firms with a specific strategy linked to their CSR. This is why we propose to use the general level of sustainable development reporting as a proxy for the general level of CSR communication.

In parallel with the rise of social and environmental concerns, the number of extra-financial reports has skyrocketed in the last few years. These reports take various forms. Contrary to financial reports which are compulsory for firms quoted in the stock exchange, these extra-financial reports are not homogenized and are purely voluntary.<sup>28</sup>

Our hypothesis is that reporting is part of the overall communication related to CSR. A firm may produce extensive reports and over-communicate considering their real commitment and investment in CSR. In most cases, these reports are subjective and give a partial overview of the real CSR content in the products sold by the firm (thus echoing the theory of information dissimulation in Lyon and Maxwell 2010). In many other cases, information is not verified (thus echoing the theory presented in this paper). The analysis of the content of annual reports has been used in the literature as a general proxy for corporate social performance (Dejean and Oxibar, 2003). However, as noted by Ullman (1985) and Igalens and Gond (2005), the analysis of annual reports involves a measurement of “social discourse” rather than of CSR per se. It is clearly our hypothesis here.

One can argue that few consumers actually read these reports. But since consumer organizations and other NGOs examine these reports, it is not problematic for our analysis. They transmit the relevant information through campaigns or reports (see for instance the alternative sustainable reports on several major oil companies published by the Friends of the Earth NGO). The general public image of firms will thus be influenced indirectly by these reports, and by the opinion relayed by NGOs. As it seems reasonable to assume that there is a strong correlation between the general level of advertising on “green issues” (which is not measurable) and the global level of reporting on such issues, we can use the latter as a proxy for the former.

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<sup>28</sup>There has been a development of laws concerning social and environmental reporting (ORSE, 2004) at the European level in recent years. However, the format of such reports is generally not very well defined in these laws and sanctions are not stipulated.



Sustainable development reporting has improved in the last few years. Different organizations have started providing clear and homogenized guidelines. Following the model of financial reports, a growing number of firms ask for an external assurance of their sustainable development reports. A third party then checks the thoroughness of the information provided by the firm, and can formulate a conclusion on the sincerity of this information. Professional standards such as the International Standard on Assurance Engagement (ISAE 3000) may help third parties in this assurance work.

We then propose an empirical distinction between “soft information” and “hard information”. Soft information will be measured by the general level of reporting. Hard information will be surrogated by the assurance of sustainable development reports by a third party. The data for both come from Corporateregister.com.

## 5.2 Index of Corporate Social Responsibility

We create an original index of the effective level of CSR based on Vigeo data. Vigeo proposes different CSR principles of universal application translated into action steps for management. They propose 6 evaluation fields and 37 criteria. These fields are: (1) Human Rights, (2) Human Resources, (3) Environment, (4) Business Behavior, (5) Community Involvement, and (6) Corporate Governance. These objectives are evaluated on the basis of about 200 action steps. As the Vigeo ranking is not public, this value is unknown to consumers.

Vigeo provides detailed data on 595 European firms<sup>29</sup>. These firms are included in the Dow Jones Stoxx 600 index, which includes the 600 biggest capitalizations at the European level.<sup>30</sup> Out of these 595 firms, 171 are from the United Kingdom, 88 are French and 52 are German. The banking and insurance sectors are the most represented in the sample, with respectively 64 and 35 firms.<sup>31</sup>

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<sup>29</sup>Vigeo is extending the coverage of its database to American and Asian firms. However, the coverage is not significant yet. As a result, we have limited our analysis to European firms.

<sup>30</sup>We do not have exactly 600 firms in the database because of the exit and entry of some firms during the period.

<sup>31</sup>See Bazillier and Vauday (2009) for a more detailed description of the Vigeo data.

The main goal of the analysis is to see whether we can observe global patterns of behavior regarding different CSR aspects and to give an assessment of the global level of CSR according to the different items. Data analysis is a very useful methodology to reach these two main objectives. Igalens and Gond (2005) propose to use data analysis to evaluate the quality of the scoring. We will then use the same methodology to get global estimates of the general level of CSR using Principal Component Analysis (PCA).<sup>32</sup>

The first axis can be interpreted as a proxy for the general level of CSR. We make this hypothesis considering the high correlation between each of the Vigeo items and the coordinates on the first axis. The correlation between the coordinates on the first axis and the performance in terms of human resources, human rights, business behavior, and environment is very high (over 0.80). This correlation is lower with community involvement (0.73) and corporate governance (0.46).<sup>33</sup> The greater the coordinate on the first axis, the better the CSR performance for the firm. In order to facilitate the interpretation of the index, we will transform the coordinates on the first axis into an index included between 0 (the worst CSR performance) and 1 (the best CSR performance). We call this variable *CSR*.

According to this interpretation of the first axis, the best CSR performances are observed in Norway (0.59), in the Netherlands (0.55) and in France (0.54). The worst performances are observed in Iceland (0.14), Ireland (0.26) and Greece (0.29). In terms of sectors, the best performances are observed in the sector of waste and water utilities (0.61), in the chemical sector (0.60) and in the energy sector (0.60). On the other side of the spectrum, the food sector (0.35), and the mechanical component sector (0.41) have the worst marks in terms of CSR performance.

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<sup>32</sup>See Bazillier and Vauday (2009) for a more detailed presentation of the PCA results.

<sup>33</sup>This lower influence of community involvement and corporate governance is consistent with the definition of corporate social responsibility. Corporate governance can be considered as a broader concept than CSR itself and community involvement relates to activities which are not directly linked to the main activity of the firm. On the contrary, CSR is directly linked to this activity.

### 5.3 An Estimation of CSR-Related Communication: the Level of CSR-Reporting

\*\* For each firm in our sample, we collected different information on their CSR reports. For this, we used Corporateregister.com which is a global directory of CSR resources, including a CSR report directory. Thanks to this directory, it is possible to determine whether or not firms have already produced a report, how many reports have been produced, how many pages each report contains, the type of report and whether the report is externally assured. Of course, having numerous, extensive reports does not mean as such that the company has a global strategy of greenwashing. However, thanks to the comparison with our first CSR index, we can detect some “usual suspects” whose specificity is to have a huge reporting/communicating activity but a very low level of CSR.

From these data, we build two measures of CSR communication: the **communication experience** (measured by the total number of reports) and the **communication effort** which is a combination of (1) the number of reports per year and (2) the number of pages in the last report.

We choose to focus only on the quantitative aspects of CSR-related communication. We are not interested in content analysis to evaluate the quality of such reports. Here, what we need is an evaluation of the quantity of “cue messages” sent by firms in order to raise their congruence with consumers. If the information is verified by an external source, it becomes “issue-relevant information” (hard information). The real level of CSR is unknown to consumers (it is typically a credence good) and is proxied by the CSR index built from Vigeo data.

Table 1 presents descriptive statistics for these variables.

Table 1: Descriptive Statistics: CSR Reports

Variables	Mean	Std. Dev.	Min	Max
Number of Reports	4.79	4.95	0	29
Year of the first report	2001	4.03	1975	2008
Number of Pages (last report)	47.89	60.73	0	436
Number of Reports (per year)	0.73	0.86	0	16

Variable	Yes (%)	No (%)
Report	70.54	29.46
Externally assured	35.02	64.98

Source: Corporateregister.com

## 6 Empirical Specification and Results: Who Are the Usual Suspects?

In this section, we test some of the implications of our model empirically. The empirical strategy will then follow the sequence of the model (see Figure 1). We will first estimate the probability of sending hard information, considering the level of CSR and the level of soft information as explanatory variables. We will then infer an explanation for the level of soft information, as we know that this level depends on the levels of hard information and CSR. Lastly, we will propose an additional statistical approach to highlight the non-linear relationship between CSR and the level of soft information.

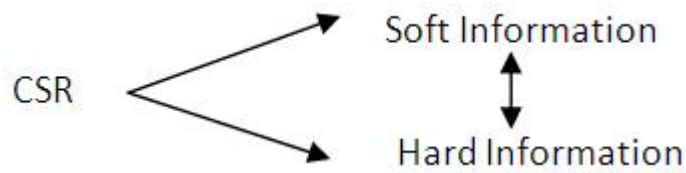


Figure 1: Sequence of Events

## 6.1 Estimating the Probability of Sending Hard Information and of an External Assurance of Sustainable Development Reports

“Hard information” in our model is approximated by externally assuring a sustainable development report (variable *CRcheck*). This variable is thus a dummy. Almost 35% of the firms in our sample externally assure their reports. In order to test the probability of sending hard information, we propose the following specification:

$$Prob(CRcheck = 1) = \phi CSR + \varphi X + \gamma Z + \epsilon \quad (11)$$

*CSR* is our CSR index and  $\phi$  the estimated coefficient associated with *CSR*. *X* is the matrix of variables related to CSR communication and  $\varphi$  the column vector associated with the matrix *X*. *Z* is a set of control variables.  $\epsilon$  is the error term and is assumed to be i.i.d. Estimations are performed using a robust probit estimator.

Control variables include the age of the firm, her level of assets (both in log)<sup>34</sup>, country dummies and sector dummies. Nevertheless, some communication behaviors are really sector-specific. These sector dummies therefore capture almost all the information which we are interested in. Even if most of our results remain valid when including these sector dummies, we will systematically present the results with and without these dummies.

From the theoretical model, we know that the probability of sending hard information is a function of the level of CSR, but is also impacted by the level of soft information. Propositions 2 and 3 tell us that the ratio of CSR over the amount of hard information sent may vary according to the effect of the CSR on the soft information sent. We will model this effect through the inclusion of an interaction term *X.CSR*.<sup>35</sup> The final specification is thus the following:

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<sup>34</sup>The data come from Orbis (Bureau van Dijk).

<sup>35</sup>As this heterogeneity in the effect of CSR on the probability of sending hard information is directly linked to the level of soft information, we choose for simplification purposes not to use random coefficient models, but to express this source of heterogeneity as a function of the level of CSR communication (*X*).

$$Prob(CRcheck = 1) = \phi CSR + \varphi X + \mu X.CSR + \gamma Z + \epsilon \quad (12)$$

However, it is obvious that the level of hard information ( $CRcheck$ ) also has an effect on the level of soft information ( $X$ ). If a firm decides to externally assure her sustainable development report, she may decide to decrease her level of soft information conjointly. This creates a bias of reverse causality that we correct by instrumenting the variable  $X$ . We thus decide to use Newey’s minimum chi-squared estimator in our probit model with endogenous regressors. The challenge is therefore to find an instrumental variable which is (1) correlated with  $X$  (the level of soft information) but (2) without a direct impact on the probability of sending hard information.

We propose to use the log of operational revenue<sup>36</sup> as an instrumental variable. There is an important literature on the economic effects of advertising (see Bagwell (2007) for an extensive overview). Among these economic effects, the impact of advertising on sales (and thus on operational revenue) is one of the most important. But the causality can go in the other direction. Larger firms are also much more likely to advertise. As noticed by Bagwell (2007), “*Advertising may be associated with higher sales, because firms respond to greater sales with greater advertising.*” Furthermore, there is also a relation between advertising and concentration which is indeed influenced by the level of sales. Kaldor (1950) argues that advertising scale economies exist so that big firms can finance large advertising expenditure more easily.

On the contrary, the link between operational revenue and the probability of sending hard information is very weak. We do not see any reason for a firm to ask for an external certification or not, depending on her level of sales. To put it differently, we consider as a reasonable assumption that the level of sales largely determines the general level of advertising and soft communication. This also must be correlated with the general level of CSR communication. But the *type* of

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<sup>36</sup>The data come from Orbis (Bureau van Dijk). An alternative would be to use the log of sales, which is more consistent with the highlights of the literature on advertising. However, the level of sales is not available for banks and financial firms. These firms represent a significant share of our sample and it is also interesting to study the possible influence of greenwashing for such firms. We thus decide to use operational revenue which has an obvious link with the level of sales and is more relevant for banks and financial firms.

communication, i.e. whether this communication is based on “tangible and verifiable” information or not, has other determinants than the level of sales.

As  $X$  is part of  $X.CSR$ , we must also instrument this interaction term. We then build a new interaction term between the log of operational revenue (our instrument) and  $CSR$ . It will be used as an additional instrument.<sup>37</sup>

We assume that  $CSR$  does not need to be instrumented. The sequence proposed by the model clearly states that the level of  $CSR$  predetermines the level of soft and hard information. Reverse causality is not likely to be a problem for this variable, as the level of communication cannot have an impact *per se* on the level of  $CSR$ .

Table 2 presents the results of probit estimates and probit estimates with instrumental variables, using the number of pages in the last report as a proxy for soft information. Tables 6 and 7 in the appendix F show the results respectively using the total number of reports and the number of reports per year as proxies for soft information.

The relation between soft information and hard information seems to be very correlated with the sector. A rapid statistical exploration of the data by sector shows that the standard error for both measures of communication is relatively low *within sectors*. This is why the inclusion of sector dummies is problematic in this set of estimates. If the results in probit are very similar with and without sector dummies, the results obtained when instrumenting the soft information variable are much less convincing when sector dummies are included.

The level of soft information is always positively correlated with a higher probability of sending hard information (except for estimates with instrumental variables and sector dummies).  $CSR$  always has a positive and significant impact on the probability of sending hard information, but this result is not significant anymore when instrumenting the soft information variable (the sign of the coefficient remains the expected one). The most interesting result is the sign

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<sup>37</sup>Unfortunately, it was not possible to find any additional instruments. Firm-specific data are limited and specific data related to the different dimensions of  $CSR$  communication are not available. Since we have as many instruments as endogenous regressors, we cannot test the orthogonality of our instruments using the Hansen-Sargan statistic for instance. Nevertheless, we observe that the sales are a good predictor of the level of soft information (in the first step of the two-step probit estimates), but are not significant when we include this variable in the estimates of the probability of sending hard information.

Table 2: Probit Estimates of Hard Information (Externally Assured)

Dependent variable	Crcheck	Crcheck	Crcheck	Crcheck
CSR	3.030*** (5.470)	2.860*** (4.797)	1.378 (1.067)	1.724 (0.796)
Number of Pages (last report)	0.0146*** (3.478)	0.0111*** (2.616)	0.0727*** (3.437)	0.0665 (1.576)
CSR x Number of Pages	-0.0171** (-2.568)	-0.0142** (-1.989)	-0.0671** (-2.372)	-0.0652* (-1.809)
Assets (in log)	0.0912** (2.073)	0.308*** (4.176)	0.0994 (1.409)	0.221 (1.362)
Age (in log)	-0.0189 (-0.181)	-0.0353 (-0.329)	-0.0545 (-0.333)	-0.0275 (-0.168)
Constant	-3.588*** (-4.275)	-7.316*** (-5.657)	-3.850** (-2.554)	-6.381** (-2.267)
Country-specific fixed effects	YES	YES	YES	YES
Sector fixed effects	NO	YES	NO	YES
Instrumental Variables	NO	NO	YES	YES
Observations	489	479	483	474
Pseudo R <sup>2</sup>	0.2495	0.3089		

Robust z-statistics in parentheses.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Probit estimates with endogenous regressors use Newey's minimum chi-squared estimator



and significance of the interaction term. In all estimates, the interaction term is negative and significant. This result is valid for all variables of soft information and also when these variables are instrumented.

The estimated coefficient of the interaction term should be interpreted cautiously. As shown by Ai and Norton (2003), the magnitude of the interaction effect in non-linear models does not equal the marginal effect of the interaction term and can be of opposite sign. We thus use the methodology used by Ai and Norton (2003) to estimate the magnitude and standard errors of the interaction effect correctly. Our main result is confirmed. For all estimates, the correct interaction effect is negative for almost all observations in the sample.

Consequently, the positive sign of the soft information proxy confirms proposition 3 in the theoretical model which states that when the level of soft information increases, the level of hard information also increases. The negative sign of the interaction term validates proposition 2 which states that soft and hard information are substitutes for firms that practice CSR. One may find either firms with a quite high level of soft information and a relatively low level of hard information or the reverse. Additionally, in this proposition, both the cue level and the CSR level decrease in similar proportion, hence the relative cue level compared to the CSR level does not change strongly. When both levels jointly decrease, then the level of hard information also decreases. This also corresponds to the empirical results.

Proposition 3 also states that the presence of soft information induces a decrease in the CSR level. This amounts to an increase in the relative cue level with respect to the CSR level. Hence, the hard information should increase. This is what proposition 3 predicts and what the negative sign of the interaction term means.

## **6.2 What Are the Determinants of the Level of Soft Communication?**

The next step in the empirical strategy is to estimate the level of “soft information”. Soft information is a type of communication which is not directly verifiable, but increases the level of congruence between the firm and the consumer. We use different levels of sustainable development reporting as proxies for soft information.

Similarly to hard information, the level of soft information is supposed to be determined first by the CSR level. However, the theoretical model predicts several possible relationships between CSR and the level of soft information. In most cases, an increase in CSR is supposed to increase the level of soft information. However, it is actually possible for firms with a low level of CSR to increase the level of soft information dramatically in order to compensate for this low level of CSR. From proposition 1, we know that the hard greenwashing strategy is playable, and from proposition 2, we know that firms can still play hard greenwashing, despite a lower level of cue compared to the one predicted by proposition 1. We also show theoretically that the “optimal level” of CSR may be lower when firms can communicate (see proposition 3).

We are lacking a counterfactual to show the latter theoretical result empirically. However, what we can do is show that the positive and monotonic relation between CSR and soft information is not relevant for some firms. What does it mean empirically? If our data fits with our theoretical model, we should observe two things: (1) a positive trend between CSR and soft information, and (2) a group of firms outside this trend, characterized by a higher level of soft information for a comparable level of CSR. The problem is that raw econometric results will not help us to identify this group of firms. Therefore, we propose to try to identify it graphically and then to add a new step in the empirical strategy. This additional step will only be used to identify the “usual suspects”, i.e. firms which over-communicate regarding their effective level of CSR. In order to do so, we will propose to put CSR as a dependent variable to highlight a possible non-linear relation between these variables. However, it should be clear that this last set of estimates does not aim at identifying a causal relation, as the sequence of the model is clear. CSR determines the level of communication and not the contrary. This “extended analysis of correlation” can be seen as a “statistical projection” and only aims at identifying a non-linear relation that cannot be shown with the current set of estimates.

The other problem which we face is related to the possible interaction between the levels of soft and hard information. As we showed in the previous section, soft information has an impact on the probability of sending hard information. The coefficient of CRcheck will thus be biased in the analysis. It is not possible to find correct measures that will be correlated with

the probability of sending hard information, but not with the level of soft information. The first reason is that we are very limited by the set of possible instrumental variables; none of them can fulfill both conditions. However, the main reason is directly explained by the type of proxies which we have chosen for soft and hard information. The level of soft information is proxied by different quantitative measures which are related to sustainable development reports. Hard information is proxied by externally assuring these reports. This means that any factor that will have an impact on the *externally assured* reports will also have, by construction, an impact on the reports (whether externally assured or not). We should therefore accept this shortcoming and be very cautious in the interpretation of the estimated coefficient of *CRcheck*. The main goal here is to identify relations between CSR and soft information. The consequence of such a shortcoming is therefore limited.

We then propose the following specification:

$$X = \beta_1 CSR + \beta_2 CRcheck + \beta_3 Z + \beta_4 Y + \epsilon \quad (13)$$

Where  $X$  is the level of soft information proxied by our three measures of sustainable development reporting,  $CSR$  is our index of the general level of CSR,  $CRcheck$  the level of hard information proxied by externally assured reports,  $Z$  a set of control variables similar to the one used in the last set of estimates, and  $Y$  is the log of operational revenue that we add as an additional control variable, since we showed in the previous instrumentation strategy that it can be used to explain the general communication level. The error term  $\epsilon$  is assumed to be i.i.d..

Table 3 shows the results when using the number of pages of the last report as a proxy for soft information, while Table 8 in Appendix G shows the results when using our two alternative proxies for soft information. For each proxy for soft information, we propose four different specifications. First, we only use assets, age and country dummies as control variables, without *CRcheck* (\*\* since we have seen that this coefficient may be biased). Then we add  $Y$  (the log of operational revenue). In a third step, we add *CRcheck* to compare the results. Finally, we also

add sector dummies to have a specification with the full set of control variables.<sup>38</sup>

Table 3: OLS Estimates of Soft Information (Number of Pages)

Dep. Variable	Number of Pages	Number of Pages	Number of Pages	Number of Pages	
CSR	119.2*** (8.983)	102.8*** (7.817)	94.68*** (6.881)	94.81*** (6.611)	
CRcheck			12.02** (2.228)	10.73* (1.846)	
Assets (in log)	0.936 (0.542)	-3.974** (-2.113)	-3.833** (-2.056)	-0.472 (-0.127)	
Age (in log)	1.211 (0.348)	-0.586 (-0.169)	-0.265 (-0.0783)	-0.501 (-0.133)	
Op. Revenue (in log)		11.39*** (5.478)	10.28*** (4.782)	6.489** (2.105)	
Constant	-42.87 (-1.245)	-131.4*** (-3.323)	-118.2*** (-2.958)	-85.17** (-2.148)	
Observations		490	484	484	482
R-squared	0.352	0.388	0.394	0.402	
Country-specific fixed effects	YES	YES	YES	YES	
Sector fixed effects	NO	NO	NO	YES	

Robust t-statistics in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

As expected, the CSR level has a positive and significant impact on the level of soft communication, whatever the proxy for communication chosen and the list of control variables included in the specification. Hence, again, proposition 3 in the theoretical model is validated, as it precisely predicts these two positive signs. However, this result does not allow us to identify the “usual suspects” that have a very high level of soft communication compared with their level of CSR. But the graphical representation of this result will help us do so. Figure 2 is the “Component plus residual plot” of CSR and soft information (Larsen and McCleary, 1972).<sup>39</sup> It represents the relationship between CSR and soft information, taking the other independent variables into account. It shows that most firms are not far from the tendency. However, a small group of

<sup>38</sup>For Table 8, we only present the results of the last two specifications. The results are similar for the first two specifications.

<sup>39</sup>See Figure H for the other two communication variables. This graph is obtained from the specification where all control variables are included (including sector dummies).

firms are clearly above it (highlighted in the circle, approximately). These firms are our “*usual suspects*”.

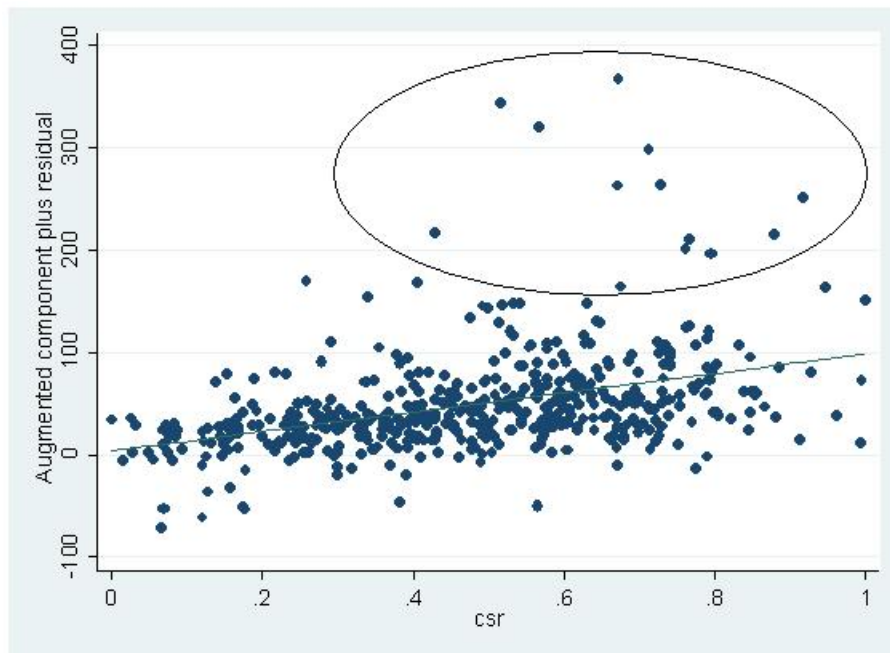


Figure 2: Component Plus Residual Plot of CSR and Soft Information (Number of Pages)

### 6.3 Who Are the “*Usual Suspects*”? The Non-Linear Relation Between Soft Information and CSR

This last set of estimates must be seen as a statistical projection of the previous set of estimates, without claiming any causal link between the variables. What we will do here is make the CSR level a dependent variable and soft information an independent variable, together with the other control variables which we have already used. The goal is not to pretend that the level of soft information has a causal effect on CSR. Once again, we keep to the sequence proposed by the theoretical model where CSR is supposed to determine both soft and hard information levels. The goal is to try to identify the firms that are located in the circle in Graph 2 more precisely. By introducing the squared term of the soft information variable, we can identify a possible inverted

U-shape relation between soft information and CSR.

Before presenting the results of the estimate with the squared term, Figure 3 shows the augmented component plus residual graph representing the relation between the soft information variable (here , the number of pages in the last report) and the CSR level, controlling for other independent variables.<sup>40</sup> The lowest smooth curve clearly indicates a non-linear relation between soft information and CSR (see Figure 5 in Annex H for other proxies for soft information).

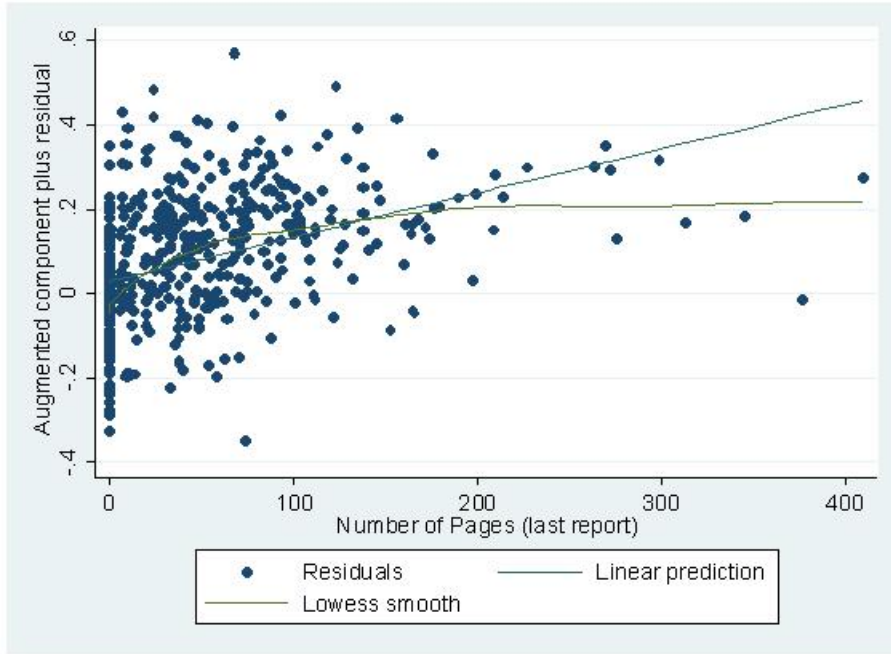


Figure 3: Component Plus Residual Plot of Soft Information (Number of Pages) and CSR

The specification is the following:

$$CSR = \gamma_1 X + \gamma_2 X^2 + \gamma_3 CRcheck + \gamma_4 Z + \gamma_4 Y + \epsilon \quad (14)$$

Where  $CSR$  is our index of the general level of CSR,  $X$  is the level of soft information proxied

<sup>40</sup>This graph is obtained after a regression including the CSR level as the dependent variable, and the following variables as independent variables: the number of pages in the last report,  $CRcheck$ , assets (in log), age (in log), operational revenue (in log), sector dummies and countries dummies.

by our three measures of sustainable development reporting,  $X^2$  its squared term,  $CRcheck$  the level of hard information proxied by externally assured reports,  $Z$  a set of control variables, and  $Y$  is the log of operational revenue. The error term  $\epsilon$  is assumed to be i.i.d.. The results are given in Table 4.<sup>41</sup>

Dep. Variable	Table 4: OLS Estimates of CSR					
	CSR	CSR	CSR	CSR	CSR	CSR
Number of Pages	0.000897*** (5.507)	0.00229*** (7.094)				
[Number of Pages] <sup>2</sup>		-5.33e-06*** (-4.660)				
Number of Reports			0.0147*** (8.988)	0.0306*** (6.684)		
[Number of Reports] <sup>2</sup>				-0.000901*** (-3.228)		
Number of Reports (per year)					0.0470* (1.948)	0.138*** (7.732)
[Number of Reports (per year)] <sup>2</sup>						-0.00777*** (-7.271)
CRcheck	0.0733*** (4.232)	0.0548*** (3.125)	0.0636*** (3.919)	0.0450*** (2.700)	0.0827*** (4.661)	0.0628*** (3.718)
Assets (in log)	0.0523*** (5.375)	0.0494*** (5.453)	0.0456*** (5.058)	0.0453*** (5.310)	0.0498*** (5.064)	0.0423*** (4.734)
Age (in log)	0.0131 (0.946)	0.00971 (0.713)	0.0104 (0.784)	0.0102 (0.791)	0.0130 (0.979)	0.0130 (0.991)
Op. Rev. (in log)	0.00886 (0.857)	0.00670 (0.679)	0.00435 (0.439)	-0.000642 (-0.0680)	0.0152 (1.479)	0.0114 (1.213)
Constant	-0.864*** (-9.466)	-0.764*** (-8.356)	-0.615*** (-5.337)	-0.503*** (-5.593)	-0.926*** (-6.918)	-0.719*** (-5.737)
Observations	482	482	491	487	491	491
R-squared	0.550	0.578	0.585	0.604	0.544	0.589
Country fixed effects	YES	YES	YES	YES	YES	YES
Sector fixed effects	YES	YES	YES	YES	YES	YES

Robust t-statistics in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The results clearly support the hypothesis of a non-linear relation between CSR and the soft information level. All estimated coefficients for proxies for soft information take a positive sign,

<sup>41</sup>Alternative specifications without sector dummies, without  $CRcheck$ , and without operational revenue gave the same results (available upon request).

while their squared terms are negative. All coefficients are highly significant.

Lind and Mehlum (2007) consider that a significant quadratic term is too weak a criterion to confirm the existence of an inverted U-shape curve. They propose to check whether the turning point is in the data interval and to test the slope on the beginning and the ending of the interval. They also propose to use a test developed by Sasabuchi (1980) which measures the significance of the inverted-U shape curve. Table 5 presents the result of these tests.<sup>42</sup> The Sasabuchi test confirms the existence of an inverted U-shape for our three communication variables. The estimated turning point is always included in the interval. The slope of the curve takes the expected sign in all cases.

Table 5: Test for U-Shaped (Lind and Mehlum, 2007)

Var.	Number of pages (last report)	Number of reports	Number of reports (per year)
Interval	[0,436]	[0,29]	[0,16]
Slope at lower bound	.0022879***	.0306469***	.1381999***
Slope at upper bound	-.0023566***	-.021585**	-.1103527***
Sasabuchi Test for inverse U-shaped	3.31***	1.79**	6.31***
Turning Point	214.7743	17.01567	8.896299
95% confidence interval for extreme point (Fieller method)	[182.47344; 283.88567]	[13.153862; 31.954222]	[8.3220635; 9.5967395]

Note: With \*\*\*, \*\* and \* respectively denoting significance at the 1%, 5% and 10% levels

These results give credit to our theoretical results. Different communication strategies are possible. This non-linear relation between soft information and CSR tends to show that some firms actually over-communicate in comparison with their effective level of CSR. This may explain why the CSR “optimal level” is found to be lower when firms can communicate. Our “usual suspects” are more likely to have a communication level which is beyond the different estimated turning points.

As for the proxy for the communication experience (the total number of reports), it can echo one intuition in the model related to the influence of credibility in CSR. Our model suggests that a firm will have an incentive to decrease her level of CSR if her level of credibility is high

<sup>42</sup>We only present the results using all control variables. The results are similar with different specifications.



enough (Grubb (2011) proves this formally). This increased credibility may be explained by two effects. The first one is an effect of “CSR efficiency” : past investments in CSR will increase the efficiency of current investments. The second one, which is not directly suggested by the model but is relatively obvious here, is a simple effect of reputation.

## 7 Conclusions

The empirical study of the greenwashing phenomenon is new in economics, while its theoretical study is very recent. Greenwashing practices have changed during the past few years and this paper offers a theoretical framework that shows the typical behavior of greenwashing firms which explains the emergence of the new greenwashing practices highlighted by TerraChoice (2010); we also provide empirical estimations that validate most of the behavior predicted in the theoretical part.

First, when firms have internalized their investment in CSR, the possibility of hard greenwashing is not ruled out at all and one can observe massive over-communication. The degree of complementarity between the consumer and the firm on hard information communication is important. A firm that is more scrutinized by consumer groups or NGOs is likelier to send hard information and less likely to greenwash.

Second, ad light greenwashing occurs when firms reduce their optimal level of CSR because they can advertise for their green products. However, they increase their effort in the communication of hard information.

Third, the presence of greenwashers may lead a firm that has invested in CSR to reduce her investment in CSR. We label this constrained light greenwashing.

Hence, if we go back to the TerraChoice terminology, this indicates that the sins of no proof and of vagueness, in the case of constrained light greenwashing, are complementary, which explains why they have increased simultaneously. Conversely, these two sins are substitutes in the case of ad light greenwashing, which explains why the sin of vagueness has grown more quickly in recent years.

Empirically, the CSR level affects the probability of sending “hard information” in order to convince skeptical consumers positively. However, the interaction between CSR and communication is negative. For a given level of CSR, the probability of sending hard information is lower when green communication increases. We also find a non-linear relation between CSR and communication. If there is a general positive trend between CSR and communication, some firms are clearly outside this trend, suggesting a possible greenwashing behavior. This empirical result confirms that green communication may reduce the optimal level of CSR for some firms. Hence we explain and confirm the two sins underlined by TerraChoice.

The greenwashing strategy may indeed represent a serious issue for the development of CSR practices. Active consumer lobbies can contribute to solving the problem by increasing the transmission of hard information and by decreasing the cost of sending it for firms. Public regulations should also help reduce this phenomenon, as it appears that sectors which are under strong public scrutiny are not tempted by greenwashing. Thus, the decision makers’ trust is as important as the consumers’. A last important aspect that needs to be underlined is that a good knowledge of the consumers’ reaction to green advertising should help reduce the greenwashing behavior.

The theoretical part also shows that dealing with greenwashing is not an easy task. Whether the aim is to fight greenwashing strategies or to encourage investment in CSR, the recommendations will differ as the constrained light greenwashing case highlights. In a way, greenwashing can be compatible with relatively high levels of CSR. Yet, in the case of ad light greenwashing, greenwashing implies a sharp decrease in CSR. Given these elements, a major recommendation would be to raise the consumers’ awareness of this potential greenwashing problem. A product bearing more green claims will not necessarily increase the probability of higher satisfaction for the consumer. We believe that shedding light on the greenwashing behavior and highlighting how to detect it is the best way to circumvent it.

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## A Proof of Lemma 1

The first two parts of the lemma are trivial. Given the four equations, if a firm can charge a large  $p_h$  for a large  $r_h$  without spending a prohibitive cost for sending cue  $\alpha^{max}$ ,  $(\alpha^{max}, 0)$  is preferred to  $(\alpha^*, 0)$  because of the systematic loss the latter induces due to suspicious consumers. A large  $r_h$  is announced.

Conversely,  $(\alpha^*, 0)$  is preferred to  $(\alpha^{max}, 0)$  for a flat curve  $p_h(r_h)$ , a steep curve  $F_a(\cdot)$  and a low  $\delta$ . A low  $r_h$  is announced.

$(\alpha^{max}, 0)$  is preferred to  $(\tilde{\alpha} > \alpha^*, 0)$  and  $(\tilde{\alpha} < \alpha^*, 0)$  if

$$p < \frac{F_a(\tilde{\alpha}) + F(x^*) - F_a(\alpha^{max}) + \delta p_h}{\delta p_h} \quad (15)$$

which is true if  $F_a(\tilde{\alpha}) + F(x^*) - F_a(\alpha^{max})$  is positive, hence for a low  $F_a(\alpha^{max})$ . A large  $r_h$  does not a priori increase the preference for  $(\alpha^{max}, 0)$ .

$(\alpha^*, 0)$  is preferred to  $(\tilde{\alpha} > \alpha^*, 0)$  and  $(\tilde{\alpha} < \alpha^*, 0)$  if

$$p < \frac{F_a(\tilde{\alpha}) + F(x^*) - F_a(\alpha^*)}{\delta p_h} \quad (16)$$

which is more likely for a low  $\delta$  and a low  $p_h$ . Announcing a low  $r_h$  a priori increases the preference for  $(\alpha^*, 0)$ , because cost functions are convex.

Between these two extreme solutions, the firm plays either  $(\tilde{\alpha} > \alpha^*, 0)$  or  $(\tilde{\alpha} < \alpha^*, 0)$  according to its maximization program. The second strategy is less costly, but it also reduces the probability of selling the product. Moreover, the first strategy allows to sell the product for sure if the consumer is gullible, although it induces a waste (the HI has been sent for nothing). All in all, it depends on the cost functions.

A necessary condition for these two strategies to be preferred is to have  $F_a(\tilde{\alpha}) + F(x^*) < F_a(\alpha^{max})$ .

As for the second part of the lemma, we know that the firm will announce a moderate  $r_h$ .

The maximization program is such that announcing a too high  $r_h$  would induce a too costly communication (of both types). Moreover, since she sends HI, the firm necessarily sends her true level  $r_h$ . This forces firms that would choose to send  $(\alpha^{max}, 0)$  to moderate their announced  $r_h$ . Otherwise, a too high  $r_h$  would signal their type.

The third part of the lemma is also trivial. If the CSR-firm prefers  $(\alpha^{max}, 0)$ , then the GW-firm also does. If two products with the same  $r_h$  and  $\alpha^{max}$  are sold, then they both have one chance out of two to be bought. The same is true if the CSR-firm prefers  $(\alpha^*, 0)$ , i.e. they both send  $(\alpha^*, 0)$  and have 1/2 chance to sell the product.

## B Proof of Result 1: the CSR-Firm Sends $\alpha^*$ or $\alpha^{max}$

**Proof.**

### B.1 Suppose First the CSR-Firm Prefers $(\alpha^*, 0)$

Either the GW-firm prefers  $(\alpha^*, 0)$  (i), or  $(\alpha^{max}, 0)$  (ii).  $p_s^{CSR}$  ( $p_s^{GW}$ ) denotes the probability the CSR-firm (GW-firm) will sell her product.

#### B.1.1 The Consumer Is Gullible

If (i), then  $p_s^{CSR} = 0$  and  $p_s^{GW} = 1$  and if (ii)  $p_s^{CSR} = p_s^{GW} = 1/2$

#### B.1.2 The Consumer Is Not Gullible

If (i), then  $1 - p_s^{CSR} = p_s^{GW} = 1$  and if (ii)  $p_s^{CSR} = 0 = p_s^{GW}$

### B.2 The CSR-Firm Prefers $(\alpha^{max}, 0)$

#### B.2.1 The Consumer Is Gullible

If (i), then  $p_s^{CSR} = p_s^{GW} = 1/2$  and if (ii)  $p_s^{CSR} = 1 = 1 - p_s^{GW}$



### B.2.2 The Consumer Is Not Gullible

If (i), then  $p_s^{CSR} = p_s^{GW} = 1/2$  and if (ii)  $p_s^{CSR} = 1 = 1 - p_s^{GW}$

### B.3 The Result

Hence, as for the probability of selling the product,  $(\alpha^{max}, 0)$  strictly dominates  $(\alpha^*, 0)$ . As a consequence, if the cue cost function is not too convex and if the price function is not too concave, the dominant strategy for the CSR-firm is to play  $(\alpha^{max}, 0)$ . The best response to this strategy for the GW-firm is also to play  $(\alpha^{max}, 0)$ . In fine, they both have a probability 1/2 of selling the product. ■

## C Proof of Proposition 1

**Proof.**

### C.1 Situation (i)

The GW-firm has sent  $\tilde{\alpha} = \alpha^*$ . We assume that a gullible consumer always chooses the high-ad product. As a consequence, with  $p_s^i$  for  $i = GW, CSR$  the probability of selling the product, then  $p_s^{CSR} = 1 = 1 - p_s^{GW}$  if she has sent  $\tilde{\alpha} > \alpha^*$  and  $p_s^{CSR} = 0 = 1 - p_s^{GW}$  if she has sent  $\tilde{\alpha} < \alpha^*$ .

### C.2 Situation (ii)

The GW-firm has sent  $\alpha^{max}$ , hence  $p_s^{CSR} = 0$  whatever  $\tilde{\alpha}$ .

### C.3 Situation (iii)

The GW-firm has sent  $(\tilde{\alpha} = \alpha^*, 0)$ . For the sake of simplicity, we assume that both products have the same announced  $r_h$ . Another way to put it is to say that for any level  $r_h$  a CSR-firm may announce, there exists a GW-firm that has announced the same level.

It should be noted that it is not in the interest of the GW-firm to try to mimic the cue communication strategy of the CSR-firm. If the consumer is gullible, the probability that he will buy the product, according to our assumption, depends on the two cues sent by both firms. The GW-firm has no clue about the real level of  $\tilde{\alpha}$ . Intuitively, the GW-firm could even send  $\alpha^{max}$ , but it would be a waste given her prior about the type of consumer she is facing. Moreover, the price would not change and the GW-firm is not able to determine whether the CSR-firm has sent  $\alpha^{max}$  or less.<sup>43</sup> Hence she will not be compensated for the large increase in the communication cost, so she sticks to her first-best strategy. If the consumer is not gullible, then sending less than  $\alpha^{max}$  makes no sense since the consumer would, by assumption, look for HI, so the GW-firm would have no chance to sell her product. As a consequence, if the GW-firm thinks the consumer is not gullible, she has no interest in mimicking the CSR-firm. If she thinks the consumer is gullible, the same argument as above holds since in such a case she is certain that she will not sell her product if in the end the consumer is not gullible.

We now turn to the two subcases.

### C.3.1 The No-GW Firm Has Sent ( $\tilde{\alpha} > \alpha^*, x^*$ )

The suspicious consumer has to choose whether to look at the product with a low cue or the one with a high cue. He knows that both products, if they contain CSR, offer the same level  $r_h$ . Given the convex shape of  $C(y)$  and the fact that a higher  $\alpha$  leads him to make a greater effort to assimilate the HI, the increased cost implied is not compensated by the increased probability of assimilating the HI, and then he chooses to look for HI for the product with the lowest cue. Consequently,  $p_s^{CSR} = p_s^{GW} = 0$ .

### C.3.2 The No-GW Firm Has Sent ( $\tilde{\alpha} < \alpha^*, x^*$ )

The consumer turns to the product with the lowest cue and so  $p_s^{CSR} = p$  and  $p_s^{GW} = 0$ .

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<sup>43</sup>Since the GW-firm does not know the cost structure of the CSR-firm, she cannot infer from a relatively low announced  $r_h$  that the strategy of the CSR-firm is to send  $(\tilde{\alpha}, x^*)$ .

## C.4 Situation (iv)

### C.4.1 The No-GW Firm Has Sent ( $\tilde{\alpha} > \alpha^*, x^*$ )

In this case, the suspicious consumer chooses the product with the signal  $\alpha^{max}$  as it is less costly (he has no effort to make). Thus, we have  $p_s^{CSR} = 0$  and  $p_s^{GW} = 1$ .

### C.4.2 The No-GW Firm Has Sent ( $\tilde{\alpha} < \alpha^*, x^*$ )

As above, the  $\alpha^{max}$ -product implies a smaller effort for the consumer. However, a new effect is at play : he also knows that the other product, if he was to decide to seek HI concerning it, is for sure a CSR-product. Hence, contrary to the previous situation, the suspicious consumer has additional information. He chooses to consider the  $\tilde{\alpha}$ -product. Indeed, the consumer has no idea about the number of GW-firms and No-GW firms on the market, but he surely knows that there is one No-GW firm.<sup>44</sup> Hence,  $p_s^{CSR} = p$  and  $p_s^{GW} = 0$ .

## C.5 The Result

Lemma 1 states that  $(\alpha^{max}, 0)$  may be a dominant strategy if  $F_a(\cdot)$  is not too convex and if  $p_h(\cdot)$  is not too concave.

If this is not the case, there is no dominant strategy for the CSR-firm when taking into account the possible strategies of the GW-firm. As a consequence, she plays her first-best strategy  $(\tilde{\alpha}, x^*)$  where  $\tilde{\alpha}$  could either be superior or inferior to  $\alpha^*$ . Considering that  $C(\cdot)$  is such that C prefers seeking HI for the low-ad product does not change anything to this result.

As for the GW-firm,  $(\alpha^{max}, 0)$  weakly dominates  $(\alpha^*, 0)$  when looking at the probability of selling the GW-product. However, since  $(\alpha^{max}, 0)$  is a more costly strategy, it is not true that the GW-firm is indifferent to having  $p_s^{GW} = 1$  which results from sending  $\alpha^{max}$  or  $\alpha^x$ . Thus, the GW-firm also plays its first-best strategy. ■

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<sup>44</sup>That is, he is not able to determine a probability that the  $\alpha^{max}$ -product hides a GW-firm.

## D Proof of Proposition 2

First of all, we know that if  $r_h$  decreases, this decreases  $\tilde{\alpha}$  and  $x^*$ . However, it decreases or increases  $\alpha^*$ . From the proof of lemma 1, we know that although one adds a negative term to the numerator of the RHS in the inequalities of the proof, there are no reasons to believe that the  $(\tilde{\alpha} > \alpha^*, x^*)$  or  $(\tilde{\alpha} < \alpha^*, x^*)$  strategy is never preferred.

If a firm prefers  $(\tilde{\alpha} > \alpha^*, x^*)$  but knows that this strategy is too risky, she may either change to  $(\tilde{\alpha} < \alpha^*, x^*)$ , to  $(\alpha^{max}, 0)$  or to  $(\alpha^*, 0)$ . This implies that the following inequalities were true:

$$p > \frac{F_a(\tilde{\alpha}) + F(x^*) - F_a(\alpha^{max}) + \delta p_h + F_{CSR}(r_h)}{\delta p_h} \quad (17)$$

$$p > \frac{F_a(\tilde{\alpha}) + F(x^*) - F_a(\alpha^*) + F_{CSR}(r_h)}{\delta p_h} \quad (18)$$

And the maximization program was such that  $\tilde{\alpha} > \alpha^*$ .

We know that a firm that would otherwise choose  $(\tilde{\alpha} > \alpha^*, x^*)$  will decrease the  $r_h$  to reach  $\tilde{\alpha} < \alpha^*$ . If the standard maximization program of  $U_f$  with respect to  $r_h$  yields an equilibrium solution  $(\tilde{\alpha} > \alpha^*, x^*)$ , then the same maximization program under the constraint  $\tilde{\alpha} < \alpha^*$  will result in a lower  $r_h^*$  since the constraint is binding.

We now need to know to what proportion the new equilibrium  $\tilde{\alpha}$  is lower. This depends on the relative speeds of increase of  $\alpha^*$  and of decrease of  $\tilde{\alpha}$ . If the speed of increase of the former is larger than the speed of decrease of the latter, then we will have a higher  $\tilde{\alpha}$ , and the opposite otherwise.

The speed of increase of  $\alpha^*$  is its derivative with respect to  $r_h$ . We do not have the derivative of  $\tilde{\alpha}$  with respect to  $r_h$ . However, we know that it is more likely to decrease quickly when  $\partial p_h / \partial r_h$  is large and when  $\partial y' / \partial \alpha$  is small (otherwise the crowding effect of the cue on the expected HI effort by the consumer would temperate the incentive of the firm to decrease the cue).

If  $\partial \alpha^* / \partial r_h < 0$  which implies that  $\partial p_h / \partial r_h * r_h < p_h$ , reducing  $r_h$  will allow to reach a new equilibrium such that the new  $\tilde{\alpha}$  is close to the previous one and with an  $\alpha^*$  now higher than

previously. On the contrary, if  $\partial\alpha^*/\partial r_h > 0$ , then both  $\tilde{\alpha}$  and  $\alpha^*$  decrease and  $\tilde{\alpha}$  is much lower than previously.

A consequence of the decrease in  $r_h$  is the reduction of the CSR cost and of the cue cost. Although the overall resulting equilibrium is not a first-best anymore, these cost decreases may allow the firm to spend more on HI communication. More specifically, in the case of a large decrease in  $\tilde{\alpha}$ , as the firm knows that this will result in a smaller effort by the consumer, she has an incentive to raise  $x^*$  compared to the first-best equilibrium.

The new maximization program implies adding the term  $-\lambda \left( \frac{\partial\tilde{\alpha}}{\partial r_h} - \frac{\partial\alpha^*}{\partial r_h} \right)$  where  $\lambda > 0$  is the Lagrange multiplier. Depending on the sign of the difference of the derivatives, this will reduce or decrease the negative effect in the maximization program.  $\frac{\partial\tilde{\alpha}}{\partial r_h} > 0$ , the sign of the other term may either be positive or negative. If  $\partial p_h/\partial r_h * r_h < p_h$ , then  $\frac{\partial\alpha^*}{\partial r_h} < 0$ , so  $\frac{\partial\tilde{\alpha}}{\partial r_h} - \frac{\partial\alpha^*}{\partial r_h} > 0$ . This means that the negative effect is greater in the maximization program, everything else being equal. Thus, we might expect a decrease in  $x^*$  concomitant to the decrease in  $r_h$ .

If  $\partial p_h/\partial r_h * r_h > p_h$ , then  $\frac{\partial\alpha^*}{\partial r_h} > 0$ . Around intermediate values of  $r_h$ , this might well be the case (for more extreme values, either  $r_h$  or  $\partial p_h/\partial r_h$  is close to zero). Hence we may have a reduced negative effect in the maximization program and hence an increase in  $x^*$ .

To conclude, if  $\frac{\partial\alpha^*}{\partial r_h} < 0$ , then  $\tilde{\alpha}$  is not much decreasing, especially if  $\partial y'/\partial\alpha$  is large and if  $\partial p_h/\partial r_h$  is small. Moreover,  $x^*$  is very likely to also decrease in this situation. However, the decrease in  $r_h$  is moderate.

To the contrary,  $\frac{\partial\alpha^*}{\partial r_h} > 0$  which is coherent with the fact that  $\frac{\partial\alpha^*}{\partial r_h} > 0$ , hence  $\partial p_h/\partial r_h$  rather large, then  $\tilde{\alpha}$  decreases sharply and  $x^*$  may increase if  $\partial y'/\partial\alpha$  is small. But the decrease in  $r_h$  is rather important.

## E Proof of Proposition 3

**Proof.** We start with the following lemma that states that under *No-Cue*, an increase of  $r_H$  has two opposed effects but that the overall effect is positive:

**Lemma 2** *An increase of  $r_H$  decreases  $\alpha$  and increases directly  $R'(y)$ , the overall effect is equal to*

$$\frac{\partial R'}{\partial r_H} = x^* \left( \frac{r_L}{r_H - r_L} \right)^2 > 0 \quad (19)$$

and

$$\frac{\partial^2 R'}{\partial^2 r_H} = x^* \left( \frac{-2r_L}{(r_H - r_L)^2} \right) \left( \frac{r_L}{r_H - r_L} \right) < 0 \quad (20)$$

so the positive effect is decreasing in  $r_H$ .

Then, let us consider first what happens if a firm announces  $\bar{r}_H$  when no cue can be sent. In this case, she spends a cost  $F_{CSR}(\bar{r}_H)$ . In parallel, an increase in  $r_H$  increases the consumer's communication effort and an increase in  $F_{CSR}(\bar{r}_H)$  reduces the communication effort by the firm.

Now, let us consider a firm that announces  $\bar{r}_H < \bar{r}_H$ . As seen above, the cost in investing in CSR is lower, so the effort the firm will make will be greater for hard information. She will however send a cue. A lower  $r_H$  means a higher  $\alpha^*$ . The effect on the consumer's effort when switching from  $\bar{r}_H$  to  $\bar{r}_H$  generates a positive but small effect based on the lemma above.

As a consequence, the firm that can use a cue saves  $F_{CSR}(\bar{r}_H) - F_{CSR}(\bar{r}_H)$ . She spends  $F_a(\bar{\alpha})$  more. The effect on both efforts is ambiguous. Switching from  $\bar{r}_H$  to  $\bar{r}_H$  implies that the effort by the firm is greater because of a greater reward and that the consumer's effort is smaller because of a smaller reward. Then, the difference between the two probabilities ultimately depends on the elasticity of investing in CSR. The higher it is, the higher the probability under  $\bar{r}_H$ .

Therefore, if the cost of sending a cue is not too high, the firm choosing  $\bar{r}_H$  may achieve the same utility under cue as a firm choosing  $\bar{r}_H$  under *No-Cue*. However, she makes an effort in hard information communication. ■

## F Probit Estimates of Hard Information

Table 6: Probit Estimates of Hard Information (Externally Assured) with Number of Reports

Dependent variable	Crcheck	Crcheck	Crcheck	Crcheck
CSR	2.581*** (4.320)	2.887*** (4.746)	2.357** (2.061)	2.502 (1.629)
Number of reports	0.136*** (2.759)	0.111** (2.261)	0.968*** (3.874)	0.958 (1.607)
Number of reports x CSR	-0.122 (-1.491)	-0.138* (-1.720)	-1.076*** (-3.297)	-1.062* (-1.763)
Assets (in log)	0.0745* (1.699)	0.301*** (3.800)	0.0960 (1.388)	0.150 (0.743)
Age (in log)	-0.0371 (-0.373)	-0.0534 (-0.509)	-0.0822 (-0.516)	-0.0909 (-0.526)
Constant	-3.186*** (-3.790)	-7.194*** (-5.183)	-4.613*** (-3.097)	-6.038** (-2.035)
Country-specific fixed effects	YES	YES	YES	YES
Sector fixed effects	NO	YES	NO	YES
Instrumental Variables	NO	NO	YES	YES
Observations	498	488	492	483
Pseudo R <sup>2</sup>	0.31	0.25		

Robust z-statistics in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Probit estimates with endogenous regressors use Newey's minimum chi-squared estimator

Table 7: Probit Estimates of Hard Information (Externally Assured) With Number of Reports Per Year

Dependent variable	Crcheck	Crcheck	Crcheck	Crcheck
CSR	3.931*** (5.027)	3.716*** (5.293)	0.800 (0.340)	-1.864 (-0.182)
Number of Reports (per year)	1.410*** (3.588)	1.185*** (3.244)	5.767*** (3.081)	8.551 (0.860)
Number of Reports (per year) x CSR	-1.944*** (-2.787)	-1.745*** (-2.944)	-4.466* (-1.684)	-5.543 (-1.096)
Assets (in log)	0.0849* (1.911)	0.308*** (4.072)	0.0456 (0.471)	-0.0541 (-0.0839)
Age (in log)	-0.0456 (-0.454)	-0.0717 (-0.696)	-0.0296 (-0.137)	-0.127 (-0.354)
Constant	-3.939*** (-4.389)	-7.778*** (-5.872)	-4.190** (-2.083)	-3.723 (-0.430)
Country-specific fixed effects	YES	YES	YES	YES
Sector fixed effects	NO	YES	NO	YES
Instrumental Variables	NO	NO	YES	YES
Observations	498	488	492	483
Pseudo R <sup>2</sup>	0.26	0.32		

Robust z-statistics in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Probit estimates with endogenous regressors use Newey's minimum chi-squared estimator



## G OLS Estimates of Soft Information

Table 8: OLS Estimates of Soft Information (Reports and Reports Per Year)

Dep. Variable	Number of reports	Number of Reports	Reports per year	Reports per year
CSR	10.65*** (9.360)	10.02*** (8.695)	1.370*** (7.381)	1.379*** (6.797)
CRcheck	1.392*** (2.926)	1.047** (2.181)	0.113 (1.563)	0.0854 (1.155)
Assets (in log)	-0.392*** (-3.079)	0.0793 (0.341)	-0.0245 (-1.413)	0.0321 (0.912)
Age (in log)	0.0123 (0.0506)	0.0811 (0.338)	-0.0291 (-0.655)	-0.00732 (-0.141)
Op. Rev. (in log)	1.160*** (7.149)	0.789*** (3.360)	0.110*** (3.611)	0.0497 (1.246)
Constant	-8.790*** (-4.128)	-20.80*** (-5.445)	-0.987*** (-2.731)	-1.814*** (-2.978)
Observations		493	491	493
R-squared	0.452	0.487	0.248	0.270
Country-specific fixed effects	YES	YES	YES	YES
Sector fixed effects	NO	YES	NO	YES

Robust t-statistics in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## H Component Plus Residual Plot of CSR and Soft Information

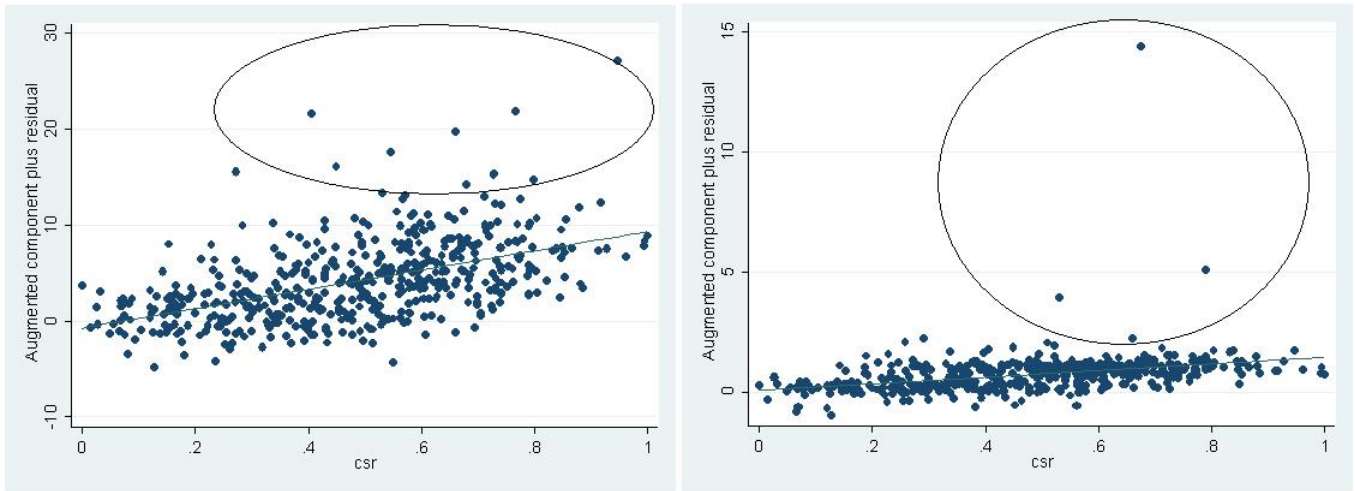


Figure 4: Component Plus Residual Plot of CSR and Soft Information  
 (1) Number of Reports and (2) Reports Per Year

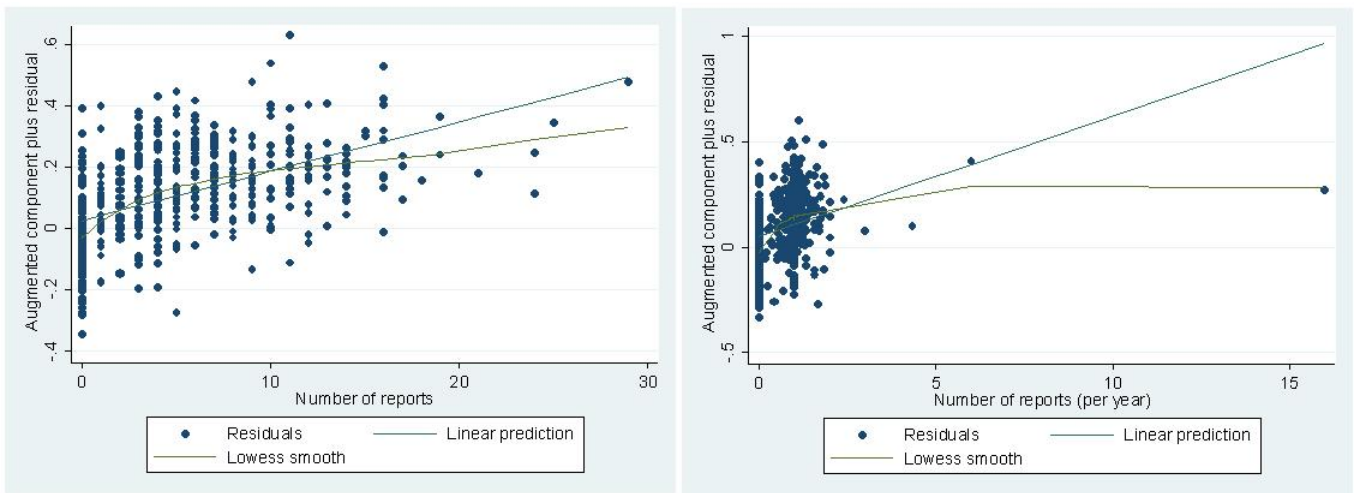


Figure 5: Component Plus Residual Plot of Soft Information and CSR  
 (1) Number of Reports and (2) Reports Per Year