

# Incidence of the Naming and Shaming Strategies of an NGO on the Signaling Strategy of a Firm

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## Abstract

This paper investigates the signaling interactions of a firm and a Green Non-Governmental Organization (G.NGO) in a market vertically differentiated. The interplay between two sources of signal, the *hard evidence* displayed by the NGO and the price set by the Monopoly, yield fruitful results concerning the path of the transmission of information on environmental quality. More precisely providing a "good news" that a firm is environmentally friendly or a "bad news" that the firm is a polluter operate on radically different channels. As a result, a surprising result is that the imperfect label (naming) never restores complete credibility while the imperfect monitoring (shaming) can. The presence of an NGO with an imperfect monitoring technique is sufficient to reduce the signaling cost and can even restore the full information prices. Nevertheless, when the market reveals information, the NGO, without heterogeneous cost, is indifferent between adopting a naming or a shaming strategy. The major point is when the market conceals information, the optimal informative strategy matches to the stage of the development of clean production technologies.

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## 1 Introduction

Green Non-Governmental Organizations (G.NGO s) play an essential role in shaping our perception. Gathering civil society, they aim to prevent harmful projects and practices. NGO s' rising influence is one of the most significant changes in business over the past four decades (Daubanes, Rochet, et al., 2019). Heyes, Lyon, and Martin (2018) present the management of salience of pollution as a key battleground between polluters and the G.NGO with which they interact, something both sides seek strategically to influence. Nowadays, the NGOs coordinate at an international level which increases their signaling power. Two directions can be taken by the NGO to influence the firm's image. Either by adopting a good cop strategy, such as the World Wide Fund (W.W.F), by working hand in hand with industry to design environmentally friendly products with the use of eco-labels. Alternatively, the NGO can behave like a bad cop, like Greenpeace, through strikes, investigations, or public revelation (Lyon, 2012).



(a) Bad Cop: Greenpeace action



(b) Good Cop: W.W.F label

Figure 1: Shaming & Naming

The exposure of events highlighting errors made in labeling or monitoring chal-

lenges the effectiveness of the informational role of G.NGO. The Figure 1 above shows a Greenpeace campaign against tuna fishing against some brands like Saupiquet, which obtained the Marine Stewardship Council (M.S.C) label where W.W.F is a stakeholder. It is well-known that on the case of M.S.C Greenpeace and the Pew Environment Group were increasingly raising doubts about the sustainability promoted by the label. [Jacquet et al. \(2010\)](#) stated that the incentives of the market had led the M.S.C. certification scheme away from its original goal. Concerning imperfect monitoring, Greenpeace admitted having overestimated the impact of sinking drilling platform when engaging a campaign against Shell.<sup>1</sup>

Nevertheless it appears that firms are often much more sensitive - and therefore reactive - than governments to image and reputation issues which constitute a high share of their wealthiness.<sup>2</sup> They are well aware of the issues at stake concerning naming or shaming campaigns and strategically interact with them.

In this paper, our theory explains the presence and intervention of G.NGO activists concerning its informational role in green markets. Our framework proposes a possibility of influencing the perception by providing *hard evidences* in a price signaling model. These pieces of evidence can be of two types: a proof that the firm is environmentally friendly (naming) or a proof that the firm is a polluter (shaming). Naming and shaming operate on radically different channels. One supports the profit of the virtuous firm and the other sanctions the black sheep. It directly extends a standard price signaling model by adding a Third-Party which endogenously provides *hard evidences* to characterize interplays between two information providers firms and G.NGO

Our main results are as follows first the presence of an NGO reduces the cost of signaling for the green producer. Moreover when sufficiently efficient to provide hard evidences, imperfect monitoring is enough to restore the perfect information result.

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<sup>1</sup><https://www.latimes.com/archives/la-xpm-1995-09-06-fi-42780-story.html>

<sup>2</sup>Le Monde 06/05/2019: [https://www.lemonde.fr/economie/article/2019/05/06/les-grands-groupes-cibles-des-ong\\_5458611\\_3234.html](https://www.lemonde.fr/economie/article/2019/05/06/les-grands-groupes-cibles-des-ong_5458611_3234.html)

Very surprisingly the imperfect label cannot bring back complete credibility and can even make separating equilibria disappear. When the market reveals the information, the NGO is indifferent between naming and shaming as a result the informative behavior in such case would definitely been explained by the heterogeneous cost of discovering a specific hard evidence. When the market conceals information, the NGO tends to match its informative role to the distribution of the market. For instance one expects the NGO to use shaming in industries where the initiatives to use clean production processes are limited.

*Related literature.* The collective perception of trust towards NGO is fundamental to study information production. Trust is a predictor of whether stakeholders will find the organization credible and will take into account its information. [Edelman \(2018\)](#) dedicated an entire survey to cover the question of trust towards organizations. Their report entitled "A Battle of Trust" shows that the trust towards NGO has many country-specific effects, but is still the most trusted organization for informed public and general population. In the context of asymmetry of information in green markets, gatekeepers of the credibility are sometimes explicitly asked to defend a specific cause. Markets incentives or social welfare maximization are not expected to be internalized in such a context. The idea of this paper is affiliated with the literature of information creation. The most well-known paper in this domain is [Dewatripont and Tirole \(1999\)](#). They show that the use of biased agents creates a different pattern of manipulation of information. The authors also underline the importance of the separation of investigation and adjudication. That is information collectors may have some influence on decision making beyond the information impact. [Lizzeri \(1999\)](#) underlines that market structure strongly influence the intermediary to disclose information. In his paper, different disclosure rules lead to varying profits for the intermediary. A monopoly intermediary that certifies a privately informed seller has an incentive to disclose the minimum information needed to induce the trade.

This article considers the informational activity of a green NGO. On this question literature almost only studies the role of green NGO on green markets as an organization inducing perfectly the level of the environmental stringency of the standard. [Baron \(2011\)](#) underlines the necessity of the participation of such organization to market the credence good. [Fischer and Lyon \(2014\)](#) explore the effect of the competition between stakeholders of different nature, NGO and industry, on the level of stringency of a label. [Heyes and Martin \(2016\)](#) identify several other features that explain the level of the standard chosen by NGO and also the over-proliferation of different labels provided on the market. [Bottega and De Freitas \(2009\)](#) extend the possibility for the NGO to use not only the certification but also the green advertisement. They analyze the impacts of the NGO on the level of average environmental quality on the market and the optimal environmental regulation by comparing the level of quality provided by the eco-label chosen by the NGO and the minimum quality standard (MQS) set by the regulator. [Mason \(2011\)](#) relaxes the hypothesis of a perfect eco-labeling scheme, and uses a signaling game to show multiple effects on welfare. The informational effects reduce the net surplus and he concludes that the introduction of an eco-label can either increase or decrease welfare. [Mahenc \(2017\)](#) raises the question of the incentives for a label organization to report the truth on the environmental quality of the good when the stakeholder responsible of the certification is over-weighting the profit associated to the green industry. From a consumer point of view [Civel, Cruz, et al. \(2018\)](#) provide a complete overview on the question the assumption of the perfect information transmission of the label. They find in the case of energy label that the Energy Performance Certificates is not perceived as perfectly informative. Moreover they state that subjects more probably infer the signal into their prior beliefs on energy quality, suggesting that reading can be considered as bayesian.

There are two articles which are closely related to the present paper. The first is [Feddersen and Gilligan \(2001\)](#) where they investigate the impact of an information-

supplying activist on the market for credence good. The activist by monitoring can send a signal about the type (good or bad) of the product to the representative consumer. The existence of the activist on the market positively affects the quality choices of firms by giving them an incentive to adopt the desirable costly operating practice and the credibility of the good product perceived by the consumer. First, in this paper, the activist minimizes the aggregate social costs of trade: the pollution. The assumption of markets incentives seems credible as long as the activist is taken as an eco-label provider and still, the knowledge of the social cost of a market is questionable. Second, in this paper, the firms are not strategics concerning the signal received by customers and omit important literature on this issue (Milgrom & Roberts, 1986; Bagwell & Riordan, 1991; Mahenc, 2007; Daughety & Reinganum, 2008). The second is Fleckinger, Glachant, and Moineville (2017) which focus their research on the effect of the informational environment on the level of the quality chosen by firms. This environment can be friendly when announcing good news or hostile when announcing bad news to consumers. This dissociation permits to underline which strategy is the most efficient to increase incentives for firms to choose the good quality given the market structure.

The rest of the paper is organized as follows. Section II presents illustrations of the theoretical issues tackled in this paper. Section III introduces a price signaling model with NGO influence. Section IV analyzes the informative behavior of an NGO. Section V concludes.

## 2 Illustrations

In 2014 the International Council of Clean Transportation conducted a study that revealed excessive emissions volume in several models of Volkswagen car sold in the United States. They alerted the Environmental Protection Agency (EPA) which ac-

cused in September 2015 Volkswagen of installing illegal manipulation devices. In October Volkswagen sales slipped globally. In November the company admitted that they cheated not only on NOx but also on CO2 emissions.<sup>3</sup> Afterwards this revelation had also consequences on the European Public Policy towards diesel.<sup>4</sup> Moreover the communication strategy of the firm following these events were deeply oriented toward the reconquest of consumers confidence.<sup>5</sup> Figure 2 shows the revenue of the I.C.C.T which monitored products which were supposed to pass environmental norms. The idea by taking a look at the budget of I.C.C.T. is to materialize the possibility of a participation of firms to the financial constraints of an NGO

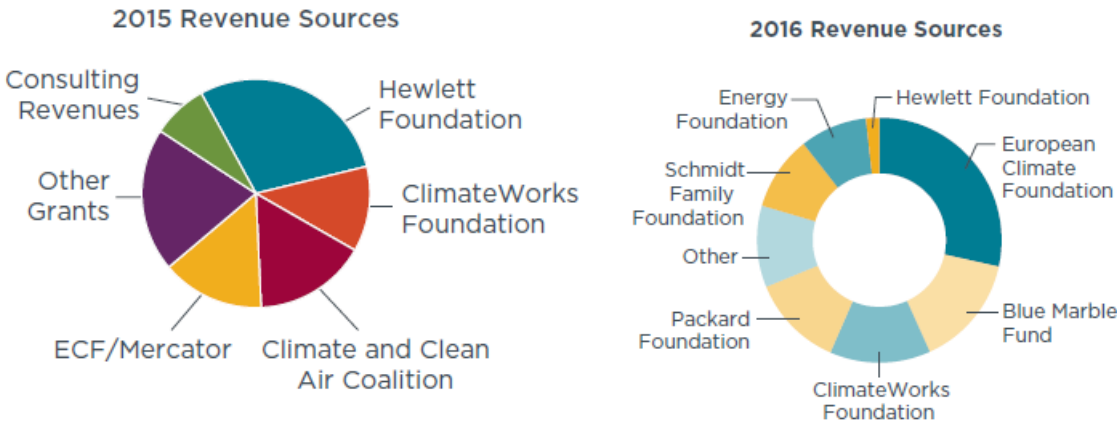


Figure 2: Revenue Sources of the International Council on Clean of Transportation (I.C.C.T.)

To quote a few Hewlett Foundation which represents approximately 40% of the revenue of the NGO in 2015 had been established by William R. Hewlett and his Wife Lamson Hewlett, creator of the multinational Hewlett-Packard (H.P).<sup>6</sup> E.C.F Mercator has been created by the family Schmidt-Ruthenbeck, owner of METRO A.G., in

<sup>3</sup><https://www.cleanenergywire.org/factsheets/dieselgate-timeline-germanys-car-emissions-fraud-scandal>  
<sup>4</sup><https://www.theguardian.com/business/2015/nov/27/vw-labour-boss-says-fresh-emissions-crisis-has-hit-orders-for-new-cars>  
<sup>5</sup>Advertising Campaign 2018: "We can doubt about everything, but not about our Volkswagen"  
<sup>6</sup><https://hewlett.org/about-us/>

1996. Note that both of these firms continuously engage in green campaigns associated with recycling, water, emissions... The point is to underline how firms took over the informative role of NGOs.

The story of the Volkswagen Emission Scandal illustrates different aspects of the interactions among consumers, green NGO, and firms. First, it is a case of monitoring where an NGO displayed a *hard evidence* revealing a failure in ecological norms. Second, it highlights how firms have understood the stakes information production. Here, they participate to the financial constraint of the NGO to facilitate their influence on the transmission of the environmental quality.

To emphasize imperfection of the labelling activity, which is often considered as perfect through economic studies, we have a similar story concerning the environmental label Forest Stewardship Council (F.S.C) launched in 1993. In 2014 Greenpeace released a report that accused F.S.C-certified logging companies of harvesting “areas that are either slated for legal protection or supposed to be protected as a part of F.S.C requirements.”<sup>7</sup> Simon Counsell, executive director of Foundation UK and an early proponent of the forest certification idea, argues that the opposite is true. His frustration with F.S.C led him to co-found the website FSC-Watch.com. He underlines that certifying agencies often display a lack of expertise on visits to logging operations, and this point is crucial to underscore the monitoring role of some green NGO, it might also rise skepticism among consumers against eco-label. It might give pause to the entire wood products industry, which has profited up to now by turning a blind eye to that illegality.

There exist many other examples with similar structure, and they are becoming ever more numerous because of the global mood to turn into a greener society. The question is how such cases may affect the path of information on environmental quality

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<sup>7</sup><https://e360.yale.edu/features/greenwashed-timber-how-sustainable-forest-certification-has-failed>



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### 3 The model

BigA, a monopoly that grows apples, is either *green* with probability  $\phi$  or *brown* with probability  $1 - \phi$ . A brown BigA grows apple at a constant marginal cost  $\mu_b > 0$ ; a green BigA does so at a higher cost  $\mu_g > \mu_b$  but in an environmental-friendly way (the subscript  $b$  and  $g$  shall be used throughout to distinguish the brown monopoly from the green monopoly). In either case, BigA sets a price  $p$  for a profit  $(p - \mu)q$  where  $q$  is the quantity demanded at that price.

PublicEye is a NGO who pursues either a *Naming* or a *Shaming* strategy. Both involve discovering hard information about BigA's type but they represent very different activities that perform differently contingently on BigA's type. With the Naming strategy, PublicEye attempts to certify BigA's green pedigree. For instance, she could demonstrate that the technology used by BigA is actually better for the environment than a more commonly used one. With the Shaming strategy, PublicEye assumes that BigA produces brown apples despite what the latter may claim. She could try to expose, for instance, an unreported use of pesticides. Although both strategy involve finding BigA's type, they are likely to perform differently for it is one thing no to find a black swan and quite another to establish that there is no such thing as a black swan.

With the Naming strategy, there is a probability  $\gamma$  that PublicEye will succeed to establish BigA's type. With the Shaming strategy, there is a probability  $\beta$  that BigA's true brown type will be exposed. Accordingly PublicEye fails to provide new hard information to the consumer with probability  $1 - \gamma$  if BigA is green and with probability  $1 - \beta$  if he is brown. Allowing for a mixed strategy, we denote  $s$  the probability that PublicEye chooses the Naming strategy.

Finally, there is a consumer who buys apples from BigA but whose marginal utility

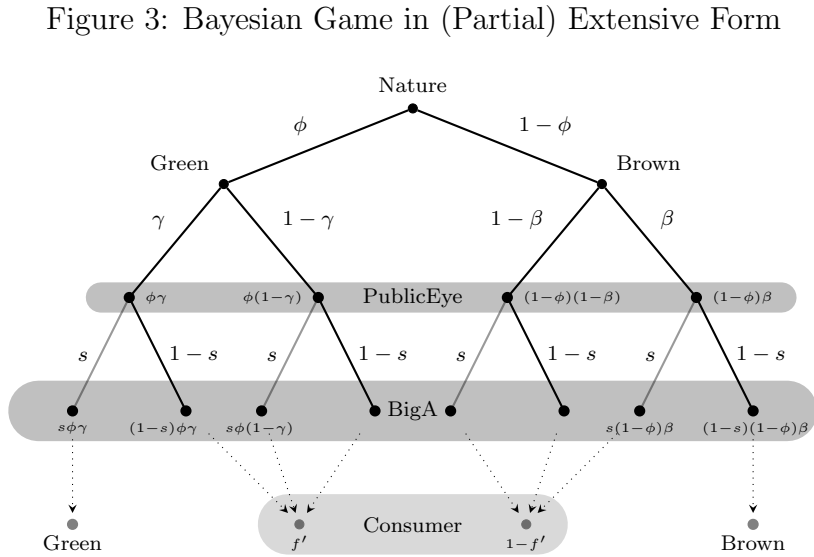
of apples depends on the latter type. Leaving the consumer aside, BigA and PublicEye play a Bayesian game (see figure 3 below) where Nature chooses first BigA's type and whether any enquiry by PublicEye will be successful. Then PublicEye chooses between Naming (the lighter edge) or Shaming while not being aware of BigA's type and BigA simultaneously chooses his price (not shown in the figure) without knowing if he is targeted by PublicEye.

Once PublicEye's enquiry is completed, the consumer knows BigA's price and ends up into one of three information states:

1. With probability  $i = s\phi\gamma$ , she knows that BigA is green (leftmost node).
2. With probability  $j = (1 - s)(1 - \phi)\beta$ , she knows that BigA is brown (rightmost node).
3. With complementary probability  $1 - i - j$ , she believes that BigA is green with probability

$$f' = \phi \frac{1 - s\gamma}{1 - i - j} \tag{1}$$

prior to factoring in the signal eventually provided by BigA's price.



The consumer is risk neutral and buys a quantity  $q \in [0, \theta - 1]$  of apples, where  $\theta - 1 > 0$  is a satiety point. She values the consumption of a quantity  $q$  of brown apples (that is, produced by a brown BigA) at  $\ln(1 + q)$  and that of green apples at  $\nu \ln(1 + q)$  where  $\nu \geq 1$ . We assume that  $\mu < 1$  and that

$$\frac{1}{\theta^2} < \frac{\mu}{\nu} \quad (2)$$

for both  $\mu = \mu_g$  and  $\mu = \mu_b$ . These regularity conditions on marginal costs *vs* marginal benefit ensure interior solutions for both BigA types' programs below.

Let  $f$  denotes the consumer's belief and  $\nu_f = f\nu + 1 - f$  so that her expected utility of buying and consuming  $q$  apples at price  $p$  is  $\nu_f \ln(1 + q) - pq$ . Her demand becomes

$$d(p, f) = \begin{cases} \theta - 1 & \text{if } p \leq \nu_f/\theta \\ \frac{\nu_f}{p} - 1 & \text{if } \nu_f/\theta < p \leq \nu_f \\ 0 & \text{if } \nu_f < p \end{cases}$$

BigA's profits at price  $p$  amount to  $(p - \mu)d(p, f)$  which is concave in  $p$ . As the price is raised from zero to  $\nu_f/\theta$ , profits first rise. Marginal profit over  $[\nu_f/\theta, \nu_f]$  amounts to

$$\frac{\nu_f \mu}{p^2} - 1$$

It decreases as price is further increased; yet, because of condition (2), it is positive at  $p = \nu_f/\theta$ . Increasing it further, we reach a global maximum at  $\sqrt{\mu\nu_f}$  where it is zero. Profits there amount to

$$\pi(\mu, f) = (\sqrt{\nu_f} - \sqrt{\mu})^2$$

They are strictly increasing in  $\nu_f$  and strictly decreasing in  $\mu$ .

PublicEye's objective is to maximize the utility of the consumer. All greek letters denote parameters; all the other variables are endogenous. We look for a Bayesian-Nash equilibrium of this game.

## Perfect Information

If either  $\gamma = 1$  or  $\beta = 1$ , then PublicEye has the costless opportunity to turn this game of incomplete information into one of perfect information. It suffices that it plays a pure strategy (in equilibrium) for then the absence of hard information nevertheless perfectly informs the consumer. For instance, suppose that PublicEye plays the Naming strategy. Then, whenever BigA is green, the consumer would learn it and she would correctly infer that BigA is brown should no hard information comes about.

Anticipating a fully informed consumer, BigA sets his price accordingly: if he is green, he sets  $p_g^* = \sqrt{\nu\mu_g}$  and realize profits  $\pi(\mu_g, 1)$  and if he is brown, he sets  $p_b^* = \sqrt{\mu_b}$  and realize  $\pi(\mu_b, 0)$ ; so  $\nu > 1$  and  $\mu_g > \mu_b$  imply that  $p_g^* > p_b^*$ . If we assume in addition that

$$\sqrt{\nu} - 1 > \sqrt{\mu_g} - \sqrt{\mu_b}$$

then a green BigA makes more profits than a brown one under perfect information.

## No Hard Information

If  $\gamma = \beta = 0$ , then PublicEye is powerless and we get a familiar signaling game where the consumer may only gather soft information inferred from BigA's chosen price. Endow the consumer with a (conditional) belief function that maps any observed price into a belief  $f$  that BigA is green. In a Perfect Bayesian Equilibrium, such function should satisfy Bayes's rule given both BigA's types equilibrium strategies and the latter should maximize profits given the beliefs and the other type's pricing strategy.

**Separating Equilibrium.** Consider first a separating equilibrium where a green BigA plays a separating price  $p_g$  and a brown one plays his first best price  $p_b^* \neq p_g$ . Set the beliefs to be one (assurance that BigA is green) if  $p = p_g$  and zero otherwise (BigA is brown). Then both BigA's types expect a demand  $d(p, 1)$  if  $p = p_g$  and  $d(p, 0)$  otherwise. Playing his first best price remains optimal for the brown type as long as as he would not gain by mimicking the green type's pricing strategy:

$$\pi(\mu_b, 0) \geq (p_g - \mu_b)d(p_g, 1) \quad (\text{IC}_b)$$

and signaling one's type is a good strategy for a green BigA if

$$(p_g - \mu_g)d(p_g, 1) \geq \pi(\mu_g, 0) \quad (\text{IC}_g)$$

A signaling price must satisfy these two inequalities: we look for an interval of signaling prices  $[p_0, p_1]$ . Define

$$h(p, \mu) = (p - \mu)d(p, 1) - \pi(\mu, 0)$$

so that  $(\text{IC}_b)$  and  $(\text{IC}_g)$  simply read  $h(p, \mu_b) \leq 0$  and  $h(p, \mu_g) \geq 0$ . We have already shown that  $(p - \mu)d(p, 1)$  is strictly concave in price and reaches a maximum in  $p = \sqrt{\mu v}$  so that  $h$  is strictly concave as well and reaches

$$(\sqrt{v} - \sqrt{\mu})^2 - (1 - \sqrt{\mu})^2 > 0$$

at its maximum — notably,  $h(p, \mu_g)$  reaches its maximum in  $p_g^*$ .

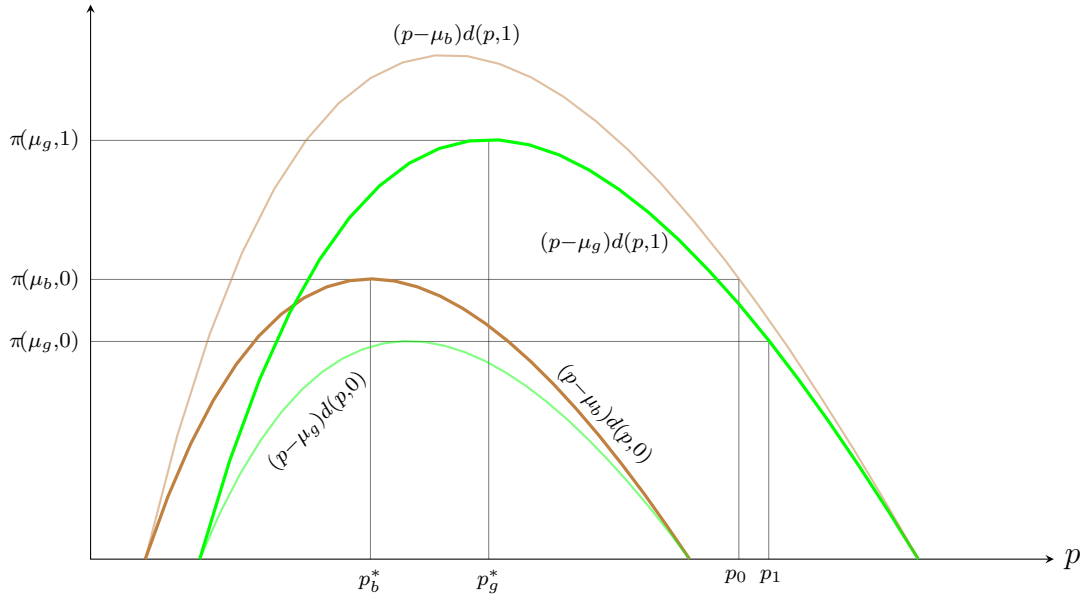
Beside,  $h$  is negative if the price is null or so large so that the demand vanishes. Given  $\mu$ , it follows that it has two roots that define an interval  $[p^-(\mu), p^+(\mu)]$  over which  $h(p, \mu) \geq 0$  and  $h(p, \mu) < 0$  outside of it. If  $p^+$  is strictly increasing, then we may set  $p_0 = p^+(\mu_b)$  and  $p_1 = p^+(\mu_g)$  to get an interval of signaling prices. Taking the

derivative with respect to  $\mu$  at  $p^+(\mu)$ , we find that

$$\frac{\partial p^+}{\partial \mu}(\mu) = -\frac{\partial h / \partial \mu}{\partial h / \partial p} = \frac{1}{\sqrt{\mu}} - \frac{\nu}{p^+(\mu)} > 0$$

as required<sup>8</sup>.

Figure 4: Separating equilibria



**Lemma 1.** *There exists a continuum of separating equilibrium. The Riley Out-*

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<sup>8</sup>First establish that  $p^+(\mu) = \sqrt{\mu} + \frac{1}{2}(\nu - 1) \left( 1 + \sqrt{1 + 4 \frac{\sqrt{\mu} - \mu}{\nu - 1}} \right)$  where the last square root is greater than one because  $\mu < 1 < \nu$ . Then

$$\begin{aligned} 1 &> \mu \\ 1 + \sqrt{1 + 4 \frac{\sqrt{\mu} - \mu}{\nu - 1}} &> \sqrt{\mu} \times 2 \\ \frac{1}{2}(\nu - 1) \left( 1 + \sqrt{1 + 4 \frac{\sqrt{\mu} - \mu}{\nu - 1}} \right) &> \sqrt{\mu} \times (\nu - 1) \\ p^+(\mu) &> \sqrt{\mu}\nu \\ \frac{1}{\sqrt{\mu}} - \frac{\nu}{p^+(\mu)} &> 0 \end{aligned}$$

come<sup>9</sup> is given by the pair of prices  $p = \bar{p}_0(\mu_b)$  and  $p_0 = p_b^*$ .

Signal the quality is costly for the producer of green apple. It has to set a price  $\bar{p}_0$  further the perfect information price  $p_g^*$  to prevent any profitable deviation for the producer of brown apples.

**Pooling Equilibria.** If both types choose the same price the consumer cannot infer any information from prices. Therefore her *posterior* belief  $f$  will be equal to her *prior* belief  $\phi$  which implies a somewhat average valuation  $\nu_\phi$  for each apple bought. Still assuming that any departure by BigA from such strategy would be interpreted by the consumer as a sure sign that his apples are brown, BigA must then balance the benefit of a higher valuation  $\nu_\phi > 1$  for his product to the opportunity cost of having to supply the market at that price. So for such equilibrium to exist the following conditions must be met:

$$h^\phi(p, \mu) = (p - \mu)d(p, \phi) - \pi(\mu, 0) \geq 0 \quad \mu \in \{\mu_b, \mu_g\}$$

Condition 3 states that the green type has no incentives to deviate from the pooling strategy and to be viewed as the brown type. Condition 4 ensures that the brown type has incentives to mimic the price of the green producer. Any price yielding a profit in both states of nature, no lower than the profit the right hand side, is a candidate for concealing information.

## Hard Information

Recall that NGO can successfully find a hard evidence that the producer of green apple with probability  $\gamma < 1$  or learn nothing with  $1 - \gamma$ . The NGO can successfully monitor the producer of brown apple with probability  $\beta < 1$  or learn nothing with probability  $1 - \beta$ .

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<sup>9</sup>The least costly separating equilibrium which survives the Intuitive Criterion Cho & Kreps (1987).

**Influence of naming and shaming when the market reveals the information.** This configuration will impact the incentives constraints of both types of apple producers in a different manner. The main impact is on the incentive of the producer of brown apple. When the producer of brown apple attempts to be taken for the green producer, there is a chance  $\beta$  that the fraud is revealed to consumers. If the fraud is revealed the consumer applies the worst belief and faces a high price. Now the right hand side of Condition  $IC_b$  is rewritten as an expected profit on the green market of  $E[\pi(p, s)] = s\beta\pi(p, 0) + (1 - (1 - s)\beta)\pi(p, 1)$ . The right hand side of Condition  $IC_g$  relaxes the worst beliefs profits. For the producer of green apple the price  $p^E = \sqrt{s\gamma\mu_g(v-1) + \mu_g}$  optimizes the expected profit  $E[\pi(\mu_g, s)] = s\gamma\pi(p, 1) + (1 - s\gamma)\pi(p, 0)$ . Note that when  $\gamma = 1$  we find  $p_g^*$  defined in the perfect information case. To achieve separation the producer of green apple must set a price  $p$  that satisfies the two following conditions:

$$\pi(p, 1) \geq E[\pi(\mu_g, s)] \quad (3)$$

$$\pi(\mu_b, 0) \geq E[\pi(p, s)] \quad (4)$$

**Proposition 1.** *If the technology of monitoring is relatively high (low)  $\beta > \beta^*(s)$  ( $\beta < \beta^*(s)$ ), there exists an unique separating equilibrium where the producer of green apple applies its full information price  $p = p_g^* = \sqrt{v\mu_g}$  ( $p = \bar{p}_b$ ) and the producer of brown apple too  $p = p_b^* = \sqrt{\mu_b}$ .*

We denote the separating price which prevents any deviations for the brown producer  $\bar{p}_b$  from (4) and  $\bar{p}_g$  the price ensuring revelation for the green producer from (3). Equalizing  $\bar{p}_b$  with the full information price  $p_g^*$  yields :

$$\beta^*(s) = \frac{(-2\mu_b^{3/2} + (-v+1)\mu_b)\sqrt{\mu_g v} + (\mu_b + \mu_g)}{\mu_b(v-1)(-\sqrt{\mu_g v} + \mu_b)(1-s)}$$



At this level of monitoring the producer of the green apple can always apply its full information price  $p_g^*$  and respect the separating conditions which is the strict dominant strategy. The distortion to signal its quality is not necessary anymore because of the hard evidence displayed by the NGO. In a nutshell it reduces the cost for the producer of the green apple to signal its quality and if high enough, reestablishes the first best. In Proposition 1, we showed that when  $\bar{p}_g > \bar{p}_b$  then  $\bar{p}_b$  does not depend of  $\gamma$ .

**Proposition 2.** *The imperfect monitoring  $\beta$  can restore full credibility, the imperfect label  $\gamma$  cannot.*

**Proof:** When  $\bar{p}_b > \bar{p}_g$  there does not exist a price which satisfies (3) and (4). To keep the core of the reasoning as clearly as possible we set  $\beta = 0$ . The following proof would hold for any  $\beta$  which respects  $\bar{p}_b > \bar{p}_g$ .

Recall that  $E[\pi(\mu_g)] = \max_{p'} s\gamma\pi(p', 1) + (1 - s\gamma)\pi(p', 0)$ . We define  $\gamma_1$  as the sufficient level of labeling satisfying the following equality  $\pi(\gamma_1) = \pi(\mu_b, 0)$ . Since  $\pi(\gamma)$  is strictly increasing in  $\gamma$ , suppose that  $\gamma > \gamma_1$  such that  $\pi(\gamma)^* > \pi(\mu_b, 0)$ . In this case (3) is always more stringent than (4) therefore  $\bar{p}_b > \bar{p}_g$ . Now suppose that there exists a price  $p(\gamma)$  satisfying (3)-(4) simultaneously. One can rewrite these constraints as follow:

$$(p(\gamma) - \mu_g) d(p, 1) \geq \pi(\gamma)$$

$$\pi(\mu_b, 0) \geq (p(\gamma) - \mu_b) d(p, 1)$$

Then  $(p(\gamma) - \mu_g) d(p, 1) \geq \pi(\gamma)^* > \pi(\mu_b, 0) \geq (p(\gamma) - \mu_b) d(p, 1)$ . By transitivity one can simplify it to  $(p(\gamma) - \mu_g) > (p(\gamma) - \mu_b)$  implying that  $\mu_b > \mu_g$  which is a contradiction. ■

This corollary insists on the fact that it does not exist a  $0 < \gamma^* < 1$ , which would reduce the cost for the virtuous producer to signal its quality. It increases the

level of confidence *per se* but it crowds out the incentive for the green type to achieve separation by paying the signaling cost. Another way to understand the result is that it relaxes the pressure of the green producer to signal its quality because the consumer has some hard evidence. Therefore the resulting price of this effect is not enough to prevent the deviation of the brown type.

**Influence of naming and shaming when the market conceals information.**

With the presence of PublicEye the two conditions that have to be full filled for the existence of a pooling equilibrium are given by:

$$s\gamma\pi(p, 1) + (1 - s\gamma)\pi(p, \phi^H(\gamma)) > \max_{p'} \gamma\pi(p', 1) + (1 - \gamma)\pi(p', 0) \quad (5)$$

$$(1 - s)\beta\pi(p, 0) + (1 - (1 - s)\beta)\pi(p, \phi^H(\beta)) > \pi(\mu_b, 0) \quad (6)$$

For (6) it is clear that when the technology of monitoring augments, the space of pooling equilibrium is reduced for the same arguments as in the case of separating equilibria. For (5) it is less obvious and the reasoning is the following. When  $\phi$  increases it increases the set of possible prices. When  $\gamma$  increases the share of profit associated to the *a priori* of the consumer is decreased. As a result when  $\gamma$  increases the possible prices satisfying (5) are reduced. In other words, for the green BigA to choose the worst-belief equilibrium profit is less and less a problem as the labeling technology augments. Using an equilibrium refinement would definitely allow us to conclude that the presence of the NGO reduce the situation where firms conceals information.

## 4 NGO Informative Behavior

The PublicEye is assumed to maximize the utility of the consumer. In this section we analyze its optimal informative behavior given the level of the technology of monitoring  $\beta$  and  $\gamma$ , the optimal pricing strategy of the firm, and the equilibrium beliefs of the

consumer. We denote  $v(f, p)$  the indirect utility function of the consumer. As showed in Figure 3 the consumer has three possible informational node,  $f = 0$  the apple is brown,  $f = 1$  the apple is green,  $f = f'$  she does not know the type of the apple.

**Informative behavior in separating equilibria.** An equilibrium of the incomplete information simultaneous game is given by  $(p_b^*, p_g, s^*, f)$  where PublicEye plays  $s^*$ , the green type type plays  $p_g$ , the brown type plays  $p_b^*$ , and the consumer reacts with belief  $f$ . Then if PublicEye's move is Naming, the PublicEye gets

$$\phi v(1, p_g) + (1 - \phi)v(0, p_b^*) \quad (7)$$

and, if PublicEye's move is Shaming, the consumer gets

$$\phi v(1, p_g) + (1 - \phi)v(0, p_b^*) \quad (8)$$

This will be an equilibrium if Naming ( $s=1$ ) is indeed a best-response for PublicEye that if it would have never incentives to deviate from the fixed point to Shaming ( $s=0$ ) whatever the beliefs on  $s$  of other players even if they believe with certainty that the NGO played Naming:

$$\phi v(1, p_g(1)) + (1 - \phi)v(0, p_b^*) \geq \phi v(1, p_g(1)) + (1 - \phi)v(0, p_b^*) \quad (9)$$

Ibidem for Shaming.<sup>10</sup> When the market fully reveals the information, the outcome of

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<sup>10</sup> As we showed, it exist two regions of separating equilibrium. When  $\beta > \beta^*$  both firms applies their full information price and the consumer is perfectly informed, when  $\beta < \beta^*$  BigA of green type has to pay a signaling cost while BigA of brown type applies its full information price. As a result we have:

$$v(1, p_g(0)) = \begin{cases} \phi v(1, p_g^*) & \text{if } \beta \geq \beta^* \\ \phi v(0, \bar{p}_g) & \text{if } \beta < \beta^* \end{cases}$$

for Shaming to be a best-response for PublicEye it needs that:

$$\phi v(1, p_g(0)) + (1 - \phi)v(0, p_b^*) \geq \phi v(1, p_g(0)) + (1 - \phi)v(0, p_b^*)$$

the NGO is limited because the separation in prices crowds-out the evidence discovered. It is clear that the payoff would be the same whatever the strategy employed and therefore there is an infinity of equilibria with  $s^* \in [0, 1]$ .

**Proposition 3.** *When firms reveal the truth PublicEye is indifferent between playing naming or shaming strategy.*

The proposition above states that when BigA correctly reveals information PublicEye is indifferent between Naming or Shaming strategy. However it is important to underline that the separating strategy depends of the presence of PublicEye. PublicEye bolsters incentive of the green BigA to unravel its type by reducing the signaling cost.

**Informative Behavior in Pooling Equilibria** An uninformed consumer that buys at price  $p$  gets an indirect expected utility of

$$v(f, p) = \nu_f (\ln(\nu_f) - \ln(p))$$

Consider a candidate mixed strategy pooling equilibrium  $(s^*, p)$  where PublicEye plays  $s^*$  and both types of BigA play a pooling price  $p$ . Then if PublicEye's move is Naming, the consumer (and thus PublicEye) gets

$$\phi\gamma v(1, p) + (1 - \phi\gamma)v(f', p) \tag{10}$$

and, if PublicEye's move is Shaming, the consumer gets

$$(1 - \phi)\beta v(0, p) + (1 - (1 - \phi)\beta)v(f', p)$$

where  $f'$  is defined above in (1) with  $s = s^*$ . For these payoffs to be part of an

equilibrium with  $s^* \in (0, 1)$ , they must be equal, so

$$\frac{v(1, p)}{v(0, p)} = \frac{\frac{1}{\phi\gamma} - 1}{\frac{1}{(1-\phi)\beta} - 1} \equiv k$$

or

$$p = \nu \frac{1}{1 - k/\nu}$$

Finally, if  $p^*(s)$  is the pooling price that would be adopted by both types should  $s$  be played, then such an equilibrium exists if there is a  $s^* \in [0, 1]$  such that

$$p^*(s^*) = p$$

Notice that if  $p^*$  is monotonous, then a mixed equilibrium is unique when it exists.

Consider a candidate pure strategy equilibrium with pooling where PublicEye plays  $s^* = 1$ . Then the consumer gets (10) with  $p = p^*(1)$  and

$$f' = \phi \frac{1 - \gamma}{1 - \phi\gamma}$$

This will be an equilibrium if Naming ( $s = 1$ ) is indeed a best-response for PublicEye that is if

$$\phi\gamma v(1, p^*(1)) + (1 - \phi\gamma)v(f', p^*(1)) \geq (1 - \phi)\beta v(0, p^*(1)) + (1 - (1 - \phi)\beta)v(f', p^*(1))$$

or more simply

$$\phi\gamma v(1, p^*(1)) \geq (1 - \phi)\beta v(0, p^*(1)) + (\phi\gamma - (1 - \phi)\beta)v(f', p^*(1))$$

Ibidem for an equilibrium with  $s^* = 0$ .

**Proposition 4.** *When the market conceals information, the optimal informative behavior of PublicEye is shaming if  $\phi < \phi^s$ , naming if  $\phi > \phi^s$  or mixed if  $\phi = \phi^s$ .*

**Proof:** Forthcoming. ■

This result insists on the fact that we do not expect PublicEye to practice naming in industries where the dynamic of green production is very low. For instance, in polluting chemical industry, the difficulty to promote environmental practices will result in a pure strategy of shaming for PublicEye. On the contrary, case, if there is a significant amount of environmental production initiative, as it is the case in some agricultural industries, it is likely that PublicEye would practice naming. In a nutshell, there is a correspondence between the proportion of firms adopting environmentally friendly production techniques and the informative behavior of PublicEye. Note that it appears legitimate to state that it is easier to find one evidence that the firm is definitively brown compared to find evidence that the firm is definitively green. Such a statement has serious implications on the evolution of the continuum path of the mixed strategy of the NGO.

## 5 Conclusion

The main contribution of the paper has been to provide a rationale for the informative behavior of G.NGO. After observing that many organizations use naming and shaming strategy, it is argued that, when imperfect, has two major impacts on the signaling strategy of a firm. First, the shaming reduces the cost of signal for the high-quality type, and can even restore the perfect information output. Second, naming decreases incentive for the high-quality firm to signal itself, to a certain point separating equilibria might even disappear in the signaling strategy of the firm. In a simultaneous incomplete information game, these results above seem robust to different timing assumptions. Depending on if the market correctly reveals or conceal the information, the informative

behavior strategy of the NGO is radically different. However, in situations where the presence of the NGO is the most desirable, *ie* when pooling price equilibria occur, the NGO tends to match its informative strategy to the environmental technology of the market.

Finally, a natural extension that appears would be to use the dynamic of the reputation over time. If an NGO would repeatedly find hard evidence proving the type of the firm, our intuition is that it might anchor the NGO to a particular informative behavior.

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