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Greenwash: Corporate Environmental Disclosure under Threat of Audit

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Abstract

We develop an economic model of "greenwash," in which a firm strategically discloses environmental information and a non-governmental organization (NGO) may audit and penalize the firm for engaging in greenwash. We identify conditions under which NGO punishment of greenwash backfires, inducing the firm to become less rather than more forthcoming about its environmental performance. We show that complementarities with NGO auditing may justify public policies encouraging firms to adopt environmental management systems. Mandatory disclosure rules offer the potential for better performance than NGO auditing, but the necessary penalties may be so large as to be politically unpalatable. If so, a mix of mandatory disclosure rules, NGO auditing and environmental management systems may be needed.

1 Introduction

In recent years, corporations have greatly increased their voluntary efforts to improve the environment and help society more broadly. Environmentally friendly businesses like Patagonia, Dean's Beans, and Seventh Generation are growing rapidly. Many large firms including Ford, GM, Dow, Pfizer and BP have begun releasing extensive environmental and social annual reports documenting their activities. Thousands of companies of all types participate in partnership programs with the Environmental Protection Agency.[1]

Despite the increase in corporate environmental activity, many such actions are dismissed as mere "greenwash" by non-governmental organizations. Unfortunately, public debate around greenwash is often both vague and strident.

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[1]For a thorough analysis of voluntary corporate environmental activities, see Lyon and Maxwell (2004b).

For example, in *Greenwash: The Reality Behind Corporate Environmentalism,* Greenpeace activists Jed Greer and Kenny Bruno excoriate twenty leading firms that "proclaim their environmentalism" for failing to take actions strong enough to justify their public proclamations. For example, they note that Shell Oil acknowledges publicly that global climate change poses a great enough risk to justify starting to adopt precautionary measures. "Yet despite this ostensible commitment to a precautionary approach, Shell plays an aggressive role in the drive to develop the world's one trillion barrels of known oil reserves..."[2] Exactly what Shell would have to do to avoid being labeled a "greenwasher" is unclear.

In this paper, we present what is to our knowledge the first economic analysis of greenwash. Since public discussion of greenwash is often polemical and imprecise, we begin in section 2 by developing a clear formal definition of greenwash, and distinguishing it from other "disinformation" strategies. In section 3, we build a simple model in which a firm makes strategic decisions about the environmental information it discloses publicly, and a non-governmental organization (NGO) such as Greenpeace may audit the company's statements and behavior and attempt to penalize the firm for engaging in greenwash. The model allows us to study rigorously in section 4 how such NGO tactics affect the firm's incentives, and to assess whether such NGO actions actually improve market performance. We identify a set of conditions under which NGO punishment of greenwash backfires, inducing the firm to become less rather than more forthcoming about its environmental performance. We then consider potential complementarities between NGO auditing of greenwash and corporate adoption of an environmental management system (EMS), and show that these complementarities may justify public policies encouraging firms to adopt EMSs. In section 5, we study the effects of mandatory disclosure rules (such as those created by the Public Company Accounting and Reform Act of 2002, commonly know as Sarbanes-Oxley). We show that mandatory disclosure rules offer the potential for better performance than NGO auditing, but that the necessary penalties may be so large as to be politically unpalatable. Finally, we consider the interaction between mandatory disclosure rules, NGO auditing, and the adoption of EMSs, and offer some tentative suggestions regarding how these mechanisms can best be combined. Section 6 concludes.

2   Defining Greenwash

Formal analysis of greenwash must begin with a clear definition of the phenomenon. Unfortunately, popular usage of the term, and even academic discussion of it, tends to be broad and vague. In their book on greenwash, Greer and Bruno (1996) never actually define the term. On the first page of the Introduction, however, they describe the world of greenwash as one in which transnational corporations "are preserving and expanding their markets by posing as friends of the environment and leaders in the struggle to eradicate poverty." Even

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[2] Greer and Bruno (1996, p. 52).

academic discussions can be broad. Laufer (2003), for example, presents a set of elements of greenwashing that include "confusion," "fronting," and "posturing." Confusion (p. 257) is achieved through "careful document control and strict limits on the flow of information made available to regulators and prosecutors." Fronting (p. 257) "is realized by subordinate scapegoating or reverse whistle blowing," and may involve actions such as "cast doubt on the severity of the problem" or "emphasize uncertainty associated with problem." Posturing (p. 256) involves the use of "front groups" to influence legislation or suggest that particular policies enjoy widespread "grassroots" support. For the purposes of formal modeling, these activities are distinct enough to each merit their own individual analysis. For example, we have previously modeled the use of "astroturf lobbying" through "front groups" in Lyon and Maxwell (2004a).

Turning to the dictionary, we find that *Webster's New Millenium Dictionary of English* defines greenwash as "The practice of promoting environmentally friendly programs to deflect attention from an organization's environmentally unfriendly or less savory activities." The *Concise Oxford English Dictionary (10th Edition)* defines it as: "Disinformation disseminated by an organization so as to present an environmentally responsible public image; a public image of environmental responsibility promulgated by or for an organization etc. but perceived as being unfounded or intentionally misleading." Both these definitions emphasize the idea that the public has limited information about corporate environmental performance, and that corporations therefore can manipulate the dissemination of information to mislead the public. These ideas are consistent with what Laufer refers to as "confusion."

The term "disinformation" goes somewhat further, and implies the provision of deliberately false or fraudulent messages. Corporate greenwashing, however, does not seem to fit this definition. Instead, the typical concerns raised by NGOs are that companies present positive information out of context in a way that could be misleading to individuals who lack background information about the company's full portfolio of activities. Consider the following example, taken from "Don't Be Fooled: The Ten Worst Greenwashers of 2003":[3]

> "Royal Caribbean points to its advanced wastewater treatment systems as a sign of environmental progressiveness, yet they are installed on just 3 of the company's 26 cruise ships. The advanced systems are only found on its Alaskan fleet, which due to Alaskan law are subject to the strictest environmental standards in the industry. Royal Caribbean deems them unnecessary on cruise ships that travel other routes."

This example, like that outlined in the Introduction, depicts a company making a statement that is true, yet not the whole truth. We view this as paradigmatic of greenwash. Thus, we will define *greenwash* as the *selective disclosure of positive information about a company's environmental or social*

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[3]Available at http://www.thegreenlife.org/dontbefooled.html.

performance, without full disclosure of negative information on these dimensions. Indeed, empirical research in accounting indicates that this is a common practice in corporate environmental disclosure.[4] Note that this is *not* the same as having a poor record of environmental performance. A firm can have a poor record without presenting any positive information about itself, or can have a relatively good record while simultaneously promoting its positive actions publicly and failing to discuss its (few) negative environmental impacts. Note also that greenwash is not the same as simply failing to report negative information; greenwash involves the additional step of selectively choosing to report positive information. These distinctions will turn out to have important implications as we develop our formal model below.

3 Basic Model

Our model focuses on a single firm, whose stock is traded publicly, and a non-governmental organization (NGO). The firm has N different activities that have some potential effect on the environment. The magnitude of N is assumed to be common knowledge, e.g., available on the firm's web site or Annual Report, as is the non-environmental economic value of each activity. However, the environmental impacts of the firm's portfolio of activities is not known at the outset of the model. The environmental impacts of the firm's N activities make up its environmental profile. The model presented in this section draws heavily upon the work of Shin (2003). However, Shin does not incorporate the presence of an NGO that can audit the firm's reports, an extension we introduce in section 4.

There are 3 periods. Let V_t represent the expected value of the firm in period t. At period 0, there is common knowledge about the likelihood there is an environmental liability associated with any given product. Each activity generates an environmental benefit of value u (e.g., an outcome that improves the firm's public image) with probability r, and an environmental liability of value d with probability $1 - r$. Thus, the expected number of environmental liabilities the firm faces is simply $(1 - r)N$, and its market value in period 0 is

$$V_0 = (ru + (1 - r)d)^N \widetilde{V}, \tag{1}$$

where $\widetilde{V}$ is the total value created by the firm in activities that have no appreciable environmental impacts. Throughout the remainder of the paper, we will simplify notation by normalizing $\widetilde{V}$ to 1. At period 2, all information becomes common knowledge, and is incorporated into stock prices. The important action in the model takes place in the interim period 1.

We assume there is a probability θ that the firm actually learns the environmental impact of the activity by period 1. Thus, at the interim period, the expected number of activities for which the manager has information on environmental outcomes is θN. The expected number of activities known to

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[4]See, for example, Deegan and Rankin (1996).

have environmental liabilities at the interim period is $\theta(1 - r)N$. The firm has the ability to disclose publicly the number of activities that demonstrably have environmental benefits. We assume that all such disclosures are verifiable by outside parties. Thus, the firm is free to selectively withhold information, but it cannot actually lie to outsiders. We assume the manager adopts a disclosure strategy that maximizes the value of the firm. It is worth noting that we would expect θ to be greater for firms that have created an environmental management system. This is a point to which we return in section 4.

Let n be the actual number of activities whose liabilities are known at the interim period, s be the number of successes and f the number of failures, so that $n = s + f$. Let the firm's disclosures of successes and failures be given by $\widehat{s}$ and $\widehat{f}$. Following Shin (2003), we assume the market sets the price of the firm equal to its actuarily fair value given all available information. Hence, the market acts as if it had an objective function to minimize $(V_1 - V_2)^2$, where V_2 is the publicly known liquidation value of the firm at the end of the game. At the interim period, the market minimizes the expected value of the loss function by setting $V_1 = E(V_2)$. If the market knows s and f, as would be the case if the firm fully disclosed its information in period 1, then

$$V_1 = E(V_2) = u^s d^f (ru + (1 - r)d)^{N-s-f}, \tag{2}$$

where u = the multiplicative impact of a success on the firm's value and d = the multiplicative impact of a failure on the firm's value. This formula is quite intuitive, since u and d are the values of successes and failures, respectively, and $(ru + (1 - r)d)$ is the expected value of an activity whose environmental impact remains unknown.

If the firm discloses $\widehat{s} > 0$, the NGO investigates the firm's report for the possibility of greenwash. With probability α the NGO obtains hard (verifiable) information about the true values of s and f at the interim period; with probability $1 - \alpha$ it learns nothing. If it learns the true state, then it reports this information publicly, and can impose a penalty $P(\widehat{s}, \widehat{f}; s, f)$, where $\widehat{s}$ = number of successes reported and $\widehat{f}$ = number of failures reported. This penalty might come about because the NGO triggers a consumer boycott, because it creates an advertising campaign that damages the firm's value, or through some other channel that the firm finds costly.

We are interested in Perfect Bayesian Equilibria (PBE), which involve specifying a disclosure strategy for the firm, a market valuation, and a set of beliefs for each time t such that (a) the disclosure strategy $(\widehat{s}, \widehat{f})$ is a best response mapping for a firm with actual environmental profile (s, f), given the market's pricing policy and the beliefs of the market and the NGO, (b) $V_1 = E(V_2)$ given the market's beliefs at period 1 and the firm's disclosure strategy, and (c) at period 0 the market believes the expected number of environmental liabilities is rN, at period 1 it believes the expected number of environmental liabilities is $h(k|s)$, which is computed using Bayes' rule. We will focus on pure strategy equilibria.

It is easy to see that If the market believed the manager always truthfully

disclosed all successes and failures, then the manager would have incentives to report $f = 0$. The reason is that a success is more valuable than a failure, that is, $u > d$, so the expected value of an activity whose environmental impact is unknown is greater than the value of a failure, that is, $ru + (1-r)d > d$. Hence, the manager always prefers to minimize the number of failures reported, and full disclosure is not an equilibrium strategy. Shin (2003) refers to the strategy of not disclosing any failures as "sanitization." Greenwash can be thought of as a special form of sanitization that involves both a refusal to disclose failures *and* the disclosure of at least one success. The distinction between sanitization and greenwash may seem overly subtle, but it becomes important in the analysis below because the typical complaints about greenwash are targeted at firms that trumpet their successes but withhold their failures. As pointed out in the Introduction, NGOs tend to punish greenwash specifically, not just sanitization.

Shin (2003) shows that if the manager follows the sanitization strategy in equilibrium, and the market knows this, then the firm's expected value at the interim stage is

$$V_{sanitize} = u^s(qu + (1-q)d)^{N-s}, \qquad (3)$$

where

$$q = \frac{r - \theta r}{1 - \theta r}$$

is the probability of success of an activity conditional on the fact that the manager has not disclosed information about that activity.[5] Note that this expression has the same structure as equation (2), except that r (the ex ante probability that an activity succeeds) in (2) is replaced by q (the conditional probability that an undisclosed activity succeeds) in (3). The sanitization equilibrium is supported by a set of off-equilibrium beliefs on the part of the market that if the manager ever reports $f > 0$, then all undisclosed outcomes are failures.[6]

It is natural to ask whether the NGO can effectively punish greenwash without auditing, e.g. by penalizing the firm retroactively based on the ultimate outcomes in period 2. It turns out this is not possible. As we noted in section 2, punishing greenwash is distinct from simply punishing the firm for bad environmental outcomes. Punishing greenwash involves punishing firms that were aware of, but failed to disclose, a failure. At period 2, however, all the NGO knows is the ultimate number of failures, NOT the number that were known at the interim period. Thus, it is impossible to punish greenwash per se by only observing period 2 outcomes. Instead, it is essential to have some sort of independent auditing structure in period 1. This is the issue to which we now turn.

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[5] Recall that by Bayes' Rule, the probability an undisclosed project succeeds is $q = \Pr(success|undisclosed) = \Pr(success\&undisclosed)/\Pr(undisclosed) = r(1-\theta)/(1-r\theta)$.

[6] This is the simplest set of off-equilibrium beliefs that support the sanitization strategy, and deter the manager from reporting any failures.

4   The Role of External Auditing

In this section we assess how auditing by an NGO affects the firm's incentives to make environmental disclosures. We derive the conditions under which NGO auditing can prevent greenwash, and then discuss an interesting complementarity between the NGO's efforts and whether or not the firm has created an environmental management system.

4.1   The Equilibrium with Auditing by an NGO

Let's start with the simplest audit technology we can think of. If the NGO spends some amount of money A, then it gets a draw. With probability α it learns the true values of s and f at the interim period. With probability $1 - \alpha$ it learns nothing. If it knows the true state, then it can impose a penalty $P(\widehat{s}, \widehat{f}; s, f)$, where $\widehat{s} = $ number of successes reported and $\widehat{f} = $ number of failures reported. For example, the penalty might take the form of a consumer boycott or damage to the firm's public image.

In order to keep the analysis tractable and focused, we present it in the context of a model with $N = 2$. This is the simplest setting in which greenwash can emerge as an equilibrium outcome. Table 1 presents the firm's payoffs for each set of possible reports the firm can make at period 1. In each box, payoffs consist of two components, each of which is indexed by the number of successes and failures reported by the firm at period 1. The first component is the firm's market value as assessed by the market, and the second is the penalty imposed by the NGO. We will use the notation $\rho(s, f)$ to indicate the firm's full-disclosure value, and the notation $V_1(\widehat{s}, \widehat{f})$ to indicate the market's valuation of the firm when it makes the disclosure $(\widehat{s}, \widehat{f})$. Note that when $\widehat{n} \equiv \widehat{s} + \widehat{f} = 2$ the market has no problem inferring the firm's true state, since information disclosures are verifiable. These values are easily seen to be $\rho(0, 2) = d^2$, $\rho(2, 0) = u^2$, and $\rho(1, 1) = ud$. It is only in states where $\widehat{n} \equiv \widehat{s} + \widehat{f} < 2$ that we must carefully analyze the market's inference problem. (It is also worth noting that if the firm faced no penalties it would always pursue the sanitization strategy; this is precisely the case treated above in section 3.1.)

2	$\rho(0,2)$		
1	$V_1(0,1)$	$\rho(1,1) - \alpha P(1,1;s,f)$	
0	$V_1(0,0)$	$V_1(1,0)$	$\rho(2,0)$
$\widehat{f} \diagup \widehat{s}$	0	1	2

Table 1: Payoffs for the Firm's Possible Reports $(\widehat{s}, \widehat{f})$ in period 1

We assume the NGO always finds it worthwhile to invest in the audit if the firm reports $\widehat{n} < N$. Furthermore, to simplify the analysis, we will assume the NGO commits *ex ante* to an audit procedure. We will focus on the state in

which the firm's true situation really is $(1, 1)$, as this is the only possible case—within the case of $N = 2$—in which greenwash can occur. Specifically, greenwashing would consist of claiming to be $(1, 0)$ when the firm is really $(1, 1)$. Thus, $P(\widehat{s}, \widehat{f}; s, f) = 0$ for all situations with the one exception that $P(1, 0; 1, 1) > 0$. We want to understand what the firm will report when $(s, f) = (1, 1)$. There are four reporting possibilities: $(\widehat{s}, \widehat{f}) \in \{(0, 0), (1, 0), (0, 1), (1, 1)\}$. Given the arguments we have made above, however, it is intuitively clear that the firm has no incentive to report $(\widehat{s}, \widehat{f}) = (0, 1)$, so we focus on the other three cases in sequence.

In order to understand the firm's reporting incentives, we must know how the market will interpret each of the three possible reports. Consider them in turn. The probability that the firm is actually of type $(1, 1)$ can then be computed via Bayes' Rule. Table 2 below presents the prior probability of each true type at the interim period, along with the value the market attaches to that type:

State	Probability	$\rho(s, f)$
$(0, 0)$	$(1 - \theta)^2$	$(ru + (1 - r)d)^2$
$(1, 0)$	$2r\theta(1 - \theta)$	$u(ru + (1 - r)d)$
$(2, 0)$	$r^2\theta^2$	u^2
$(0, 1)$	$2(1 - r)\theta(1 - \theta)$	$d(ru + (1 - r)d)$
$(0, 2)$	$(1 - r)^2\theta^2$	d^2
$(1, 1)$	$2r(1 - r)\theta^2$	ud

Table 2: Interim Period States, Probabilities, and Values

We will use the notation $\mu(\widehat{s}, \widehat{f}; s, f)$ to indicate the probability the market assigns to the firm playing reporting strategy $(\widehat{s}, \widehat{f})$ when it is of type (s, f).[7] In addition, we will define $\Psi(\widehat{s}, \widehat{f})$ as the probability the market assigns to observing a report $(\widehat{s}, \widehat{f})$; this is the sum of the probabilities of each interim type of firm multiplied by the probability that type reports $(\widehat{s}, \widehat{f})$. For example,

$$\Psi(0, 0) = (1 - \theta)^2\mu(0, 0|0, 0) + 2(1 - r)\theta(1 - \theta)\mu(0, 0|0, 1) \\ + (1 - r)^2\theta^2\mu(0, 0|0, 2) + 2r(1 - r)\theta^2\mu(0, 0|1, 1).$$

We turn now to the expected value the firm of type $(1, 1)$ obtains from alternative possible disclosure strategies. If the $(1, 1)$ type reports $(1, 1)$, the market knows for sure the firm's type, and the firm has market value

$$E[1, 1|1, 1] = ud. \tag{4}$$

If the $(1, 1)$ type reports $(1, 0)$, then the market believes it is either a $(1, 0)$ and revealing truthfully, a $(2, 0)$ failing to report a success, or a $(1, 1)$ and engaging in greenwash. Thus, $\Psi(1, 0) = 2r\theta(1-\theta)\mu(1, 0|1, 0) + r^2\theta^2\mu(1, 0|2, 0) +$

$2r(1-r)\theta^2\mu(1,0|1,1)$. If the NGO audits, and finds that the firm is really a $(1,1)$ but engaged in greenwash, then the NGO imposes the penalty $P(1,0;1,1)$. The firm's expected value in this case is

$$
\begin{aligned}
E[1,0|1,1] \quad = \quad & u(ru+(1-r)d)\frac{2r\theta(1-\theta)\mu(1,0|1,0)}{\Psi(1,0)} + u^2\frac{r^2\theta^2\mu(1,0|2,0)}{\Psi(1,0)} \\
& +ud\frac{2r(1-r)\theta^2\mu(1,0|1,1)}{\Psi(1,0)} - \alpha P(1,0;1,1).
\end{aligned}
\tag{5}
$$

If the $(1,1)$ type reports $(0,0)$, then the market will conclude this report might have come from any of types $(0,0)$, $(0,1)$, $(0,2)$ or $(1,1)$.[8] Note that there is no possibility of a punishment in this case, since a report of $(0,0)$ does not constitute greenwash. The firm receives an expected payoff of

$$
\begin{aligned}
E[0,0|1,1] \quad = \quad & \frac{(1-\theta)^2(ru+(1-r)d)^2\mu(0,0|0,0)+2(1-r)\theta(1-\theta)d(ru+(1-r)d)\mu(0,0|0,1)}{\Psi(0,0)} \\
& +\frac{(1-r)^2\theta^2 d^2\mu(0,0|0,2)+2r(1-r)\theta^2 ud\mu(0,0|1,1)}{\Psi(0,0)}.
\end{aligned}
\tag{6}
$$

We are interested in whether the NGO's audit capability is ever sufficient to induce the firm to fully disclose its environmental information. To begin this analysis, note that the NGO is assumed to only punish greenwash, which means there is no punishment for reporting $(0,0)$. Thus, firms of type $(0,1)$ or $(0,2)$ always have incentives to report $(0,0)$. In other words, $\mu(0,0|0,0) = \mu(0,0|0,1) = \mu(0,0|0,2) = 1$. In addition, we know $\mu(1,0|2,0) = 0$, since the firm has no incentive to hide a success. Furthermore, for truthful disclosure to be an equilibrium, we must have the firm truthfully report its state when it is a $(1,1)$, that is, $\mu(1,1;1,1) = 1$ and $\mu(0,0;1,1) = 0$, and not report falsely, that is, $\mu(1,0;1,1) = 0$. Substituting in these values of $\mu(\cdot)$ greatly simplifies equations (4) through (6).

Truthful reporting requires that $E[1,1|1,1] > E[1,0|1,1]$ and $E[1,1|1,1] > E[0,0|1,1]$. Making the substitutions described above, we find that $E[1,1|1,1] > E[1,0|1,1]$ simplifies to

$$
ud > u(ru+(1-r)d) - \alpha P(1,0;1,1).
$$

Note that without the threat of an audit and a penalty, the firm will never report truthfully, since $ru+(1-r)d > d$ for all $r > 0$. The necessary penalty to induce truthful disclosure is

$$
P(1,0;1,1) > \frac{ru(u-d)}{\alpha}.
\tag{7}
$$

Similarly, we find that the condition $E[1,1|1,1] > E[0,0|1,1]$ simplifies to

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[8]Note that a firm of type $(1,0)$ or $(2,0)$ has no incentive to report $(0,0)$.

$$ud > \frac{(dr - d - ru + ru\theta)^2}{(1 - r\theta)^2}.$$

Some rearrangement shows that this inequality holds for

$$r < \frac{\sqrt{du}(1 - \theta) - d}{u(1 - \theta)^2 - d}. \tag{8}$$

As θ goes to 1, this inequality holds for all r. This means that the market believes the firm always knows its true type at the interim period. If the firm reports $(0,0)$, the market infers that the firm is lying, since it is almost certain that the firm knows both realizations of its activities. Thus, the market believes the firm must be either a $(0,2)$ or a $(1,1)$. Since being a $(1,1)$ is strictly better than being a $(0,2)$, the firm prefers to report truthfully when it finds it is a $(1,1)$. As r goes to 0, again the inequality always holds. The reason is that it is extremely unlikely that the firm obtains any successes at all. Hence, reporting $(1,1)$ is a favorable statement relative to the market's prior expectation that the firm is a $(0,2)$. More generally, the firm will report truthfully when a report of $(1,1)$ is "good" relative to the market's prior expectation, that is, when r is small enough.

The following Proposition summarizes the sufficient conditions for the firm to fully disclose its environmental performance information in the interim period.

Proposition 1 *When the NGO punishes greenwash by imposing the penalty $P(1,0|1,1)$, the firm cannot be induced to fully disclose its private information. In particular, a firm with no successful activities will always fail to disclose its failures. However, greenwash can be deterred (that is, a firm of type $(1,1)$ can be induced to report truthfully) if (a) $P(1,0|1,1) > ru(u - d)/\alpha$, and (b) $r < \frac{\sqrt{du}(1-\theta)-d}{u(1-\theta)^2-d}$.*

The first condition in the Proposition simply says that the penalty for being caught greenwashing must be large enough to deter the firm from reporting $(1,0)$ when the state is $(1,1)$. Even when this condition is met, however, there is no guarantee that the firm discloses fully. It may instead retreat to disclosing nothing at all. The second condition identifies the conditions under which the firm prefers to disclose fully rather than disclose nothing. The smaller is θ, the smaller is the set of r for which the firm elects not to greenwash, that is, the less likely that the firm fully discloses. Also, when r is small the firm is more likely to fully disclose. The intuition is that if the firm announces $(0,0)$, then the market infers the firm is likely to be either a $(0,1)$ or a $(0,2)$, neither of which is appealing, so the firm discloses $(1,1)$. We summarize the conditions facilitating full disclosure in the following corollary to Proposition 1.

Corollary 2 *Greenwash can be prevented for a larger range of parameter values when (a) the probability an activity is environmentally benign is small, (b) the*

probability the manager knows the environmental impact of a given project at the interim period is large, (c) the probability an audit is informative is large, (d) the penalty imposed by the NGO on a firm that is caught greenwashing is sufficiently strong, and (e) the NGO finds it worthwhile to incur the audit cost.

Note that if the greenwash penalty is strong enough to meet condition (a) of Proposition 1, there are two possibilities. First, the firm may eschew greenwash, which occurs if r is small and/or θ is large. These parameter values mean the firm's activities are likely to have negative environmental impacts, and that the firm's manager is likely to know the environmental impacts of the firm's actions by the interim period. This case is perhaps most likely to describe firms with well-developed environmental management systems in industries with substantial environmental externalities, which we will refer to with the shorthand "well-informed firms in dirty industries." Second, the firm may decide to disclose nothing, which occurs if r is large and/or θ is small. These parameter values mean the firm is unlikely to have substantial environmental impacts, but also unlikely to know about these impacts at the interim period. This case is perhaps most likely to describe firms with poorly developed environmental management systems in industries with modest environmental externalities. We will refer to them with the shorthand "poorly informed firms in clean industries." These results imply that punishing greenwash is not necessarily beneficial for society, as is formalized in the following Corollary to Proposition 1.

Corollary 3 *NGO punishment of greenwash reduces information flows to the market and hence is socially detrimental if condition (a) of Proposition 1 holds but condition (b) does not.*

Proof. When condition (a) of Proposition 1 holds but (b) does not, the firm of type $(1,1)$ chooses to report $(0,0)$ instead of $(1,0)$, which is what it would report absent the NGO's audit. This change in disclosure strategy deprives the market of the information that the firm had a success. Since the market's goal is to minimize the difference between the expected and realized values of V_2, this loss of information reduces the accuracy of the market's valuation in the interim period, and hence reduces overall market performance, which is socially detrimental. ∎

Corollary 3 shows that punishing greenwash is not necessarily beneficial for society. There is a real possibility that NGO activity against greenwash could cause a reduction in environmental disclosure, which reduces overall market performance, and is socially undesirable. In order to avoid this outcome, NGO attention ought to be focused on well-informed firms in dirty industries and not on poorly informed firms in relatively clean industries. For the most part, the case studies in Greer and Bruno (1996) and Johnson (2003) comport with this recommendation. The firms indicted by Greer and Bruno include such giants of the petroleum and chemical industries as Royal Dutch/Shell, Mobil, Dow, DuPont, and Monsanto. These firms operate in industries known to have substantial environmental impacts, and are large and well-managed enough that

one would expect them to be well informed about environmental impacts of their activities. However, the targets also include Asea Brown Boveri, condemned in part because its pressurized fluidized bed combustion (PFBC) plants for coal emit only "marginally less" carbon dioxide than conventional coal-burning power plants, even though their emissions of sulfur dioxide are 59 percent lower and emissions of nitrogen oxides are 50 percent less than conventional plants. What would happen if ABB stopped touting its PFBC plants? Presumably there would be less use of PFBC and more use of conventional coal-burning plants, which would lead to a dirtier environment. It is hard to see how this could be an environmentally favorable outcome. In addition, Heinz Corporation (owner of Starkist Tuna) is condemned because even though it was the first firm to commit to "dolphin safe" tuna fishing techniques, it did not support regulation of fishing practices in the Eastern Pacific, and did not contribute to "an international research program for alternative fishing methods and equipment." Whether censuring ABB and Heinz could reasonably be expected to make them more forthcoming or more environmentally friendly is questionable.

4.2 Environmental Management Systems and NGO Auditing

As noted above, NGO auditing of greenwash is not guaranteed to be socially valuable. It is particularly likely to backfire for poorly informed firms in clean industries, that is, when r is large and/or θ is small. This observation suggests that there is a complementarity between the NGO's auditing activities and the presence of environmental managements systems (EMS) within the audited firms, which would be interpreted in our model as increasing θ. In our model, however, firms have no incentive to adopt an EMS, since the firm's market value in the interim period is lower when it adopts an EMS, as is shown in the following proposition.

Proposition 4 *In the interim period, the firm's value in the sanitization equilibrium is decreasing in θ.*

Proof. Differentiating equation (3) with respect to θ yields $dV_{sanitize}/d\theta = u^s(N-s)(qu+(1-q)d)^{N-s-1}(u-d)(dq/d\theta)$. All terms in this expression are positive with the possible exception of $dq/d\theta$. Recalling that $q = (r-\theta r)/(1-\theta r)$,

and differentiating this expression yields $dq/d\theta = -r(1-r)/(1-\theta r)^2 < 0$. Thus, $dV_{sanitize}/d\theta < 0$. ∎

The intuition for the proposition is as follows. In the sanitization equilibrium, the firm withholds unfavorable information to increase its market value. This strategy works because for each withheld piece of information, the market valuation of the firm reflects only the possibility, not the certainty, of a failure. However, as the likelihood increases that the firm knows the environmental outcomes of its activities, the market increasingly interprets non-disclosure as withheld negative information rather than as true uncertainty on the part of

the firm. Adopting an EMS improves the firm's internal information, and thus makes the market increasingly skeptical when the firm does not fully disclose all possible environmental information.

Admittedly, our model does not incorporate the benefits of an EMS in terms of improved internal control and ability to comply with environmental regulations. Nevertheless, our analysis does identify a countervailing incentive that tends to deter firms from adopting EMSs. Furthermore, our story is broadly consistent with the empirical results of Delmas (2000), who finds that many firms elect not to adopt ISO 14001 (a particular form of EMS) because they wish to limit public access to internal information about their environmental performance.

Our results suggest that public policy pressures may be required to induce a broad cross-section of firms to adopt EMSs. Interestingly, Coglianese and Nash (2001, p. 15) find that there has been "an explosion of programs in the United States that offer financial and regulatory incentives to firms that implement EMSs." These programs are being implemented at both the federal and state levels. Whether these programs are likely to achieve their objectives is unclear. Coglianese and Nash (2001, p. 16) point out that "[a]ll of these policy initiatives are premised on the assumption that EMSs make a difference in environmental performance. Yet this question merits research and evidence rather than untested optimism." Our analysis points to a different rationale for encouraging firms to adopt EMSs. We do not presume that an EMS makes any difference in environmental performance, but instead simply assume an EMS improves the firm's internal information about its environmental performance. In this capacity, an EMS operates as a complement to NGO auditing of environmental disclosure and greenwash. An EMS increases the likelihood that management is well informed about its environmental liabilities. Thus, when a firm discloses nothing about its environmental performance, the market infers that the firm is failing to disclose some negative information, and thus downgrades its rating of the company's value. The threat that its stock will be devalued makes a firm less willing to adopt a policy of non-disclosure. In turn, this means that an NGO's threat to punish greenwash is more likely to drive the firm to disclose fully rather than to not disclose at all.

5 Disclosure Requirements and Auditing

Even when conditions are such that punishing greenwash can actually induce greater disclosure rather than less disclosure, such punishment is never enough to bring about full disclosure of environmental information. The reason is that firms with no successful activities to point to can simply remain silent about their failures without fear of punitive action by the NGO. This observation suggests that it is not greenwash *per se* that is the fundamental problem; it is the failure to fully disclose. In this section, we consider an alternative approach to inducing disclosure of environmental information, namely relying upon legislation that mandates disclosure and penalizes firms that fail to comply.

The Public Company Accounting and Reform Act of 2002 (commonly know as Sarbanes-Oxley) was signed into law in July of 2002, and contains a number of provisions that require publicly traded companies to improve the accuracy of their financial disclosures and establish better internal controls for financial reporting. One area where better internal controls will likely be needed is in developing processes to identify, track, quantify and assess the financial impact of potential environmental liabilities.

In addition, the Securities and Exchange Commission (SEC) has promulgated Regulation S-K, which contains several items affecting the disclosure of environmental costs and liabilities. In particular, Item 101 requires companies to disclose material effects of compliance (or non-compliance) with environmental laws, Item 103 requires disclosure of pending, non-routine litigation (with environmental litigation typically being considered non-routine), and Item 303 requires disclosure of business trends or events likely to have a material effect of a company's financial condition. One can easily see how certain environmental "trends or events" such as discovery of environmental contamination (e.g. PCB in fish) might have such a material effect. Of these, Item 303 is perhaps most closely related to our analysis. It is important to note that even this provision leaves substantial room for managerial discretion in determining what is "likely" and what is a "material effect."

Below we revisit the payoff table for the firm, with $F(\widehat{s}, \widehat{f}; s, f)$ the fine levied by the regulator if an audit determines the firm failed to comply with disclosure regulations.[9] It is unnecessary for the regulator to punish firms that fail to report good news, so we will not consider fines for reporting $\widehat{s} < s$. Market forces will induce firms to report good news without the need for regulation.

2	$\rho(0,2)$		
1	$V_1(0,1) - \alpha F(0,1;s,f)$	$\rho(1,1)$	
0	$V_1(0,0) - \alpha F(0,0;s,f)$	$V_1(1,0) - \alpha F(1,0;s,f)$	$\rho(2,0)$
$\widehat{f}/\widehat{s}$	0	1	2

Table 3: Payoffs for the Firm's Possible Reports $(\widehat{s}, \widehat{f})$ in period 1

There are three states to investigate: $(0,1)$, $(0,2)$, and $(1,1)$. Firms of type $(1,0)$ and $(2,0)$ have no reason to not disclose, while type $(0,0)$ has no options. Note that states $(0,1)$ and $(0,2)$ were not part of our analysis in section 4, because they do not involve "greenwash" proper, that is, they don't involve any reporting of positive information. We consider the three relevant states (or types of firm) in turn.

Type $(0,1)$: If the firm is of type $(0,1)$, there are two possible reports: $(0,1)$ or $(0,0)$. If the firm reports $(0,1)$, the market assumes the firm may be of types $(0,1)$, $(0,2)$, or $(1,1)$. However, it doesn't seem to make any sense for a $(1,1)$ to report $(0,1)$. We will assume the market places no probability on

---

[9]We assume the regulator commits to an audit program in advance. Thus, there is no issue of whether the regulator would really want to follow through on the audit in a truthful reporting equilibrium.

this possibility, that is, $\mu(0,1|1,1) = 0$. Assuming the firm reports all positive news, then the market knows the firm can be either a type $(0,1)$ or $(0,2)$. Thus,

$$E[0,1|0,1] = d(ru+(1-r)d)\frac{2(1-r)\theta(1-\theta)\mu(0,1|0,1)}{\Psi(0,1)} + d^2\frac{(1-r)^2\theta^2\mu(0,1|0,2)}{\Psi(0,1)}.$$

Similarly,

$$E[0,0|0,1] \quad = \quad \frac{(1-\theta)^2(ru+(1-r)d)^2 + 2(1-r)\theta(1-\theta)[d(ru+(1-r)d)]\mu(0,0|0,1)}{\Psi(0,0)}$$

$$+\frac{(1-r)^2\theta^2d^2\mu(0,0|0,2) + 2r(1-r)\theta^2ud\mu(0,0|1,1)}{\Psi(0,0)} - \alpha F(0,0;0,1).$$

Type $(0,2)$**:** If the firm is of type $(0,2)$, there are three possible reports: $(0,2)$, $(0,1)$ or $(0,0)$. If the firm fully discloses, the firm can confirm this fact and the firm's value is

$$E[0,2|0,2] = d^2.$$

If the firm reports $(0,1)$, the market assumes the firm may be of types $(0,1)$, $(0,2)$, or $(1,1)$. However, it doesn't seem to make any sense for a $(1,1)$ to report $(0,1)$. We will assume the market places no probability on this possibility, that is, $\mu(0,1|1,1) = 0$. Assuming the firm reports all positive news, then the market knows the firm can be either a type $(0,1)$ or $(0,2)$. Thus,

$$E[0,1|0,2] = d(ru+(1-r)d)\frac{2(1-r)\theta(1-\theta)\mu(0,1|0,1)}{\Psi(0,1)} + d^2\frac{(1-r)^2\theta^2\mu(0,1|0,2)}{\Psi(0,1)} - \alpha F(0,1;0,2).$$

If the firm reports $(0,0)$, the market must assess what type of firm it faces, which could be $(0,0), (0,1), (0,2)$ or $(1,1)$. Noting that $\mu(0,0|0,0) = 1$, we can write the firm's expected payoff as

$$E[0,0|0,2] \quad = \quad \frac{(1-\theta)^2(ru+(1-r)d)^2 + 2(1-r)\theta(1-\theta)[d(ru+(1-r)d)]\mu(0,0|0,1)}{\Psi(0,0)}$$

$$+\frac{(1-r)^2\theta^2d^2\mu(0,0|0,2) + 2r(1-r)\theta^2ud\mu(0,0|1,1)}{\Psi(0,0)} - \alpha F(0,0;0,2).$$

Type $(1,1)$**:** If the $(1,1)$ type reports $(1,1)$, the market knows for sure the firm's type, and the firm has market value

$$E[1,1|1,1] = ud.$$

If the $(1,1)$ type reports $(1,0)$, then the market believes it is either a $(1,0)$ and revealing truthfully, a $(2,0)$ failing to report a success, or a $(1,1)$ and

15

engaging in greenwash. The firm's expected value in this case is

$$
\begin{aligned}
E[1,0|1,1] \;=\;& u(ru+(1-r)d)\frac{2r\theta(1-\theta)\mu(1,0|1,0)}{\Psi(1,0)} + u^2\frac{r^2\theta^2\mu(1,0|2,0)}{\Psi(1,0)} \\
&+ ud\frac{2r(1-r)\theta^2\mu(1,0|1,1)}{\Psi(1,0)} - \alpha F(1,0;1,1).
\end{aligned}
$$

If the $(1,1)$ type reports $(0,0)$, then the market will conclude this report might have come from any of types $(0,0)$, $(0,1)$, $(0,2)$ or $(1,1)$.[10] The firm receives an expected payoff of

$$
\begin{aligned}
E[0,0|1,1] \;=\;& \frac{(1-\theta)^2(ru+(1-r)d)^2 + 2(1-r)\theta(1-\theta)d(ru+(1-r)d)\mu(0,0|0,1)}{\Psi(0,0)} \\
&+ \frac{(1-r)^2\theta^2 d^2\mu(0,0|0,2) + 2r(1-r)\theta^2 ud\mu(0,0|1,1)}{\Psi(0,0)} - \alpha F(0,0;1,1).
\end{aligned}
$$

5.1 The Full Disclosure Equilibrium

We are interested in the conditions that will induce all types to disclose fully. In the full disclosure equilibrium, the market will assesses $\mu(s,f|s,f) = 1$ and $\mu(\widehat{s},\widehat{f}|s,f) = 0$ for any $\widehat{s} \neq s$ or $\widehat{f} \neq f$. For full disclosure to be incentive compatible, we must have

$$
E(s,f|s,f) > E(\widehat{s},\widehat{f}|s,f) \qquad \forall \widehat{s}, \widehat{f} \neq s, f.
$$

The following conditions must hold in a full disclosure equilibrium

$$
E[0,1|0,1] > E[0,0|0,1] \Rightarrow d(ru+(1-r)d) > (ru+(1-r)d)^2 - \alpha F(0,0;0,1).
$$

$$
E[0,2|0,2] > E[0,1|0,2] \Rightarrow d^2 > d(ru+(1-r)d) - \alpha F(0,1;0,2).
$$

$$
E[0,2|0,2] > E[0,0|0,2] \Rightarrow d^2 > (ru+(1-r)d)^2 - \alpha F(0,0;0,2).
$$

$$
E[1,1|1,1] > E[1,0|1,1] \Rightarrow ud > u(ru+(1-r)d) - \alpha F(1,0;1,1).
$$

$$
E[1,1|1,1] > E[0,0|1,1] \Rightarrow ud > (ru+(1-r)d)^2 - \alpha F(0,0;1,1).
$$

A bit of algebra shows that the fines necessary for full disclosure are

$$
F(0,0;0,1) > \underline{F}(0,0;0,1) \equiv \frac{r(u-d)(ru+(1-r)d)}{\alpha}.
$$

$$
F(0,1;0,2) > \underline{F}(0,1;0,2) \equiv \frac{r(u-d)d}{\alpha}.
$$

$$
F(0,0;0,2) > \underline{F}(0,0;0,2) \equiv \frac{r\,(u-d)\,(2d+r(u-d))}{\alpha}.
$$

---

[10]Note that a firm of type $(1,0)$ or $(2,0)$ has no incentive to report $(0,0)$.

$$F(1,0;1,1) > \underline{F}(1,0;1,1) \equiv \frac{r(u-d)u}{\alpha}.$$

$$F(0,0;1,1) > \underline{F}(0,0;1,1) \equiv \frac{(u-d)\left(ur^2 - d(1-r)^2\right)}{\alpha}.$$

The following Lemma ranks the minimum thresholds $\underline{F}(\widehat{s}, \widehat{f}|s, f)$, which will be convenient in establishing results below.

Lemma 5 *(a)* $\underline{F}(1,0;1,1) > \underline{F}(0,0;0,1) > \underline{F}(0,1;0,2) > \underline{F}(0,0;1,1)$ *and (b)* $\underline{F}(0,0;0,2) > \underline{F}(0,0;0,1).$

Proof. In (a), the first two inequalities are clear from inspection. Next, observe that $F(0,1;0,2) > F(0,0;1,1)$ if $rd > (ur^2 - d(1-r)^2)$, which can be rearranged to form $r^2(u-d) + d(1-r) > 0$. In (b), observe that $\underline{F}(0,0;0,2) > \underline{F}(0,0;0,1)$ if $2d + r(u-d) > ru + (1-r)d$, which can be rearranged to form $d > 0$. ■

In light of the Lemma, the only unresolved question regarding the necessary penalties to induce full disclosure is whether $F(0,0;0,2) \lessgtr F(1,0;1,1)$. It is easy to see that $F(1,0;1,1) > F(0,0;0,2)$ if $u > 2d + r(u-d)$, or

$$r < \frac{u-2d}{u-d}.$$

Note that if $d > u/2$, then this condition always fails. This is the case when there is relatively little variance associated with the environmental activity. Regardless of whether the condition holds, however, it is possible to establish sufficient conditions on penalties that will induce full disclosure, as shown in the following proposition.

Proposition 6 *Full disclosure can be induced through a policy of mandatory disclosure that includes penalties at least as great as $u(u-d)/\alpha$ for failures to disclose.*

Proof. If $r < (u-2d)/(u-d)$, then $F(1,0;1,1) > F(0,0;0,2)$, and a sufficient condition for full disclosure is $F(1,0;1,1) > r(u-d)u/\alpha$. ■

If $r > (u-2d)/(u-d)$, then $F(0,0;0,2) > F(1,0;1,1)$, and a sufficient condition for full disclosure is $F(0,0;0,2) > (u-d)\left(ur^2 - d(1-r)^2\right)/\alpha$. Since $r < 1$, a penalty of $\overline{F} \equiv u(u-d)/\alpha$ is always sufficient to induce truthful disclosure, since $\overline{F} > F(0,0;0,2)$ and $\overline{F} > F(1,0;1,1)$.

The proposition shows that mandatory disclosure requirements, with the requisite level of fines, are more powerful instruments than penalizing greenwash alone. As we found in section 4, full disclosure can never be achieved simply by auditing and punishing greenwash. Furthermore, the NGO's ability to deter

17

greenwash depends importantly on the values of parameters such as r and θ. Mandatory disclosure requirements offer the ability to eliminate withholding of information, regardless of r or θ.

Although mandatory disclosure rules are attractive in principle, in practice they may require the use of fines that are too large to be politically feasible. If so, then there is no guarantee that a mandatory disclosure law will be more effective than auditing by an NGO. We turn to this issue in the following section.

5.2 Limited Regulatory Penalties

In the previous section, we showed that if there are no limits on penalties for failure to disclose information, then legislative requirements can induce companies to fully disclose their environmental risks. Often, however, government penalties are less than would be required to prevent socially damaging corporate action.[11] Under Sarbanes-Oxley, firms may face fines of up to \$5 million, and corporate managers may face up to \$1 million in fines. Unfortunately, fines of this magnitude are unlikely to induce truthful disclosure from firms of any substantial size. To get a sense of the magnitudes required, note that Konar and Cohen (1998) find that poor environmental performance significantly reduced the intangible asset value of firms in the S&P 500, with the average intangible liability valued at 360 million dollars. For the average firm in the sample, the replacement value of tangible assets was roughly \$4.29 billion, so environmental liabilities averaged approximately 8.4% of the replacement value of tangible assets. For purposes of calibration, then, suppose conservatively that the firm has 1000 activities with environmental impacts, and that $u = 1$, so environmental successes provide no net benefit. Then $d = 0.997$. In addition, suppose only 10% of firms are likely to be audited, so that $\alpha = .1$. Then $u(u - d)/\alpha = .0247$, and for the average firm in the S&P 500, penalties would have to be roughly \$100 million per unreported activity to induce full disclosure. The \$5 million fine that can be levied under Sarbanes-Oxley is nowhere close to enough to discipline the reporting behavior of large firms.

If political constraints limit the fines that can be imposed, then the full disclosure equilibrium may fail to exist. In this case, it is natural to ask whether NGO auditing might complement mandatory disclosure requirements, and thereby restore the full disclosure equilibrium. We explore this question in the remainder of this section.

From section 5, we know that depending upon parameter values, in some cases it is more difficult to induce full disclosure by a firm of type $(0, 2)$, while in other cases it is more difficult to induce full disclosure from a firm of type $(1, 1)$. In addition, we know from section 4 that NGO punishment of greenwash affects only the incentives of firms of type $(1, 1)$. Suppose that $r > (u - 2d)/(u - d)$, so $F(0, 0; 0, 2)$ must be larger than any other penalty if full disclosure is to be

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[11]For example, many authors have criticized the Occupational Safety and Health Administration (OSHA) for setting fines that are too low to deter corporate safety violations. For details, see Weil (1996).

induced. Suppose also that the maximum politically feasible fine is $F_{\max}$. Then NGO auditing will be of no additional value if

$$F_{\max} \in \left(\frac{r(u-d)u}{\alpha}, \frac{(u-d)\left(ur^2 - d(1-r)^2\right)}{\alpha} \right).$$

In this case, greenwash is already deterred by the mandatory disclosure rules, and NGO auditing provides no additional effect on behavior.

Alternatively, suppose $r < (u - 2d)/(u - d)$, so $F(1,0;1,1)$ must be larger than any other penalty if full disclosure is to be induced. If $F_{\max} < r(u-d)u/\alpha$, then NGO auditing may in principle improve reporting behavior. Consider the case where
$$F_{\max} \in \left(\frac{(u-d)\left(ur^2 - d(1-r)^2\right)}{\alpha}, \frac{r(u-d)u}{\alpha} \right).$$

If mandatory disclosure rules exist, but there is no NGO auditing, then a firm of type $(0,2)$ prefers to fully disclose, rather than report $(0,0)$, but a firm of type $(1,1)$ prefers to engage in greenwash and report $(1,0)$. However, if the mandatory disclosure rules are supplemented by NGO auditing, and if $F(1,0;1,1) + P(1,0;1,1) > ru(u-d)/\alpha$, then a firm of type $(1,1)$ will prefer to report $(1,1)$ than to report $(1,0)$.

5.3   Mandatory Disclosure, NGO Auditing, and EMS

Given the magnitude of the fines needed to induce full disclosure, it is possible that even the combination of government-mandated fines and NGO penalties will fall short of the levels needed to induce full disclosure. If this is the case, then EMSs re-emerge as a complementary tool that may enhance the effectiveness of the other two mechanisms.

If legislatively-mandated fines are very small, e.g., if $F_{\max} < \underline{F}(0,0;1,1)$, then they alone will have no impact on the firm's behavior, and the situation is virtually the same as that in section 4. The one exception is that the total penalty that can be imposed on the firm for greenwashing is increased by the amount of the government-imposed fine, but this is a marginal effect.

If fines are moderate in size, matters become more complex. If $F_{\max} > \underline{F}(0,0;1,1)$, then a firm of type $(1,1)$ would be deterred from reporting $(0,0)$ if all other types had incentives to report truthfully. However, if types $(0,1)$ and/or $(0,2)$ have incentives to report $(0,0)$, then $\underline{F}(0,0;1,1)$ is not a sufficiently large fine to prevent the $(1,1)$ type firm from opting not to disclose. The firm's adoption of an EMS would improve matters, reducing incentives for non-disclosure.

In general, none of the three tools discussed here is likely to be sufficient to induce full disclosure of environmental liabilities by corporations. Combining the three offers promise for improving corporate disclosure, but a full analysis of the interplay between the three is beyond the scope of this paper.

6 Conclusions

This paper has presented what is to our knowledge the first economic analysis of greenwash. We defined greenwash as the selective disclosure of positive information about a company's environmental performance, without full disclosure of negative information on these dimensions. We then modeled the phenomenon using tools from the literature on financial disclosure. In our model, a non-governmental organization (NGO) can audit corporate environmental reports, and penalize firms caught engaging in greenwash. It is possible that the NGO's actions will deter greenwash, but we also identified conditions under which they will backfire and induce the firm to avoid disclosing any environmental information at all, an outcome that is worse than greenwash. The likelihood of this outcome is reduced if the firm has adopted an environmental management system (EMS), and the complementarity between EMSs and NGO auditing of greenwash points to a benefit from public policies that mandate the adoption of EMSs.

We also studied mandatory disclosure policies, and found that they have the potential to induce firms to fully disclose information about their environmental activities. However, the fines necessary to induce full disclosure may be so large as to be politically unpalatable. If this is the case, then disclosure may require the use of a set of complementary instruments, including mandatory disclosure standards, NGO auditing and implementation of EMSs.

There are a number of areas in which further research would be valuable. First, it would be interesting to allow for the firm's environmental activities to be heterogeneous in nature, varying in cost, likelihood of success, and environmental impact. This would allow for an analysis of firms' incentives to invest in projects known to have a high probability of success but low environmental value, an accusation leveled against some firms. In this case, greenwash may divert scarce funds from valuable risky projects to relatively certain but low-value projects. A second area meriting research is empirical study of greenwash, its effects on corporate valuation, and its interaction with NGO information campaigns.

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