

Informing Buyers vs. Regulators

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Abstract

Both the market and the regulator have incomplete information regarding the products' characteristics, but non-governmental organizations or activists often have expertise or motivation to investigate and acquire more information. Negative reports about a product's environmental externalities, for example, may either persuade a regulator to regulate the industry, or buyers to switch to better products. We show that the latter strategy, referred to as (informational) boycotts, is preferred and chosen when the industry in question is very competitive, while informational lobbying is preferred otherwise. There might be multiple equilibria, and the regulator may want to commit to an open-door policy to facilitate regulation. A closed-door policy is more likely to be preferred, we show, when one takes into account that also the market structure itself is endogenous.

Key words: Private politics, activism, informational lobbying, cheap talk, multiple audiences, hard vs. soft information, information acquisition,

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1 Introduction

A fundamental question in social science is how to take advantage of dispersedly distributed information. Agents that have particularly distinct views or preferences, here referred to as *activist groups*, may be especially motivated to acquire information and they may also try to use the information to persuade decision makers. In a regulated market economy, the important decision makers include the buyers and the regulator. Thus, on the one hand, activists might want to persuade the buyers to shed away from harmful products and switch to other products instead. Such informative activism may be interpreted as a *boycott*. On the other hand, activists might prefer *informational lobbying* if that can persuade regulators to reduce the harm from entire industries.

This paper analyses the choice between informational boycotts and lobbying and investigates how this choice should in itself be regulated. To do this, we start with a standard model of the market - represented as Cournot competition - and we allow an activist group (A) to have additional (soft or hard) information that it can report to the representative buyer (B) or a regulator (R).

Note that the two communication methods do not mix well. The buyer may carefully select his products only if the regulator remains passive, while the regulator is more willing to step in if (and only if) the buyer is careless. Thus, providing information to both B and R may lead to free-riding between the two of them, and also to multiple equilibria. Therefore, A may prefer to select one of the equilibria by communicating with only one of the two potential receivers. It can also be shown that A's communication with B tends to be less effective if B anticipates that A has a tendency to exacerbate in order to persuade R to act. Similarly, it may be harder for A to persuade R to regulate the market if R knows that when A informs B, B will in any case switch to the less harmful products. For these reasons, we mainly focus on comparing A's communication with B to A's communication with R.

We model A's report to B as cheap talk. A targets one firm and investigates the firm's type (f.ex., the emission content). Thereafter, A can send a message to B. In equilibrium, A will only report whether the targeted firm is "good" or "bad" compared to some endogenous threshold. A has an incentive to report honestly because B will move his purchasing decisions from bad firms to good firms. However, A will also have an incentive to persuade B that firms are (on average) bad because B will then purchase less overall. Therefore, A reports that the firm is "bad" more often than not, and this bias reduces the efficiency of communication.

When A communicates with R, we assume that A always prefers less emission and thus more regulation. With this assumption, there is no hope for informative cheap talk. At the same time, a regulator may have more expertise to verify information than do the buyers. For both reasons, we allow A to acquire and communicate hard, verifiable information on a firm's type when communicating with R. There will then be some threshold such that R will take action and regulate the industry if and only if the evidence is at least as significant as the

threshold.

When comparing the two strategies, we emphasize that the "B-equilibrium" (informational boycotts) is more efficient when the market is thick or the number of firms is large, since then consumers will easily switch from bad to good producers. If most of the firms are quite bad (in A's view), however, then A will find it hard to communicate credibly with B, since A is tempted to report "bad" too often in order to reduce the total production. Thus, informational lobbying is preferred in less competitive markets where most of the firms are "bad."

We also endogenize the firms' types. Suppose the firms can invest and reduce their emission content. When the number of firms in the market, n , is large, then there is an incentive to free-ride when the firms fear collective regulation, while there can be a "race to the top" to gain market shares when consumer campaigns are expected. Thus, firms invest more in the B-equilibrium than in the R-equilibrium when n is large. The opposite holds when n is small, because then buyers cannot switch so easily to other products, and a boycott is not credible/severe as a threat.

We further show that there may be multiple equilibria when n is large: If firms expect the R-strategy, they invest little, and then A finds it desirable to influence R. If the firms expect the B-equilibrium, they invest more, and this will in turn make the B-strategy more attractive from A's point of view. If R's (or A's) objective is to maximize the firms' investments, it may be desirable with a "closed-door policy" that makes communication between the regulator and the activist group less likely, so that the marked-disciplining equilibrium will be coordinated on. If n is small, R may instead want to commit to an "open-door policy" and facilitate communication with A, we show.

While our model is theoretical, it is interesting to note that the European Union does have a relatively open-door policy in that activist groups are often consulted before policy decisions are made. In the US, this is less common, according to commentators (we can and will add references here!). This difference fits well with our model since the US economy is ranked as being more competitive than markets in Europe, according to the The Global Competitiveness Index (2016-17). (Also the World Economic Forum ranks the US sixth in "intensity of local competition," and only the UK and Malta are ranked above the US in Europe.)

Of course, the market structure (and n) is in itself endogenous. Profit, and thus n (when there is free/costly entry), tend to be smaller when costly regulation can be expected. Thus, when entry is beneficial to R, for example because consumer surplus increases in the level of competitiveness, R may want to commit to a closed-door policy more often than when the market structure is perceived as being exogenous.

Literature [to be expanded/rewritten]. The issue of an interest group, such as activists, using either of the channels (launching a corporate campaign to persuade the buyers, or informing and lobbying the regulatory agency), is well studied in the literature. This is particularly true in the case of lobbying (Austen-Smith, 1993; Grossman and Helpman, 1994, 2001), but the literature

on corporate campaigns and boycotts instigated by activists is also vast (Baron, 2003, 2009; Baron and Diermeier, 2007).

The literature of investment in environmentally-friendly technologies, or other forms of self-regulation, by firms in a competitive environment is particularly relevant. Similar to our model, in Baron (2001), investments in corporation’s reputation increase demand for its product (in our model, consumers’ beliefs that a given company is polluting decrease consumers’ willingness to pay). In a different theory, Feddersen and Gilligan (2001) suggest that self-regulation by some of the competing firms helps them differentiate from each other thus reducing price competition. In other models, self-regulation does not lead to any direct benefits to the firms but is rather a response in order to avoid a boycott (Baron, 2003, among others), government action (e.g., Maxwell, Lyon, and Hackett, 2000), or both (Baron, 2014a; Egorov and Harstad, 2017). Maxwell, Lyon, and Hackett (2000) model a group of firms who can lobby for government regulation to prevent further entry, though they must self-regulate themselves to comply with the lobbied requirements. (See also Daubanes and Rochet, 2013, for society’s trade-off between having informed but captured regulators versus uninformed activists exert pressure on the industry, and Daubanes and Rochet, 2016.) Lyon and Maxwell (2008) provide an overview of theoretical motives for self-regulation.

Few papers study the activists’ strategic choice of targeting consumers versus regulators. On the theory side, Lyon and Salant (2013) model activists who use corporate campaigns to make some firms self-regulate, which in turn makes these firms willing to lobby for regulation in order to create a level playing field. Our paper focuses on the credibility trade-off in targeting, rather than such strategic considerations. Empirically, Eesley, Decelles, and Lenox (2015) study different activists’ tactics (e.g., boycotts or lawsuits) and show that activists tactics often vary by their cause.

Our paper is also related to IO literature on imperfectly informed buyers, price signals, and credence goods. In fact, our model is set up in a way to avoid the possibility of price signals, for the sake of simplicity. This is in line with Mahenc (2004), who also shows that the use of price signals is impossible without informed buyers (and in our model, all buyers are equally well—or poorly—informed).

2 The Market

The market is modelled as a standard Cournot game with n producers. The circular city model by Salop (1979), with transport costs as in a Hotelling model, would have given similar results.

To start from the basics, the payoff to a representative buyer (B) when buying quantity x_i from firm i at price p_i is assumed to be:

$$u = -\frac{a}{2} \left(b/a - \sum x_i \right)^2 - \sum_i \tilde{s}_i x_i - \sum_i p_i x_i.$$

The goods from the various firms are perfect substitutes, unless they are characterized by different $\tilde{s}_i$'s. Characteristic $\tilde{s}_i$ is not immediately observable to the consumer, and it can be interpreted as how damaging good i is for the environment, the consumer's individual health, the labor standards used in the production, or the amount of some other externality that the buyer internalizes. To fix ideas, we often refer to $\tilde{s}_i$ as firm i 's emission content (or the part of this emission that is taken into account by a single buyer). Since the characteristic $\tilde{s}_i$ may measure some externality, one buyer can also be harmed by the consumption of other buyers, but these harms would not be payoff-relevant (in that they would not influence a buyer's decision). We allow for the possibility that the activist group (A) cares much more than the consumer about the $\tilde{s}_i$'s.

For a start, we will assume that the harm can be written as $\tilde{s}_i = k_i + s_i$, where an iid shock $s_i \sim U[0, z]$ is uniformly distributed with density $1/z$ between 0 and z , while $k_i = Q - e_i$ is some additional emission level which declines in a firm's investment level e_i , relative to some exogenous level Q . The investments are discussed only at the end and then it will be showed that the firms are all investing the same amount $e_i = e$ so that $k_i = k = Q - e$ is the same for everyone. Until the end of the note, when we discuss investments, k will be treated as a primitive parameter of the model.

Although consumers may not observe the s_i 's directly, the consumer's expectation over s_i , Es_i , will influence the willingness to buy a good. Product i and j can both be purchased (and thus produced) if $Es_i + p_i = p_j + Es_j$. Thus, a larger Es_i will force the producer of product i to reduce the price. The lower price is further motivating the producer to produce a smaller quantity of the good.

The marginal production cost for firm i is c_i , which we assume is the same ($c = C/n$) for most of the analysis. Otherwise, parameters without subscripts refer to the sum, i.e., $s \equiv \sum_j s_j$, and $Es \equiv \sum_j Es_j$.

Proposition 0. *In equilibrium, firm i will produce the quantity:*

$$x_i = \frac{b + Es - (1 + n)Es_i - c - k}{(1 + n)a},$$

receive the profit:

$$\pi_i = \frac{1}{a} \left(\frac{b + Es - (1 + n)Es_i - c - k}{1 + n} \right)^2, \quad (1)$$

and the sum of externalities will be:

$$S \equiv \sum \tilde{s}_i x_i = (nk + s) \frac{b - k - c}{(1 + n)a} + \frac{Es(s - k) - (1 + n) \sum_j s_j Es_j}{(1 + n)a}. \quad (2)$$

Naturally, a firm will produce less if the firm's damage Es_i is expected to be large, since the firm will then receive a small price. The other firms will take

advantage of the reduced quantity and increase their production quantities (so, $\partial x_j / \partial E s_i > 0$ if $j \neq i$). As far as the quantity x_i and the profit is concerned, differences in the $E s_j$'s have the same effects as would any difference in the marginal production costs.

Although the consumer or buyer, B, may be uncertain about the s_j 's, a non-governmental organization or activist group, A, may be able or motivated to obtain more information. To keep things simple, we will (for the most part) assume that A monitors or targets a single firm and thereby observe the harm from this particular firm. Since the shocks are iid, it continues to be the case that $E s_j = z/2$ for the producers that are not monitored by A. The objective of A is to minimize the expected level of S .

Proof of Proposition 0.

Demand: For the consumers, the derivative of u wrt x_i is, when $x \equiv \sum_j x_j$:

$$b - ax - (p_i + \tilde{s}_i),$$

so, for every i such that $x_i > 0$, the derivative must equal zero, implying:

$$\tilde{s}_i + p_i = P \equiv b - ax.$$

The profit to firm i , having marginal production cost c_i , and obtaining the price $p_i = P - \tilde{s}_i$, is therefore:

$$(P - \tilde{s}_i - c_i) x_i = (b - ax - \tilde{s}_i - c_i) x_i$$

The firms' decisions: If we introduce the definition $y_i \equiv c_i + \tilde{s}_i$, and symbols without subscripts refer to the sum (so that $y \equiv \sum y_i$), then firm i 's foc is:

$$\begin{aligned} (b - ax - ax_i - \tilde{s}_i - c_i) &= 0 \Rightarrow \\ x_i &= \frac{P - y_i}{a} \Rightarrow \\ x &= \frac{nP - y}{a} = \frac{nb - nax - y}{a} \Rightarrow \\ b - ax &= P = b - nP + y \Rightarrow \\ P &= \frac{b + y}{1 + n} \Rightarrow \\ P - y_i &= \frac{b + y - (1 + n) y_i}{1 + n} \Rightarrow \\ x_i &= \frac{b + y - (1 + n) y_i}{(1 + n) a} \Rightarrow \\ x &= \frac{nb - y}{(1 + n) a}. \end{aligned}$$

With this, we can write the profit of producer i as:

$$\pi_i = \frac{1}{a} \left(\frac{b + y - (1+n)y_i}{1+n} \right)^2.$$

When y_i is unknown, the equilibrium will be as above if just y_i is replaced by Ey_i . The expected sum of the negative (externality) effects is then as follows.

$$\begin{aligned} S &\equiv \sum \tilde{s}_i x_i = \sum \tilde{s}_i \frac{b + Ey - (1+n)Ey_i}{(1+n)a} \\ &= \frac{\tilde{s}b + \tilde{s}Ey - \sum (1+n)\tilde{s}_i Ey_i}{(1+n)a} \\ &= \frac{\tilde{s}(b + Ey) - \sum (1+n)\tilde{s}_i Ey_i}{(1+n)a} \\ &= \frac{\tilde{s}(b + E\tilde{s} + C) - (1+n)\sum \tilde{s}_i (E\tilde{s}_i + c_i)}{(1+n)a}. \end{aligned}$$

With equilibrium effort e to reduce pollution from Q , we can just replace $\tilde{s}_i$ above with $s_i + k$, where $k = Q - e$ and let the shock s_i be iid and uniform on $[0, z]$, to get that the expected sum of pollution is:

$$\begin{aligned} S &= \frac{(s + nk)(b + kn + Es + C) - (1+n)\sum (s_i + k)(Es_i + k + c_i)}{(1+n)a} \\ &= \frac{(s + nk)(b + kn + Es + C) - (1+n)(kEs + nk^2 + kC + sk + \sum s_i (Es_i + c_i))}{(1+n)a} \\ &= \frac{(s + nk)b + s(Es + C) - (kEs + nk^2 + kC + sk) - (1+n)\sum s_i (Es_i + c_i)}{(1+n)a} \\ &= \frac{(s + nk)b + sC - nk^2 - kC - sk + Es(s - k) - (1+n)\sum s_i (Es_i + c_i)}{(1+n)a}. \end{aligned}$$

QED

3 Boycotts

The activist group, A, seeking to minimize S , is able to investigate and observe s_i . We will here assume A can send a cheap-talk message to B regarding what firm i 's type is, in the hope that such a message will influence B's purchasing decision, and thereby the produced quantities. We further assume that the buyer B cannot verify what A observes, so s_i is in this respect "soft information" to A. (It may also be simple to assume that the firms are equally unaware of the s_i 's as is the buyer, although the equilibrium below continues to remain an equilibrium if the firms are aware of their characteristics.)

In the equation (2) for S , s_i is i 's actual type, while Es_i is what the consumers believes that the type is. A larger belief, as measured by Es_i , has two implications:

On the one hand, a larger expected type Es_i (holding the *other* expected types constant) means that consumers *switch away from product i and instead to the other products*. This effect is negative, in that it reduces S , if product i is actually relatively good (i.e., if $s_i < z/2$).

On the other hand, a larger expected type Es_i means that the sum $Es = E \sum s_i = \frac{n-1}{2}z + Es_i$ is larger, and therefore the *total produced amount, x , goes down* (and then S tends to go down as well).

This latter effect may motivate A to announce that firm i is "bad" even if s_i is (slightly) less than the average $z/2$.

The sum of the two effects are given by this equation:

$$\frac{\partial S}{\partial Es_i} = -n \frac{s_i - z/2 + [k + z/2]/n}{(1+n)a}. \quad (3)$$

According to (3), A understands that by reporting that i has a large emission level, total S goes down if and only if $\frac{\partial S}{\partial Es_i} < 0 \Leftrightarrow s_i > l \equiv \frac{z}{2} - \frac{k+z/2}{n}$.

Therefore, when A only knows one firm i 's type, there are only two possible equilibrium messages, even if the message space is arbitrarily large. A will say the firm is "bad" or has a large harm if $s_i > l \equiv \frac{z}{2} - \frac{k+z/2}{n}$, but otherwise A prefers to announce that firm i is relatively "good" and has a small harm $s_i \leq l$. We have that the threshold is $l < z/2$, because a "bad" announcement will decrease overall consumption, as mentioned above. However, when $n \rightarrow \infty$, there is no shift in the overall sum of consumption, since one "bad" firm just allows consumers to switch to the other firms, and the threshold is simply $z/2$. For a smaller n , the threshold is smaller when k is large because a large k (meaning that all firms are polluting) makes it very tempting for A to announce that the firm is "bad" (since the sum of consumption will then decrease) even if this firm happens to be relatively better than the expected types of the other firms, i.e., $z/2$.

Proposition 1. *The equilibrium message from A to B is that the targeted firm i is "bad" iff $s_i > l \equiv \frac{z}{2} - \frac{1}{n}(\frac{z}{2} + k) < \frac{z}{2}$, and "good" otherwise. If $n \rightarrow \infty$, $l \rightarrow \frac{z}{2}$.*

The proof follows from (3). Note that A has no credibility, and provides no information to B, if $l = 0$, i.e., if:

$$n \leq 1 + 2k/z \Leftrightarrow k > (n-1)z/2.$$

The consumers are rational and can calculate l . When $l \in [0, z]$, a "bad" announcement leads to the belief $Es_i = l/2 + z/2$, while a "good" report (suggesting that s_i is small) means that the expectation of the consumer is $Es_i = l/2$.

If the threshold l is relatively close to $z/2$ (f.ex. because k is small) A's campaign will have a quite positive effect on the expected S , because consumers will switch away from the targeted firm if it is bad, and towards it, if it is good. Relative to the expected S , when there is no campaign at all, it is easy to derive

the *expected* reduction in S (unconditional on the realization s_i) if A is going to target firm i only.

Proposition 2. *When A informs B, the expected decrease in S is:*

$$D_B = \frac{(zn)^2 - (2k + z)^2}{16an(1+n)}.$$

Note that the expected reduction in S , D_B , is smaller if k is large, because A may then be tempted to announce "bad" even if the investigated firm has a type that is (slightly) less than the average type. After all, a "bad" announcement decreases the sum of consumption. The buyer anticipates this, of course, and will react less to A's claim. Therefore, communication is harmed by a larger k and D_B is then smaller.

A larger heterogeneity between the firms, as measured by z , is instead increasing D_B , because the expected type is then changing quite a lot whether the firm is claimed to be bad or good.

Proof of Proposition 2.

Compared to the status quo (with no information) a bad report generates the belief $Es_i = \frac{1}{2}(z + l) = \frac{1}{2}(3\frac{z}{2} - \frac{1}{n}(\frac{z}{2} + k))$, so the change in belief can be written as: $ds_i = Es_i - \frac{z}{2} = \frac{l}{2} = \frac{1}{2}(\frac{z}{2} - \frac{1}{n}(\frac{z}{2} + k))$.

A good report implies $Es_i = l/2 = \frac{1}{2}(\frac{z}{2} - \frac{1}{n}(\frac{z}{2} + k))$, so $ds_i = Es_i - z/2 = -\frac{1}{2}(\frac{z}{2} + \frac{1}{n}(\frac{z}{2} + k))$. Hence the changes in quantities are:

$$\begin{aligned} dx_i &= \frac{-nds_i}{(1+n)a} \in \left\{ \frac{n}{(1+n)a} \frac{1}{2} \left(\frac{z}{2} + \frac{1}{n} \left(\frac{z}{2} + k \right) \right), \frac{-n}{(1+n)a} \frac{1}{2} \left(\frac{z}{2} - \frac{1}{n} \left(\frac{z}{2} + k \right) \right) \right\} \\ &= \frac{n}{2(1+n)a} \left\{ \frac{z}{2} + \frac{1}{n} \left(\frac{z}{2} + k \right), -\frac{z}{2} + \frac{1}{n} \left(\frac{z}{2} + k \right) \right\} = \frac{k + z/2}{2(1+n)a} \pm \frac{zn}{4(1+n)a} \\ dx_j &= \frac{ds_i}{(1+n)a} \in \frac{1}{(1+n)a} \left\{ \frac{1}{2} \left(\frac{z}{2} - \frac{1}{n} \left(\frac{z}{2} + k \right) \right), -\frac{1}{2} \left(\frac{z}{2} + \frac{1}{n} \left(\frac{z}{2} + k \right) \right) \right\} = \\ &= -\frac{k + z/2}{2n(1+n)a} \pm \frac{z}{4(1+n)a}. \end{aligned}$$

So, after a bad report (which is issued with probability $\frac{1}{z}(z - l) = \frac{1}{z}(z - (1 - \frac{1}{n})\frac{z}{2} + \frac{k}{n}) =$

$\frac{1}{2} + \frac{z/2+k}{zn}$), the change in S is:

$$\begin{aligned}
EdS &= \left(\frac{z+l}{2} \right) dx_i + (n-1) \frac{z}{2} dx_j = \frac{1}{2} \left(3\frac{z}{2} - \frac{1}{n} \left(\frac{z}{2} + k \right) \right) \left[\frac{k+z/2}{2(1+n)a} - \frac{zn}{4(1+n)a} \right] \\
&\quad + (n-1) \frac{z}{2} \left[-\frac{k+z/2}{2n(1+n)a} + \frac{z}{4(1+n)a} \right] \\
&= \frac{1}{2} \left[3\frac{z}{2} - \frac{1}{n} \left(\frac{z}{2} + k \right) - (n-1) \frac{z}{n} \right] \frac{k+z/2}{2(1+n)a} - \frac{1}{2} \left[3\frac{z}{2} - \frac{1}{n} \left(\frac{z}{2} + k \right) - \frac{z}{n} (n-1) \right] \frac{zn}{4(1+n)a} \\
&= \frac{1}{2} \left[\frac{z}{2} - \frac{1}{n} \left(k - \frac{z}{2} \right) \right] \frac{k+z/2}{2(1+n)a} - \frac{1}{2} \left[\frac{z}{2} - \frac{1}{n} \left(k - \frac{z}{2} \right) \right] \frac{zn}{4(1+n)a} \\
&= \frac{1}{2} \left[\frac{z}{2} - \frac{1}{n} \left(k - \frac{z}{2} \right) \right] \left(\frac{2k-z(n-1)}{4(1+n)a} \right) = \frac{1}{2} \left[\frac{z(n+1)-2k}{2n} \right] \left(\frac{2k-z(n-1)}{4(1+n)a} \right) \\
&= -\frac{1}{2} \left[\frac{(zn-2k)^2 - z^2}{8n(1+n)a} \right] = -\frac{(zn-2k)^2 - z^2}{16an(1+n)} < 0.
\end{aligned}$$

After a good report, which is issued with probability $l/z = \frac{1}{2} - \frac{1}{zn} \left(\frac{z}{2} + k \right)$,

$$\begin{aligned}
EdS &= \frac{l}{2} dx_i + (n-1) \frac{z}{2} dx_j = \frac{1}{2} \left(\frac{z}{2} - \frac{1}{n} \left(\frac{z}{2} + k \right) \right) \left[\frac{k+z/2}{2(1+n)a} + \frac{zn}{4(1+n)a} \right] \\
&\quad + (n-1) \frac{z}{2} \left[-\frac{k+z/2}{2n(1+n)a} - \frac{z}{4(1+n)a} \right] \\
&= \frac{1}{2} \left(\frac{z}{2} - \frac{1}{n} \left(\frac{z}{2} + k \right) - (n-1) \frac{z}{n} \right) \left[\frac{k+z/2}{2(1+n)a} + \frac{zn}{4(1+n)a} \right] \\
&= \frac{1}{2} \left(-\frac{k}{n} - (n-1) \frac{z}{2n} \right) \left[\frac{2k+z(n+1)}{4(1+n)a} \right] = -\frac{1}{4n} \left[\frac{(2k+zn)^2 - z^2}{4(1+n)a} \right] \\
&= -\frac{(zn+2k)^2 - z^2}{16an(1+n)}.
\end{aligned}$$

So, in total, the expected change in S is:

$$\begin{aligned}
&-\frac{(zn-2k)^2 - z^2}{16an(1+n)} \left[\frac{1}{2} + \frac{z/2+k}{zn} \right] - \frac{(zn+2k)^2 - z^2}{16an(1+n)} \left[\frac{1}{2} - \frac{z/2+k}{zn} \right] \\
&= -\frac{(zn)^2 + 4k^2 - z^2}{16an(1+n)} + \frac{8kzn}{16an(1+n)} \left[\frac{z/2+k}{zn} \right] \\
&= -\frac{(zn)^2 + 4k^2 - z^2}{16an(1+n)} + \frac{4k(z+2k)}{16an(1+n)} \\
&= -\frac{(zn)^2 - 4k^2 - z^2 - 4kz}{16an(1+n)} = -\frac{(zn)^2 - (2k+z)^2}{16an(1+n)}.
\end{aligned}$$

QED

4 Lobbying

As an alternative to targeting the buyer B, the activist group A may seek to influence the public regulator, R. In contrast to B, it may be reasonable to assume that R has more expertise and can verify A's claim regarding the type of firm i . We thus here assume that if A targets firm i , A obtains hard information on s_i which it can disclose to R. (If R must pay some verification cost to observe s_i , the results would not change as long as this cost would be small.)

Further, suppose that R will regulate with some probability q if it has been proved (by hard information) that $s_1 > s'$, for some given threshold s' . We can endogenize this threshold in several alternative ways by making assumptions on R's objective function. For our purposes, there is no need to do that here. Also, assume that regulation will mean that S is reduced to some level, $\underline{S}$. For the most part, we will assume that $\underline{S} = 0$.

Suppose that consumers are unaware of the lobbying effort and continues to have beliefs $Es_i = z/2$ for every firm, even if lobbying fails and there turns out to be no regulation. [Remark to be elaborated upon: In principle, consumers should understand that no regulation (failed lobbying) is good news and that the emission level is likely to be small, and then consumption will increase. However, this effect is small if activist groups are rare or rarely active in one particular industry. Also, accounting for this effect would not change the results below qualitatively.]

Proposition 3. *The expected reduction in S , compared to business-as-usual, is:*

$$D'_R = q \left(1 - \frac{s'}{z} \right) \left[\xi \left(\frac{s'}{2} + n \left[k + \frac{z}{2} \right] \right) - \underline{S} \right], \text{ where } \xi = \frac{b - C/n - k - z/2}{(1 + n)a}.$$

Proof of Proposition 3. With this assumption, the expected change in S comes from the formula (2) above, where the s_1 , given that regulation will take place (because $s_1 > s'$) is on average $(s' + z)/2$. Further, s_1 happens to be in this range with probability $(z - s')/z = 1 - \frac{s'}{z}$, since z is also the density of the distribution of s_1 . For the other firms, the expected s_i is simply $z/2$. The consumers are assumed to be unaware of everything and continue to have $Es_i = z/2$ for all firms.

Thus, the expected reduction in S under this type of regulation is D'_R , IF

$C = \sum c_i$ and $c_i = C/n$ is exactly the same for everyone:

$$\begin{aligned}
D'_R &= q \left(1 - \frac{s'}{z}\right) \left[\frac{k \frac{nb-nk-C}{(1+n)a} + \frac{b+C-k}{(1+n)a} \left(\frac{nz}{2} + \frac{s'}{2}\right) +}{\frac{n \frac{z}{2} \left(\frac{nz}{2} + \frac{s'}{2} - k\right) - (1+n) \left(\frac{nz}{2} + \frac{s'}{2}\right) \left(\frac{z}{2} + c_i\right)}{(1+n)a}} - \underline{S} \right] \\
&= q \left(1 - \frac{s'}{z}\right) \left[\frac{k \frac{nb-nk-C}{(1+n)a} + \frac{b+C-k}{(1+n)a} \left(\frac{nz}{2} + \frac{s'}{2}\right) +}{\frac{n \frac{z}{2} (-k) - \left(\frac{nz}{2} + \frac{s'}{2}\right) \left(\frac{z}{2} + c_i\right) - n \left(\frac{nz}{2} + \frac{s'}{2}\right) c_i}{(1+n)a}} - \underline{S} \right] \\
&= q \left(1 - \frac{s'}{z}\right) \left[\frac{k \frac{nb-nk-C}{(1+n)a} + \frac{b+C-k}{(1+n)a} \left(\frac{nz}{2} + \frac{s'}{2}\right) +}{\frac{-n \frac{z}{2} k - \left(\frac{nz}{2} + \frac{s'}{2}\right) \left(\frac{z}{2} + \left(\frac{1+n}{n}\right) C\right)}{(1+n)a}} - \underline{S} \right] \\
&= q \left(1 - \frac{s'}{z}\right) \left[k \frac{nb-nk-C-nz/2}{(1+n)a} + \frac{b-C/n-k-z/2}{(1+n)a} \left(\frac{nz}{2} + \frac{s'}{2}\right) - \underline{S} \right] \\
&= q \left(1 - \frac{s'}{z}\right) \left[\frac{b-C/n - \left[k + \frac{z}{2}\right]}{(1+n)a} \left(\frac{s'}{2} + n \left[k + \frac{z}{2}\right]\right) - \underline{S} \right], \text{ rewritten as} \\
D'_R &= q \left(1 - \frac{s'}{z}\right) \left[\xi \left(\frac{s'}{2} + n \left[k + \frac{z}{2}\right]\right) - \underline{S} \right] \text{ where } \xi = \frac{b-C/n-k-z/2}{(1+n)a}
\end{aligned}$$

QED

5 The Choice Between Lobbying and Boycotts

Suppose A chooses between communicating with R and B, and suppose A makes this choice before knowing anything on s_1 .

Proposition 4. *Suppose that $\underline{S} = c = 0$.*

A prefers to target R instead of B if and only if n is small and k is large, i.e., if $n < \tilde{n}(k)$ for some increasing function $\tilde{n}(k)$, where $\tilde{n}(k)$ is implicitly defined by the following condition (which is equivalent to $n < \tilde{n}(k)$ and also to $k > \tilde{k}(n)$):

$$q \left[1 - \frac{s'}{z}\right] \left(\frac{b-\eta}{\frac{nz}{2}-\eta}\right) > \frac{1}{4n} \left(\frac{\frac{nz}{2}+\eta}{\frac{s'}{2}+n\eta}\right), \text{ where } \eta \equiv k + z/2. \quad (4)$$

The intuition is as follows. If n is large, then boycotts are effective in reducing S because consumers can easily switch to other, better producers. Thanks to this effect, A is also more willing to report honestly whether a firm is good/bad when n is large, and this is further strengthening the effectiveness of boycotts.

If k is large, so that most firms are quite harmful, then A is quite tempting to report that the targeted firm is bad and the efficiency of communication declines, in that l declines. In addition, A's benefit of regulation, which reduces

overall S , becomes more significant. For both reasons, A prefers to influence R when k is large.

If we endogenize s' in a realistic way so that R becomes harder to persuade based on one single evidence, then s' increases in n , and this strengthens the results. (If k is large, R is easier to persuade, and this should reduce s' , again strengthening the result.)

By comparison with boycotts, targeting R also seems better if b large, because then the market size is large and it becomes more important for A to reduce total emission to some fixed quantity (here assumed to be zero). (Of course, if we endogenize n , n may increase in b , counteracting the direct effect of b .)

Proof of Proposition: Comparing this type of deterministic Regulation with Boycotts (Soft info to consumers), A, who minimizes the expected S , prefers R over B by A IF $D'_R > D_B$. The inequality $D'_R > D_B$ becomes, if $\underline{S} = C = 0$ and $\eta \equiv k + z/2$:

$$\begin{aligned} q \left(1 - \frac{s'}{z} \right) \left[\xi \left(\frac{s'}{2} + n \left[k + \frac{z}{2} \right] \right) - \underline{S} \right] &> \frac{\left(\frac{nz}{2} - \eta \right) \left(\frac{nz}{2} + \eta \right)}{4an(1+n)} \Rightarrow \\ q \left(1 - \frac{s'}{z} \right) (b - \eta) \left(\frac{s'}{2} + n\eta \right) &> \frac{\left(\frac{nz}{2} - \eta \right) \left(\frac{nz}{2} + \eta \right)}{4n} \Rightarrow \\ q \left[1 - \frac{s'}{z} \right] \left(\frac{b - \eta}{\frac{nz}{2} - \eta} \right) &> \frac{1}{4n} \left(\frac{\frac{nz}{2} + \eta}{\frac{s'}{2} + n\eta} \right), \end{aligned}$$

which is more likely to hold when k is large (at least if we assume that $b > \frac{nz}{2}$), because the first parenthesis increases in k while the second decreases. Also, the inequality is more likely to hold when n is small, because we can rewrite the inequality as:

$$4q \left[1 - \frac{s'}{z} \right] (b - \eta) \left(\frac{s'}{2} + n\eta \right) > n \left(\frac{z}{2} \right)^2 - \eta^2,$$

where the LHS increases less than proportionally in n , while the RHS increases faster than proportionally in n . **QED**

6 Endogenizing Firm Types

If we return to the model described at the beginning, we have that a firm i 's actual emission level is $\tilde{s}_i = s_i + k_i = s_i + Q - e_i$, where Q is a constant, s_i is an iid shock, while e_i is the firm's investment level. Suppose now that firms invest simultaneously at the start of the game (at some sufficiently convex investment-cost function, $c(e_i)$).

In equilibrium, every firm will invest the same so that $e_i = e$ is the same for every firm, and so is $k = Q - e$. Since this is anticipated in equilibrium, if A

investigates the firm and observes $\tilde{s}_i$, this is (as assumed above) equivalent to letting A observe the shock s_i .

If A is expected to influence buyers, then, with some probability p_n^B (perhaps equal to $1/n$), a given firm will be targeted by A in that A will observe this firm's quality/emission and A will announce whether the firm is "bad" or good" depending on the observed $\tilde{s}_i$. No other firms will be targeted.

If, instead, A is expected to influence R, then, with some probability p_n^R (perhaps equal to $1/n$), a given firm will be targeted. If it then turns out that $\tilde{s}_i$ is above some threshold, then R will regulate the entire industry with probability q , as already described. The consequence of regulation for the firm is that it may face some regulatory cost, which we for now will assume is equal to a fraction z of the firm's profit. (Perhaps this fraction is 1, if regulation implies that R closes down the industry because it is too harmful.) We further assume that p_n^R/p_n^B is not a function of n .

Proposition 5. *There exists some threshold $\hat{n}$, such that, if $n < \hat{n}$, then firms invest more if A is expected to target R instead of B. If $n > \hat{n}$, firms invest more if A is expected to target B instead of R. When $n = \hat{n}$, investments and thus k is the same in the two cases and $\hat{n}$ can be written as:*

$$\hat{n} = \frac{4zqp_n^R (b - c - k - \frac{z}{2})^2}{p_n^B z(4b - z + 2k)}.$$

Intuitively, a larger n leads to a (relatively) larger loss of consumers for a targeted firm that is reported to be bad, while a larger increase if it is reported to be good. This sensitivity makes the boycott relatively effective and the firms have a lot to gain by investing more and thus raise the odds that it will be praised as good instead of being blamed as bad. To some extent, one can say that when n is large, then the threat of boycotts leads to a "race to the top" among the firms, who each has a lot to gain from being reported as good instead of bad. The threat of regulation, on the other hand, is a public bad for the set of firms and the free-riding incentives imply that they invest less (to avoid collective regulation) when n is large.

Proof of Proposition 5. The proof has three parts.

(i) *Firms' incentives under boycotts:*

From the profit-function above, we get that being targeted and praised as

"good" rather than "bad" increases the firm's profit by:

$$\begin{aligned}
& \frac{1}{a} \left(\frac{b + (n-1)z/2 - n\frac{1}{2} \left(\frac{z}{2} - \frac{1}{n} \left(\frac{z}{2} + k \right) \right)}{1+n} \right)^2 \\
& - \frac{1}{a} \left(\frac{b + (n-1)z/2 - n\frac{1}{2} \left(3\frac{z}{2} - \frac{1}{n} \left(\frac{z}{2} + k \right) \right)}{1+n} \right)^2 \\
& = \frac{1}{a} \left(\frac{b + (n-1)z/2 - n\frac{1}{2} \left(2\frac{z}{2} - \frac{1}{n} \left(\frac{z}{2} + k \right) \right) + \frac{nz}{4}}{1+n} \right)^2 \\
& - \frac{1}{a} \left(\frac{b + (n-1)z/2 - n\frac{1}{2} \left(2\frac{z}{2} - \frac{1}{n} \left(\frac{z}{2} + k \right) \right) - \frac{nz}{4}}{1+n} \right)^2 \\
& = \frac{nz}{a} \frac{b + (n-1)z/2 - n\frac{1}{2} \left(2\frac{z}{2} - \frac{1}{n} \left(\frac{z}{2} + k \right) \right)}{(1+n)^2} \\
& = \frac{nz}{a} \frac{b - z/2 + n\frac{1}{2} \left(\frac{1}{n} \left(\frac{z}{2} + k \right) \right)}{(1+n)^2} = \frac{nz}{a} \frac{b - z/2 + \frac{1}{2} \left(\frac{z}{2} + k \right)}{(1+n)^2} \\
& = \frac{nz}{4a} \frac{4b - z + 2k}{(1+n)^2}.
\end{aligned}$$

Since one is targeted with prob p_n^B , and one more invested unit shifts the distribution of types to the types that will be "good" with density is $1/z$, we get the following: If the cost of effort is $c(e_i)$, the equilibrium effort is e^B , and $k^B = Q - e^B$, the firms' investments satisfy:

$$c'(e^B) = p_n^B n \frac{4b - z + 2^B k}{4a(1+n)^2}. \quad (5)$$

The 2OC holds because a larger investment decreases $k^B = Q - e^B$, and this limits c' in the above equation, and thus the firms' investments.

Note: Firms invest more if the market is large (b is large or a is small), and if density of shock is large because then being "good" leads the buyers to believe that the firm is significantly much better than the others (since heterogeneity is large when z is large).

(ii) *Firms' incentives under lobbying:*

We here assume that there is some threshold s' such that if s_i is proven to be above s' , then R regulates (after A provides hard info) with probability q , and i makes some loss, L . By investing one more unit, this probability is reduced by qp_n^R/z , since $1/z$ is the density. Thus, firms' equilibrium investments are given by:

$$c'(e^R) = \frac{qp_n^R L}{z}.$$

For example, L may be equal to a firm's entire profit if R closes down the industry because it is polluting too much.

With (1), $y_i \equiv c + \tilde{s}_i$, and $\tilde{s}_i = s_i + k$, we get the following expected profit when there is no activism and the expected s_i is $z/2$

$$E\pi_i = \frac{1}{a} \left(\frac{b - c - k - z/2}{1 + n} \right)^2.$$

Regulation may imply that a firm loses a fraction $\varkappa$ of this profit. Then, each firm invests such as to:

$$c'(e^R) = \frac{\varkappa q p_n^R}{za} \left(\frac{b - C/n - k^R - z/2}{1 + n} \right)^2. \quad (6)$$

which is smaller if n and z are large. Note that, because $k^R = Q - e^R$, the 2OC will hold only if the function $c(\cdot)$ is sufficiently convex. Suppose this is the case.

(iii) *Comparison.*

We can now compare the investments. Consider a special case where the two investments are exactly the same, so $k^B = k^R = k$. Then, from (5) and (6):

$$\begin{aligned} p_n^B n \frac{4b - z + 2k}{4a(1 + n)^2} &= \frac{\varkappa q p_n^R}{za} \left(\frac{b - c - k - z/2}{1 + n} \right)^2 \iff \\ \left(\frac{p_n^B}{4\varkappa q p_n^R} \right) zn [4b - z + 2k] &= (b - c - k - z/2)^2. \end{aligned} \quad (7)$$

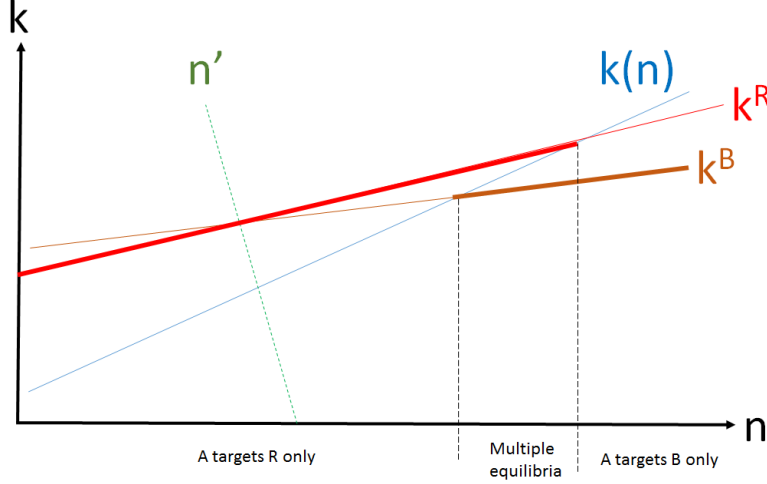
If $c = 0$, the left-hand side increases in n but the right-hand side does not, implying that investments must be larger under boycotts if n is sufficiently large. The threshold $\hat{n}$ is implicitly defined by (7) when we recognize that $k = Q - e$ and e is the equilibrium effort, as $e^R = e^B$ when $n = \hat{n}$. Also, if the (equilibrium) k is larger, the left-hand side of (7) increases while the right-hand side declines, so $\hat{n}$ must decrease. **QED.**

7 Multiple and Mixed-Strategy Equilibria

From the analysis above, we know that after the investment (and thus k) is sunk, A prefers to target R iff $n > \hat{n}(k)$. At the same time, k depends on A's expected strategy, and $k^B > k^R$ iff $n > \hat{n}$.

Therefore, if $n > \hat{n}$, there can possibly be multiple self-fulfilling equilibria: Firms might invest a lot because they expect boycotts, and exactly therefore A boycotts rather than lobby. In another possible equilibrium, firms invest little because they expect that A targets R instead, and therefore A will indeed target R.

If $n < \hat{n}$, there is instead a unique equilibrium. However, there might not be a unique equilibrium in pure strategies: If firms expect A to boycott, then firms invest little, and then A prefers to target R (and vice versa). If there are such "cycles," the unique mixed-strategy equilibrium must be such that firms



invest exactly $\tilde{k}(n)$, and A randomizes between lobbying and boycotts with probabilities such that firms are in fact willing to invest exactly $\tilde{k}(n)$.

Proposition 6.

(i) If $n > \hat{n}$, the equilibrium is boycotts if the investment costs are small, lobbying if the investment costs are large, and for moderate investment costs, both equilibria may exist (because investments are larger with boycotts).

(ii) If $n < \hat{n}$, the equilibrium is boycotts if the investment costs are very small, lobbying if the investment costs are very large, and for moderate investment costs, equilibrium investments are given by k satisfying $\hat{n} = \tilde{n}(k)$, so that A is indifferent between boycotts and lobbying, and A randomizes between the two actions with probabilities such that the firms are indeed willing to invest the level k satisfying $\hat{n} = \tilde{n}(k)$.

The proof would be based on the other propositions/reasonings above.

In the figure below, $k(n) \equiv \tilde{k}(n)$ is the upward-sloping blue line, while $n' \equiv \hat{n}$ is drawn as the dotted (downward-sloping) green line.

We have not found it necessary to assume anything about the investment costs (except for sufficient convexity) and how they may or may not depend on n , but it is reasonable that both equilibrium investment levels e^R and e^B will decrease in n , implying that the equilibrium pollution levels k^R and k^B will increase in n (The figures have drawn the curves in this way, and here the curves are drawn as relatively flat, although this is not necessary for the results). What we do know is that k^R increases in n faster than does k^B , leading to the point $n' \equiv \hat{n}$ at which they cross.

There are (at least) two interesting possibilities mentioned in Proposition 6.

First, assume that the investment costs are so large that k^B and k^R cross at some k that is above the blue line $k(n) \equiv \tilde{k}(n)$. This is illustrated in the first

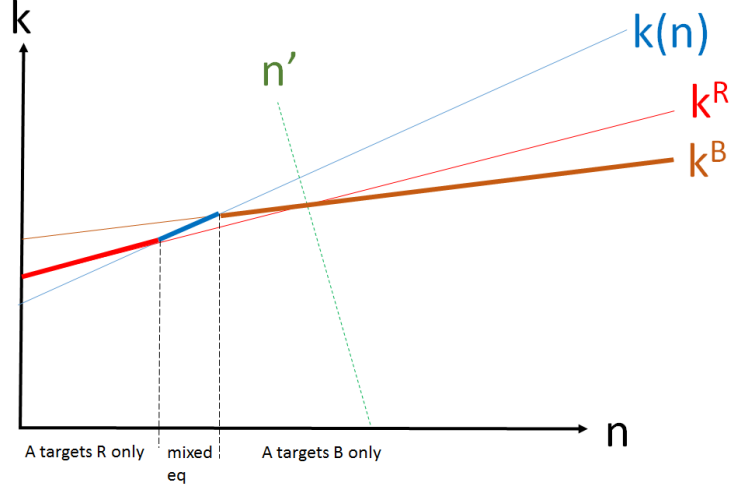


figure.

Then, around this point, the investment costs are so large, and the equilibrium pollution level is so large, that A targets R and R might regulate. For smaller n 's, A continues to prefer lobbying and targets R. However, it is possible that when n is very large, k^B might cross $k(n)$, and for so large n , we have the two multiple equilibria discussed in Proposition 6(i). For even larger n 's, even the k^R might cross $k(n)$ and for so large n 's, A targets B (with soft information in the unique equilibrium).

In the figures, all pairs of (k, n) that constitute an equilibrium are drawn with **bold/tick** lines.

A second possibility, illustrated in the second figure, arises when the investment costs are so small that k^R and k^B cross for some k which is below the line $k(n)$. Then, around this point, the pollution level is so small that A does not want to attempt to lobby, and A boycotts instead.

However, for n quite small, we might have the mixed-strategy equilibrium, discussed in Proposition 6(ii). For such small n 's, we have the mixed-strategy equilibrium where A randomizes and the firms invest exactly $k(n)$, illustrated as the (blue) bold segment of $k(n)$. For even smaller n 's, A targets R only in the unique equilibrium.

8 Regulating Lobbying

In reality, R can influence its willingness/ability to be influenced by A's lobbying effort. That is, the parameters s' and q may be endogenous, or there may be

a cost of obtaining hard information (that could depend on what R defines as "hard").

If $n > \hat{n}$, investments are larger if boycotts are expected, but, as mentioned, there may be multiple equilibria. To ensure that the B-equilibrium is selected, R (and also A) may want to make lobbying impossible or difficult/costly/unattractive. That is, with many firms, R should try to commit to rules for not communicating with A.

If $n < \hat{n}$, instead, investments may be higher because of the possibility that A might lobby. To ensure such large investments, R (and also A) may want to commit to being available for lobbying so that future lobbying will indeed be credibly anticipated (for example because R has an open-door policy, or because hard information is inexpensive).

Proposition 7.

(i) If $n > \hat{n}$, investments might be higher if R commits to an closed-door policy.

(ii) If $n < \hat{n}$, investments might be higher if R commits to an open-door policy.

The proof follows from the propositions/reasoning above. The EU is indeed well-known to be frequently inviting activist groups.

9 Endogenous Market Structure

While we have above taken the number firms as given, this number can be endogenized if one allows for entry at some entrance cost. In equilibrium, the firms will enter until the profit for each firm equals the entrance cost. Thus, there will be a mapping from the entrance cost to the equilibrium number of firms. The results above, stated as conditional on the number of firms, can instead be stated conditional on the entrance cost. If one believes that the entrance cost is higher in the EU than in the US, then the equilibrium number of firms will be smaller in the EU, and thus we should expect activists to influence regulators rather than buyers more often in the EU than in the US, and the government should prefer to commit to an open-door policy more often, as well.

But the equilibrium number of firms will also depend on whether A is expected to influence B or R. Since the profit function is convex in the expected type, the expected profit in the B-equilibrium is larger than $\pi\left(\frac{\bar{z}}{2}\right)$, which, in turn, is larger than the expected profit in the R-equilibrium. With free entry and similar investment costs, the number of firms must thus be larger in the B-equilibrium. Of course, if the equilibrium investments are much larger in an equilibrium with boycotts, then the overall profit (net of investment costs) can be smaller with boycotts and then entry can be smaller, as well.

Proposition 8. *For every given investment level, the equilibrium number of firms is larger when A influences B instead of F . Thus, when entry is valuable, it may be optimal with a closed-door policy more often than predicted by Proposition 7.*

In other words, even if an open-door policy to activists' informational lobbying may raise firms' investments and thus be beneficial in the EU (if one takes the market structure as given), a closed-door policy may still be better if one takes into account the equilibrium number of firms that will enter.

10 Conclusions

This paper compared activists' provision of information to markets (or buyers) vs. planners (or regulators). The first type of strategy can be interpreted as private politics and boycotts, and is preferred, we showed, when the market is competitive. With fewer firms in the market, informational lobbying is preferred instead. Since there may be multiple (self-enforcing) equilibria, one may in the latter case want to commit to an open-door policy, in which activists can (easily) provide information to the regulator before the regulator decides on its policy. This is indeed what one observes in the European Union, where the regulators have institutionalized meetings with various NGOs to a larger extent than in the US. Even though this practice may motivate the firms to invest in quality and emission-reductions, the lower profit associated with public regulation can deter entry and ultimately welfare. If one takes into account the effect on the market structure, the open-door policy is less likely to be optimal than otherwise.

The model is extremely stylized and should be extended in several directions. Current research is focusing on explaining why the combination of informational lobbying and boycotts is rarely preferred, and thus why it makes sense to analyze the two strategies separately rather than together. We have also considered only a very special form of regulation, and we have assumed a simple objective function for the activists. Future research should generalize the model in these and several other directions.

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