Watchdogs of the Invisible Hand: NGO Monitoring, Corporate Social Responsibility and Industry Equilibrium

Gani ALDASHEV, Michela LIMARDIZ, Thierry VERDIER

CRED – November 2013

Department of Economics
Working Papers
2014/04

UNIVERSITÉ DE NAMUR

Watchdogs of the Invisible Hand: NGO Monitoring, Corporate Social Responsibility, and Industry Equilibrium*

Gani Aldashev[†], Michela Limardi[‡], Thierry Verdier[§]

November 18, 2013

Abstract

Globalization has been accompanied by rising pressure from advocacy non-governmental organizations (NGOs) on multinational firms to act in socially-responsible manner. We analyze how NGO pressure interacts with industry structure, using a simple model of NGO-firm interaction embedded in an industry environment with endogenous markups and entry. We characterize the effect of NGO pressure on the industry equilibrium (intensity of competition, market structure, and the share of socially responsible firms), and the impact of industry-level changes (market size, consumer tastes) on NGO activism. In the long run, multiple equilibria might exist: one with fewer firms and a large share of them being socially-responsible, and the other with more firms but fewer of them acting socially responsibly.

Keywords: NGOs, corporate social responsibility, private regulation, monopolistic competition.

JEL Classification: L31, L13, D43.

*We thank Jean-Marie Baland, Maitreesh Ghatak, Rohini Somanathan, Jean-Philippe Platteau, and participants at ETSG Conference (Rome), the Workshop on NGOs, Nonprofits, and Aid Effectiveness (Namur), and the Workshop on Economics of Institutions (CUNEF, Madrid) for useful comments. The first author acknowledges financial support from the Belgian Science Policy Program on Inter-University Poles of Attraction (PAI-UAP P6/07).

†Department of Economics and CRED, University of Namur, and ECARES (ULB). E-mail: gani.aldashev@unamur.be.

‡University of Lille and Paris School of Economics. E-mail: michela.limardi@gmail.com.

§Corresponding author: Paris School of Economics and CEPR. Mailing address: PSE, 48 Boulevard Jourdan, 75014 Paris, France. E-mail: verdier@pse.ens.fr.

1 Introduction

Rise of private regulation of firms by non-profit activists is an important recent phenomenon. Such regulation normally arises in settings where the government is easily influenced or captured by firms (Baron 2010, Chapter 4). Alternatively, private monitoring and regulation emerges when standard labor and environmental regulations and governmental enforcement systems on which they depend are overwhelmed by rapid changes in the economy (O'Rourke 2003). One key example is the environment in which multinational enterprises (MNEs) in developing countries operate. These firms are often pressured by non-governmental organizations (NGOs) whose declared objective is reducing the negative effects of globalization. NGOs engage in "private politics" (Baron 2001), i.e. exert pressure on multinational firms by exploiting the NGOs' campaigning capacity, so as to induce the firms to adopt socially responsible practices. The well-known examples of such NGO activities include the international campaigns against Nike (triggered by the poor working conditions in its suppliers' factories in Vietnam), WalMart (caused by its' anti-union activities), and Tiffany & Co. (related to the sales of 'conflict' diamonds). The techniques employed by NGOs vary from lawsuits and organized political lobbying to mobilizing consumer protests and boycotts to destruction of firm property.[1]

Precise measures of the evolution of private-politics activities by NGOs are hard to find. However, an indication of their rising importance for the corporate world is the twenty-fold increase in the number of citations referring to NGOs in *Financial Times* over the last ten years (Yaziji and Doh 2009). Similarly, Harrison and Scorse (2010) estimate that the number of articles regarding child labor - one of the key issues tackled by advocacy NGOs - has increased by 300 percent and the number of articles on sweatshop activities has increased by more than 400 percent in the last decade. This shows that the role of NGOs as 'civic regulators' of multinational firms has become crucial, so as to affect the entire industries (e.g. apparel, textile, mining). This is confirmed, for example, by a recent study of Harrison and Scorse (2010) for textile, footwear, and apparel (TFA) industries in Indonesia, and by the studies by Doh and Guay (2003) and Yaziji and Doh (2009) that list twelve international codes of corporate conduct (at industry level) on labor and environmental issues, in which NGOs played a key role as promoters and enforcers.

[1] Yaziji and Doh (2009) and Baron (2010) provide excellent descriptive analyses of the interactions between NGOs and multinational firms.

Despite the importance of NGO pressure at industry level its likely impact on market structure, economic analyses of the interaction between NGOs and corporations have so far concentrated on one-to-one (i.e. one NGO, one firm) interactions or models with a fixed market structure, usually a simple oligopoly (Baron 2001, 2003; Feddersen and Gilligan 2001; Baron and Diermeier 2007; Immordino 2008; Bottega and De Freitas 2009; Krautheim and Verdier 2012). So far, to the best of our knowledge, there exist neither any analyses of the effects of NGO pressure on long-run industry-level economic outcomes, such as long-run aggregate output, market structure, entry and exit into the industry, the intensity of competition, and the share of firms that engage in socially-responsible behavior, nor any studies that address the effect of industry-level changes on the intensity of NGO activism.[2]

Conducting a fully-fledged theoretical analysis of the effects of NGO activity on an industry as a whole (rather than on single firms or a fixed market structure) is important for several key reasons. First, a host of industry-level variables that are crucial for economic behavior simply cannot be studied in single-firm models. These include, for instance, the number of firms in the industry and the degree of intensity of competition between firms. Second, industry-level characteristics might, in their turn, affect the individual firms' payoffs from adopting (or not) socially-responsible actions under the pressure by NGOs, as well as the NGOs' payoffs from putting the pressure on firms. In such a case, the industry-level analysis might help to explain empirically the extent of socially-responsible actions by firms and watchdog activities of NGOs by linking them to observable industry-level variables (e.g., market size, entry costs, or the degree of homogeneity of the industry products). Finally, given that NGO pressure affects profits of individual firms and in the long run firms decide on entry to and exit from the industry, the long-run effects of NGO pressure on corporations may be quite different from the short-run effects (with a fixed market structure).

In this paper, we make the first step towards closing this gap in theoretical literature, by analyzing the industry-level short- and long-run equilibrium effects of NGO pressure. To do so, we build a game-theoretic model of the interaction between an NGO and firms, in which the NGO monitors the adoption by firms of 'socially responsible' actions, and the firms decide between taking the costly socially-responsible action or eschewing this action and

[2]The only paper that studies the industry-level effects of corporate social responsibility is Besley and Ghatak (2007); however, in their model, NGOs are modelled as direct producers, rather than private monitors or advocacy organizations, as in our model. Examples of other models in which NGOs act as producers of goods and services in developing countries and compete with each other are Aldashev and Verdier (2009, 2010) and Guha and Roy Chowdhury (2013).

facing the risk of a damage inflicted by the NGO if the non-adoption is discovered. We then embed this interaction in a model of monopolistic competition with heterogeneous firms and endogenous mark-ups (Ottaviano, Tabuchi, and Thisse 2002; Melitz and Ottaviano 2008). Conveniently, this model allows us to capture, in the short run, the interaction between the degree of competition in the industry (i.e. endogenous price margins), the monitoring effort by the NGO, and the fraction of firms adopting the socially responsible actions. Allowing for free entry, we then determine the long-run equilibrium market structure (i.e. the number of firms in the industry), together with the three variables mentioned above. We study how the short- and long-run industry equilibria change in response to exogenous changes in NGO payoffs, firm technology (production costs), and consumer preferences.

Our main contribution is to build a unified model that describes, on the one hand, the effect of NGO monitoring on industry structure and equilibrium, and, on the other hand, the impact of changes at the level of industry (such as, for instance, an increase in market size or a change in consumer tastes) on the intensity of NGO activism. The model delivers predictions simultaneously about the degree of monitoring of firms by NGOs, the decisions of firms of adopting socially responsible actions, the intensity of competition in the market, and, in the long run, the number of firms in the industry.

In addition, our analysis helps to clarify the debate about the role of competition in inducing unethical behavior (see Shleifer 2004 for an informal discussion and examples, and Cai and Liu 2009 and Fernandez-Kranz and Santalo 2010 for empirical analyses). We show that when ethical behavior by firms is monitored by NGOs, the intensity of competition and the extent of ethical behavior are jointly determined. The direction of the empirical correlation between these two measures crucially depends on the *origin* of exogenous changes that induce the variation in both. For instance, a change in consumer tastes can lead to more intense competition and less socially-responsible behavior, whereas more generous financing of watchdog NGOs induces more intense competition between firms and more socially-responsible behavior.

The rest of the paper is organized as follows. Section 2 presents the setup of the model and the basic firm-NGO interaction. In Section 3, we embed this interaction in a monopolistic-competition setting with endogenous mark-ups. Section 4 characterizes the short-run industry equilibrium. In Section 5, we allow for entry and exit of firms, so as to characterize the long-run industry equilibria. Section 6 concludes.

2 A simple model

2.1 Setup

Consider an industry with N (ex ante identical) firms located in a developing country and one non-governmental organization (NGO). The NGO is a mission-oriented organization in the sense of Besley and Ghatak (2005); its mission involves serving as a watchdog organization of the industry, i.e. as an enforcer of adoption by the firms of certain "socially responsible" actions. These actions correspond, for example, to internalization of negative externalities that firms' production generates. Moreover, the government institutions are too weak to enforce these actions via public policies (e.g. the political representation of the potential beneficiaries of the socially responsible actions of the firms is absent or the government is easily lobbied by the firms). The precise reasons for this political failure is not crucial: for our purposes, it is sufficient to assume that in the absence of the NGO pressure, no firm would undertake the socially responsible action. This setting describes well the industries with multinational corporations operating in developing countries that choose whether or not to comply with international labor standards, use environment-friendly production technologies, or adopt affirmative-action human resource management practices.[3]

Consider a typical firm. For simplicity, let's assume that acting in socially responsible manner is a binary action, and call the adoption of socially responsible action as "acting green" while the non-adoption "acting brown". The consumers of the good produced by the firms (in the developing countries) cannot discern whether or not the good was produced in the socially responsible manner. We are thus in the realm of credence goods, since the quality of the good (i.e. the technology it embodies) is not observable neither before nor after purchase it. Let $e \in [0, 1]$ denote the probability of adopting the "green" action and $E \in [0, 1]$ be the monitoring effort exerted by the NGO.

The timing of the game is as follows:

1. The NGO decides on its monitoring effort E (common for all firms). Simultaneously, each firm i chooses the "green" action with probability e. We assume that the choice of acting "green" or "brown" is irreversible (or that the cost of conversion is sufficiently high).

[3] As Yaziji and Doh (2009) note: "The demands that the NGOs make in [watchdog] campaigns are not to change the institutional standards, but merely to enforce them; the message is institutionally conservative" (p. 95).

2. The NGO discovers the choice of the action by the firm with probability E. If the NGO discovers that the firm is acting "brown", the firm has to bear an additional cost (as explained below), while the NGO obtains a benefit of $H > 0$. This benefit corresponds, for example, to the higher future donations thanks to the media exposure of the successful NGO campaign.[4]

The punishment inflicted by the NGO if the misbehavior of the firm is detected can take the form of active interference with the production process (organizing worker revolts or destroying some parts of the firm's production lines), which implies that the firm has to spend resources for continuing to produce normally. This is somewhat different from the channel of influence of Baron and Diermeier (2007), where NGO conducts boycotts or reputation-damaging activism. For the sake of simplicity, we assume that the NGO campaign against the misbehaving firm has a sufficiently strong effect to serve as a credible threat for the firm (Baron 2010).

Note that we abstract from the possible collaboration between the NGO and firms. Such cooperation has been heavily criticized in recent years since auditors in these cooperative programs are paid directly by the firms that are being monitored, which thus leaves substantial scope for corruption. Firms are nowadays reluctant to enter into such agreements and in the last years, a new approach has emerged to respond to this concern. This involves independent monitoring and verification by NGOs (sometimes called "socialized regulation" (O'Rourke 2003)).

Acting brown implies for the firm the marginal cost of production equal to c_B, with corresponding profit $\pi(c_B)$. Acting green implies a marginal cost φc_B and profits $\pi(\varphi c_B)$. If the NGO detects the brown action of the firm, it is able to impose a penalty, which implies the marginal cost equal to λc_B, and the profit equal to $\pi(\lambda c_B)$. We concentrate on the non-trivial case with $\lambda > \varphi > 1$. In other words, the firm's marginal cost is highest when it adopts brown action and gets discovered by the NGO, is smaller if adopting green action, and is smallest when the firm adopts brown action and goes undiscovered. This implies that the firm choosing to act green trades off the elimination of the risk of being discovered by the NGO as acting brown against the higher marginal cost of acting green, φc_B.

[4] Limardi (2011) finds that one additional case of non-compliance with international labor standards by a multinational firm, discovered by an NGO, implies a 20 per cent increase of private donations to the NGO.

2.2 Firm-NGO interaction

At stage 1, the problem of the firm is to maximize its expected profits:

$$e\pi(\varphi c_B) + E(1-e)\pi(\lambda c_B) + (1-e)(1-E)\pi(c_B)$$

The corresponding first-order condition implies the optimal choice of the firm:

$$e = \begin{cases} 1 \ \text{ if } \ \pi(\varphi c_B) > E\pi(\lambda c_B) + (1-E)\pi(c_B) \\ 0 \ \text{ if } \ \pi\varphi c_B) < E\pi(\lambda c_B) + (1-E)\pi(c_B) \\ \in [0,1] \ \text{ if } \ \pi(\varphi c_B) = E\pi(\lambda c_B) + (1-E)\pi(c_B) \end{cases},$$

which can also be written as

$$e = \begin{cases} 1 \ \text{ if } \ E > \rho \\ 0 \ \text{ if } \ E < \rho \\ \in [0,1] \ \text{ if } \ E = \rho \end{cases}, \tag{1}$$

where

$$\rho \equiv \frac{\pi(c_B) - \pi(\varphi c_B)}{\pi(c_B) - \pi(\lambda c_B)}. \tag{2}$$

ρ denotes the relative disincentive (in terms of profit differential) of acting green as compared to acting brown and being punished. (2) indicates that ρ is threshold probability of inspection by NGO that makes the firm just indifferent between acting green and brown: a slightly higher inspection probability would induce all firms to act green (while under a slightly lower inspection rate all firms act brown). Note that ρ increases with the marginal cost of production under green action (φ) and decreases with the cost of punishment (λ).

Intuitively, the firm chooses which of the two losses to avoid: the loss from adopting the green action or the loss from taking the risk of being caught as a brown-action firm. When the monitoring effort of the NGO is sufficiently high, the size of the second loss outweighs that of the first, and the firm prefers to choose the green action.

The problem of the NGO is as follows. Let V_G and $V_B(< V_G)$ denote the unit (i.e. per firm) payoff of the NGO if the firm adopts green or brown action, respectively. Let H denote the unit payoff from exposing the brown-action firm (i.e. the benefits of visibility, as discussed above). The NGO chooses how many firms to inspect, picking them at random. We suppose that inspecting K firms taken at random costs $\Psi(K)$ with $\Psi(0) = \Psi'(0) = 0$, $\Psi'(K) \geq 0$, and $\Psi"(K) > 0$ for all $K \in [0, N]$. Therefore, the probability that a given firm is inspected equals

$$E = \frac{K}{N}.$$

Let's denote with m the fraction of firms that choose the green action. Then, the problem of the NGO is:

$$\max_{K\in[0,N]} K[mV_G + (1-m)(V_B + H)] + (N-K)[mV_G + (1-m)V_B] - \Psi(K).$$

The first-order condition of this problem is[5]:

$$(1-m)H = \Psi'(K)$$

or

$$(1-m)H = \Psi'(NE). \tag{3}$$

This equation pins down the NGO's optimal choice of monitoring, given the firms' behavior, $E(m)$. Explicitly solving for E, we obtain

$$E = \frac{\Psi'^{-1}\left((1-m)H\right)}{N}.$$

Given that Ψ is convex, E is decreasing in m. The intuition is straightforward: higher fraction of firms adopting green action reduces the visibility benefits that the NGO obtains from (costly) monitoring and thus leads to a lower monitoring effort.

Assuming that the number of firms N is sufficiently big, by the law of large numbers, the probability that any given firm chooses the green action is approximately equal to the fraction of green-action firms, i.e. $m = e$. The two first-order conditions, (1) and (3), jointly determine the Nash equilibrium of the game and pin down the equilibrium green-action adoption by firms and monitoring effort by the NGO, m^* and E^*:

$$\begin{aligned} E^* &= \rho = \frac{\pi(c_B) - \pi(\varphi c_B)}{\pi(c_B) - \pi(\lambda c_B)} \\ m^* &= 1 - \frac{\Psi'(N\rho)}{H}. \end{aligned}$$

Figure 1 describes graphically the Nash equilibrium of the game[6].

[Insert Figure 1 about here]

[5] The second order condition for a maximum is satisfied, given that $\Psi"(K) > 0$.

[6] We assume that the cost function $\Psi(NE)$ is convex enough and/or the reputation gain H small enough to ensure that the equilibrium value of NGO monitoring per firm E is less than 1. Formally this is obtained when $H \leq \Psi'(N)$.

The equilibrium of the game is in mixed strategies. It is clear why there cannot exist a pure-strategy equilibrium: if all firms act green, the NGO's best response is not to exert any monitoring effort. If instead, all firms act brown, the NGO has the maximum incentives to monitor; however, then all firms will find it beneficial to switch to acting green. Therefore, in equilibrium, any given firm must be indifferent between acting green or brown. The equilibrium thus pins down the fraction of firms that act green, $m^* \in (0, 1)$, which must be compatible with the equilibrium monitoring effort of the NGO, $E(m^*)$. Technically, the mixed-strategy equilibrium obtains because the actions of the NGO and firms are strategic substitutes and the firms are (ex ante) identical.

Inspecting the equilibrium conditions, we identify several simple comparative statics results. An increase in the marginal cost of green-action production (φ) or a fall in the production of punished brown-action firms (λ) shifts rightward the best response function of firms (1), as it increases the relative disincentives of acting green (as compared to acting brown). Hence, in a new equilibrium, fewer firms act green and the NGO exerts higher monitoring effort. This corresponds to a move from point A to point B in Figure 2.

[Insert Figure 2 about here]

Instead, an increase in the number of the firms in the industry (N), a fall in the visibility benefits of the NGO (H), or an increase in the marginal cost of monitoring ($\Psi'(.)$) leads to a downward shift in the best-reponse function of the NGO (a reduction in monitoring effort E for a given fraction of firms acting green, m). In a new equilibrium we obtain a lower equilibrium fraction $m^*$of green firms, whereas the monitoring effort of the NGO $E^* = \rho$ rests the same as before. The intuition for this result is the following. The NGO's decreased payoffs from monitoring (for a given initial level of m) translates into lower monitoring effort. However, this immediately implies that all firms switch to acting brown. Then, the NGO's probability of 'capturing' brown-acting firms shoots up, thus inducing it to restore its effort of monitoring, just to the level where all the firms are again indifferent between acting brown or green. Graphically, this corresponds to a move from point A to point C.

3 Endogenous market structure

Until now, we left unspecified the competitive environment of the industry, having summarized it by the profit function $\pi(.)$ of a typical firm. To understand the two-way interactions between the NGO monitoring, and the competitive strategies of firms and market structure of the industry, we need to be more specific on the way firms interact with each other in the sector. For this, we opt for the modelling perspective of a monopolistically competitive industry with firms producing horizontally differentiated products.

More precisely, we embed our NGO-firm interaction in a simple linear-quadratic model of monopolistic competition with endogenous mark-ups (Ottaviano, Tabucchi and Thisse 2002, Melitz and Ottaviano 2008). This specification fits well our purposes for the following reason. The older monopolistic-competition models with Dixit-Stiglitz (1977) preferences imply constant mark-ups for firms. This aspect, however, impedes the possibility for competitive pressure to affect firms' margins and firm-level output, significantly underplaying the impact of a change in market structure on firms and, consequently, on the NGO behavior. In particular, this feature would imply that the relative disincentive (in terms of profit differential) of acting green as compared to acting brown and being punished would not be affected by the intensity of competition between firms. In such case, the equilibrium NGO monitoring effort would be independent from the degree of competition between firms and the industrial market structure. This is quite unlikely in reality, which is why we opt for the framework with endogenous mark-ups, that does not have this undesirable feature.

3.1 Demand side

The market consists of atomistic consumers, whose mass is L. Consumer preferences are defined over a continuum of differentiated varieties indexed by $i \in \Omega$ and a homogenous good chosen as the numeraire. The preferences are described by the linear-quadratic utility function

$$U = q_0 + \beta \int_{i\in\Omega} q_i di - \frac{1}{2}\gamma \int_{i\in\Omega} q_i^2 di - \frac{1}{2}\left[\int_{i\in\Omega} q_i di\right]^2,$$

where q_0 and q_i denote consumption of the numeraire good and variety i of the differentiated good, respectively. The demand parameters β and γ are positive, with β denoting the degree of substitutability between the numeraire good and the differentiated varieties and γ standing for the degree of product differentiation between varieties. If $\gamma = 0$, varieties are perfect substitutes and consumers care only about the total consumption level over all varieties, given by

$$Q^c = \int_{i\in\Omega} q_i di.$$

Let p_i be the price of one unit of variety i, and let's assume that consumers have positive demand for the numeraire good. Then, standard utility maximization gives the individual inverse demand function

$$p_i = \beta - \gamma q_i - Q^c,$$

whenever $q_i > 0$. This holds when

$$p_i \leq \frac{1}{\gamma + N} (\gamma\beta + N\overline{p}),$$

where N is the measure of the set of varieties Ω with positive demand (and, given that each firm produces only one variety, the number of firms in market) and $\overline{p}$ is the average price index, given by

$$\overline{p} = \frac{1}{N}\int_{i\in\Omega} p_i di = \beta - \frac{\gamma}{N}Q^c - Q^c = \beta - \frac{\gamma + N}{N}Q^c.$$

Market demand for variety i can thus be expressed as

$$\widetilde{q_i} = Lq_i = \frac{\beta L}{\gamma + N} - \frac{L}{\gamma}p_i + \frac{N}{\gamma + N}\frac{L}{\gamma}\overline{p}. \tag{4}$$

Note that in this linear demand system, the price elasticity of demand is driven by the intensity of competition in the market. More intense competition is induced either by a lower average price for varieties $\overline{p}$ or by more product varieties (larger N). Thus, the price elasticity of demand increases with N and decreases with $\overline{p}$.

3.2 Production

The numeraire good 0 is produced with constant returns to scale (one unit of good 0 requires one unit of labor) under perfectly competitive conditions.[7] Contrarily, each variety of the differentiated good is produced under monopolistically competitive conditions. Although firms in the differentiated good sector are ex-ante identical, after their choice of technology (brown or green) and NGO monitoring, they end up having different ex-post marginal costs of production (c_i): it is c_B for brown firms that are not punished by the NGO, λc_B for those brown firms that are punished and φc_B for the green firms.

One key modelling point is of order here. We assume that the entire effect of NGO activism and pressure on a firm goes through the increase in the marginal cost of production if the firm is discovered by the NGO as acting brown. This can be thought of as capturing the higher cost associated with repairing and/or preventing the damage caused by aggressive

[7] Production of the numéraire good is made using a standardized technology and is not subject to NGO pressure.

confrontational strategies that some NGOs adopt (such as the disruption of fishing activity by Greenpeace activist ships or the destruction of fields of genetically modified crops by the activist group of José Bové). Alternatively, and more broadly, this higher cost can be thought of as the cost of neutralizing the negative advertising generated by activist protests and media exposure. However, we do not model the effect of NGO activism on consumer demand, for a pragmatic reason: endogenizing the demand response, but still allowing for endogenous market structure would complexify analytically the model to the point of making it intractable.

Consider now a given variety i produced with marginal cost c_i. Then, profits for that variety can be written as

$$\pi_i = \widetilde{q}_i (p_i - c_i).$$

The profit maximizing output level $\widetilde{q}_i = q(c_i)$ and price level $p_i = p(c_i)$ are linked by the following expression:

$$\widetilde{q}_i = q(c_i) = \frac{L}{\gamma}\left[p(c_i) - c_i\right]. \tag{5}$$

Note that output per firm increases with the size of the market L.

The profit-maximizing price can be written as

$$p(c_i) = \frac{1}{2}\left[c_i + \frac{\beta\gamma}{\gamma + N} + \frac{N}{\gamma + N}\overline{p}\right], \tag{6}$$

and thus, the (absolute) markup over price is

$$p(c_i) - c_i = \frac{1}{2}\left[\frac{\beta\gamma}{\gamma + N} + \frac{N}{\gamma + N}\overline{p} - c_i\right]. \tag{7}$$

In addition to the taste-for-variety parameter γ, the markup depends on the intensity of competition which, in turn, depends on the average price for varieties $\overline{p}$ and on the number of varieties and firms on the market, N.

The average price $\overline{p}$ and average cost $\overline{c}$ can be expressed as

$$\overline{p} = \frac{\overline{c} + \frac{\beta\gamma}{\gamma+N}}{\frac{2\gamma+N}{\gamma+N}}, \tag{8}$$

$$\overline{c} = \frac{1}{N}\int_{i\in\Omega} c_i di, \tag{9}$$

and, therefore, the equilibrium profits of a firm with cost c_i are given by

$$\pi(c_i) = \frac{L}{4\gamma}\left[c_D - c_i\right]^2, \tag{10}$$

where, c_D denotes the cut-off cost level

$$c_D = \frac{2\beta\gamma}{2\gamma + N} + \frac{N}{2\gamma + N}\bar{c}. \tag{11}$$

This is the level of the cost for a firm that is indifferent between remaining in the industry or exiting. The firm with the marginal cost c_D earns zero profits, given that its price is driven down to the marginal cost, $p(c_D) = c_D$. Any firm with the marginal cost $c_i < c_D$ earns positive profits.

The cut-off cost level c_D is thus a key variable of the model, as it captures the intensity of competition in the industry. This cut-off cost declines (i.e. the competition becomes more intense) when there are more firms in the industry (larger N), when more low-cost firms are present in the market (lower $\bar{c}$), and when product varieties are closer substitutes (smaller γ).[8]

4 Short-run industry equilibrium

We are now ready to analyze the industry equilibrium with NGO monitoring. Substitution of (10) into (2) gives us the threshold level:

$$\rho = \frac{(c_D - c_B)^2 - (c_D - \varphi c_B)^2}{(c_D - c_B)^2 - (c_D - \lambda c_B)^2} = \frac{(\varphi - 1)\left[2c_D - (\varphi + 1)c_B\right]}{(\lambda - 1)\left[2c_D - (\lambda + 1)c_B\right]}.$$

Note that the relative disincentives to act green versus brown (ρ) depend on the cut-off cost level c_D. Deriving this expression with respect to c_D, we obtain that ρ decreases with c_D:

$$\frac{\partial \rho}{\partial c_D} = \frac{2c_B(\varphi - \lambda)}{(\lambda - 1)\left[2c_D - (\lambda + 1)c_B\right]^2} < 0.$$

Figure 3 which plots the profit functions of three types of firms, as a function of the cut-off cost level c_D. The numerator of ρ is the difference between the profit of the brown-acting firm (unpunished) and that of the green-acting firm. Graphically, this corresponds to the vertical distance between curves x and y. Similarly, the denominator of ρ is the difference between the profit of the brown-acting firm (unpunished) and that of the brown-acting punished firm. Graphically, this difference is described by the vertical distance between curves x and z. Take now a certain cost level c'_D. One clearly sees that a small decrease in this cost, $c'_D - \varepsilon$, implies a bigger relative fall in the distance between x and z curves than in the distance

[8] See Melitz and Ottaviano (2008) for the formal proof of this result.

between x and y curves, i.e. when c_D decreases, the denominator of ρ shrinks faster (at the rate $2(\lambda-1)$) than its numerator (which shrinks at the rate $2(\varphi-1)$).

The Nash equilibrium (m^*, E^*) thus becomes[9]

$$
\begin{aligned}
E^*(c_D) &= \frac{(\varphi-1)\left[2c_D-(\varphi+1)c_B\right]}{(\lambda-1)\left[2c_D-(\lambda+1)c_B\right]}, \\
m^* &= 1-\frac{\Psi'(NE^*(c_D))}{H}.
\end{aligned}
$$

Note that E^* is negatively sloped in the cut-off cost level, c_D, i.e. the equilibrium monitoring effort increases with the intensity of competition in the market:

$$
\frac{\partial E^*(c_D)}{\partial c_D} = \frac{\partial \rho}{\partial c_D} < 0.
$$

An increase in the intensity of competition (i.e. lower c_D) compresses the profits of all the three types of firms, but not in the same proportion. In particular, it reduces more the disincentive from acting brown than the disincentive to act green. Therefore, at a given NGO monitoring intensity, firms now have a stronger incentive to act brown. This implies that all firms start (temporarily) to act brown. Then, as the NGO adjusts its monitoring effort (upwards), the level of monitoring that makes the firms again indifferent between the two technologies increases. Thus, in the new equilibrium, we observe higher monitoring effort but a lower fraction of green firms.

Thus, given (3) and (11), the industry equilibrium is described by the following system:

$$
\begin{aligned}
E^*(c_D) &= \frac{(\varphi-1)\left[2c_D-(\varphi+1)c_B\right]}{(\lambda-1)\left[2c_D-(\lambda+1)c_B\right]} \\
m^* &= 1-\frac{\Psi'(NE^*(c_D))}{H} \\
c_D &= \frac{2\beta\gamma}{2\gamma+N}+\frac{N}{2\gamma+N}\overline{c}(m,E)
\end{aligned}
\tag{12}
$$

where, the industry average cost is given by:

$$
\overline{c}(m,E) = \left[m\varphi+(1-m)(E\lambda+(1-E))\right]c_B
$$

Simple inspection shows (see formal proof is in the appendix) that, because of $\lambda > \varphi$, the function $\overline{c}(m, E^*(c_D))$ is decreasing in m (the fraction of firms acting green):

$$
\frac{\partial \overline{c}(m, E^*(c_D))}{\partial m} < 0.
$$

[9]Note that a necessary and sufficient condition to have $E^*(c_D) < 1$ is that $2c_D > (\lambda+\varphi)c_B$ which is satisfied as long as $c_D > \lambda c_B > \varphi c_B$ (that we have assumed earlier).

Intuitively, as $\lambda > \varphi$, the expected cost of acting brown (and eventually being punished) is larger than the cost of acting green. Hence, an increase in the fraction of green-action firms should lead to a reduction of the industry-average cost.

We may then rewrite the equilibrium conditions (12) as

$$\begin{aligned} E^*(c_D) &= \frac{(\varphi-1)\left[2c_D-(\varphi+1)c_B\right]}{(\lambda-1)\left[2c_D-(\lambda+1)c_B\right]}, \\ m^* &= 1-\frac{\Psi'(NE^*(c_D))}{H}, \\ c_D &= \frac{2\beta\gamma}{2\gamma+N}+\frac{N}{2\gamma+N}\overline{c}(m,E^*(c_D)). \end{aligned} \tag{13}$$

For a given value of firms N in the industry, the second equation provides a positively-sloped relationship $m = \widetilde{m}(c_D)$ and the third equation provides a negatively-sloped relationship $c_D = \widetilde{c}_D(m)$. Hence the intersection of these two relationships (and, therefore, the short run industry equilibrium) is unique.[10]

[Insert Figure 4 about here]

This is illustrated in Figure 4 which constructs graphically the short-run equilibrium. The bottom-left segment is simply Figure 1. Consider now two values of the cut-off cost level, c_D^0 and $c_D^1(< c_D^0)$. The cut-off cost level c_D^0 corresponds to a certain level of equilibrium monitoring effort E^0 and a fraction of green-acting firms m^0. As the intensity of competition in the product market increases (a move from c_D^0 to c_D^1), the negative relationship between c_D and E (the first equation of (13), depicted in the bottom-right segment of Figure 4) maps into a lower equilibrium fraction of firms acting green, as explained above. This, via the 45° line on the top-left segment, maps into the level m^1, on the top-right panel of the figure. This gives us the relationship $m = \widetilde{m}(c_D)$, described by the second equation of (13).

However, the cut-off cost level is not exogenous, but depends on the average cost in the industry. In particular, higher fraction of green firms, which implies lower industry-average cost, leads to a lower cut-off cost level. Thus, for the industry structure to be in an equilibrium, the share of green firms and the cut-off cost level should be compatible with both the relationship $m = \widetilde{m}(c_D)$ derived above and the relationship $c_D = \widetilde{c}_D(m)$, described graphically by the negatively-sloped line on the top-right panel. The unique intersection of the two lines thus gives the short-run equilibrium.

[10] The formal proof of existence and uniqueness of the industry equilibrium for a given N is provided in the Appendix.

4.1 Comparative statics

We now proceed to deriving several comparative statics results, analyzing the effect of changes in the exogenous parameters on the short-run industry equilibrium. In particular, we concentrate on the following changes:

- *Changes in the NGO payoffs*: an increase in H or a fall in $\Psi'(.)$ (higher visibility benefit that the NGO gets per each brown-action firm punished or lower marginal cost of monitoring effort);
- *Changes in (relative) production costs*: an increase in λ (stronger effect of punishment by the NGO on firms' production costs); a decrease in φ (lower cost of acting green), a higher value of c_B (higher baseline marginal costs, e.g. coming from higher wages for the low-skilled labor in the developing country);
- *Changes in market structure:* a higher value of N (more firms in the industry; this will be endogenized in the next section);
- *Changes in consumers' tastes:* a higher β or γ (higher elasticity of substitution between the numeraire good and the differentiated good or between the varieties of the differentiated good).

We consider each of them in turn.

4.1.1 Effect of changes in the NGO payoffs

An increase in H or a fall in $\Psi'(.)$ qualitatively have the same effect on the equilibrium values. Such a change only affects the $\widetilde{m}(c_D)$ line, by shifting it leftward/up. Intuitively, the change occurs in the following manner. The first effect is that at a given level of intensity of competition, the monitoring effort by the NGO increases. Consequently, the fraction of green-acting firms increases. This corresponds to the move from A to B on Figure 5a.

[Insert Figure 5a about here]

This, in turn, leads to a decrease in the industry-average production cost, leading to tougher competition, which partially mitigates the incentives to act green. Thus, the fraction of green-acting firms falls, settling at the new equilibrium level which is higher than at the initial equilibrium (the move from B to C). We thus end up in the new equilibrium, with more intense competition and a higher fraction of green-acting firms:

$$\frac{\partial c_D}{\partial H} < 0, \ \frac{\partial m^*}{\partial H} > 0, \ \frac{\partial c_D}{\partial \Psi'(.)} > 0, \ \frac{\partial m^*}{\partial \Psi'(.)} < 0.$$

Note that the relative magnitudes of this effect on the share of green firms and the intensity of the competition depend crucially on the elasticity of $\widetilde{c}_D(m)$ line, which describes how strongly the industry competition depends on the share of green firms. If the cost differences between the three types of firms is relatively large (i.e. λ is much bigger than φ, which in turn is much bigger than 1), even a minor variation in the shares of three types of firms in the sector has a large effect on the industry-average cost, and thus the $\widetilde{c}_D(m)$ line is quite elastic. In this case, the effect of a higher H will translate to a relatively large drop in c_D, but a relatively small increase in m^*. Contrarily, when the cost differentials are small, $\widetilde{c}_D(m)$ line is almost vertical, and an increase in H translates almost entirely into a large increase in the share of green firms (with little change in the intensity of industry competition).

4.1.2 Effect of changes in (relative) production costs

The effects of an increase in λ, a decrease in φ, and a decrease in c_B are qualitatively similar. Intuitively, as the cost of being punished by the NGO increases, all the firms temporarily face a higher incentive to act green. The NGO's incentives to monitor fall; the required monitoring effort to make firms again indifferent (between the green and brown actions) goes down, but a higher fraction of firms act green. Thus, for a given intensity of competition, the fraction of green-acting firms goes up (leftward/up shift of the $\widetilde{m}(c_D)$ line on Figure 5b and a move from point A to B)

[Insert Figure 5b about here]

However, an increase in $\boldsymbol{\lambda}$ affects also the $\widetilde{c}_D(m)$ relationship. Given that the NGO monitoring falls, fewer brown-action firms are punished ex post. This reduces the industry-average cost and thus increases the intensity of competition (leftward shift of the $\widetilde{c}_D(m)$ line, move from point B to C).

Thus, overall, the effect on c_D is clearly negative (i.e. equilibrium competition becomes more intense). However, the net effect on the equilibrium fraction of green-acting firms is ambiguous (and depends on the magnitude of the shift in the $\widetilde{c}_D(m)$ line):

$$\frac{\partial c_D}{\partial \lambda} < 0, \; \frac{\partial m^*}{\partial \lambda} \gtrless 0, \; \frac{\partial c_D}{\partial \varphi} > 0, \; \frac{\partial m^*}{\partial \varphi} \gtrless 0, \; \frac{\partial c_D}{\partial c_B} > 0, \; \frac{\partial m^*}{\partial c_B} \gtrless 0.$$

Note that this comparative statics describes an interesting possibility that the equilibrium share of green firms *decreases* when the cost of green technology falls. This happens because the negative effect of the cost of green technology on the industry-average cost (and thus industry competition) can outweigh the positive effect operating through NGO monitoring.

4.1.3 Effect of changes in market structure

An exogenous increase in the number of firms in the industry, ceteris paribus, makes the market competition more aggressive (a reduction in c_D). This induces a lower fraction of firms to act green (graphically, this corresponds to a leftward shifts in the $\widetilde{c}_D(m)$ line and the move from point A to B on Figure 5c).

[Insert Figure 5c about here]

This increases the NGO's incentives to monitor more, and the resulting increase in the brown-acting firms that are punished partially compensates the fall in c_D. However, the increase in N has also a second effect: more firms imply higher marginal cost of monitoring, which induces the NGO to adjust downwards its monitoring effort (dilution effect). Foreseeing this, even fewer firms act green, and we end up with an unambiguously lower fraction of firms acting green (rightward shift of the $\widetilde{m}(c_D)$ line, a move from point B to C).

The total effect on equilibrium competition is ambiguous. As there are fewer green firms, the industry-average cost increases, and this softens the competition. However, there is also the usual Melitz-Ottaviano effect: the increase in the number of firms directly makes the market more competitive. The total effect depends on which of these two channels dominates:

$$\frac{\partial c_D}{\partial N} \gtrless 0, \; \frac{\partial m^*}{\partial N} < 0.$$

4.1.4 Effect of changes in consumer tastes

Finally, let's consider an increase in γ (or in β, which has the same qualitative effects). This reduction in the degree of substitutability between the varieties relaxes the competition - the usual feature of monopolistic-competition models (an increase in c_D) and thus shifts the $\widetilde{c}_D(m)$ line to the right (move from point A to B in Figure 5d).

[Insert Figure 5d about here]

This reduces the relative disincentive of acting green and thus increases the fraction of green-acting firms. The resulting reduction in industry-average costs partially compensates the fall in the intensity of competition (move from point B to C). The new equilibrium exhibits weaker competition and the unambiguously higher fraction of firms acting green:

$$\frac{\partial c_D}{\partial \beta} > 0, \ \frac{\partial m^*}{\partial \beta} > 0, \ \frac{\partial c_D}{\partial \gamma} > 0, \ \frac{\partial m^*}{\partial \gamma} < 0.$$

5 Long-run industry equilibrium

In this section we endogenize the market structure of the industry, by supposing that the entry in and exit from the industry in the long run is unrestricted. The free-entry condition that pins down the long-run values equates the expected profit of a typical firm in the industry to the fixed cost of entry, which we denote with F:

$$m^e \pi(\varphi c_B) + E^e(1 - m^e)\pi(\lambda c_B) + (1 - m^e)(1 - E^e)\pi(c_B) = F.$$

Here, the long-run equilibrium values are denoted with subscript e. Given that the equilibrium strategy of a firm (in terms of green/brown action) is mixed, i.e. $m^e \in (0, 1)$, with any firm being indifferent between acting green or brown, the free-entry condition reduces to

$$\pi(\varphi c_B) = F,$$

or, using the expression for profits (10),

$$\frac{L}{4\gamma}\left[c_D - \varphi c_B\right]^2 = F.$$

This condition allows us to calculate the equilibrium intensity of competition [11]. Under free entry, the indicator of the intensity of competition, the cut-off marginal cost c_D^e, becomes

$$c_D^e = \varphi c_B + \sqrt{\frac{4\gamma F}{L}}. \tag{14}$$

[11] Technically, we require that $c_D > \lambda c_B$, because otherwise firms that are punished have to exit the market. We therefore assume that

$$\varphi c_B + \sqrt{\frac{4\gamma F}{L}} \geq \lambda c_B,$$

to ensure that c_D is always larger than λc_B. This basically corresponds to assuming that there is sufficient product differentation.

Given (14), we then immediately obtain the long-run equilibrium values of the fraction of green-action firms m^e, NGO monitoring E^e, and the number of firms in the industry N^e:

$$E^e = \frac{(\varphi-1)\left[2c_D^e-(\varphi+1)c_B\right]}{(\lambda-1)\left[2c_D^e-(\lambda+1)c_B\right]} \tag{15}$$

$$m^e = 1-\frac{\Psi'(N^eE^e)}{H} \tag{16}$$

$$c_D^e = \frac{2\beta\gamma}{2\gamma+N^e}+\frac{N^e}{2\gamma+N^e}\overline{c}(m^e,E^e). \tag{17}$$

Substituting (14) into (17) gives:

$$\varphi c_B+\sqrt{\frac{4\gamma F}{L}}=f(m,N). \tag{18}$$

Equation (16) defines a decreasing relationship $m=\overline{m}(N)$ between the share of green-action firms and the total number of firms in the industry. Intuitively, a higher number of firms increases the marginal cost of monitoring effort for the NGO, by the dilution effect discussed in the previous section. At a given level of monitoring effort, this higher cost has to be compatible with a higher marginal benefit of effort for the NGO, i.e. a larger share of firms acting brown.

Equation (18), instead, describes a decreasing relationship $N=\overline{N}(m)$. The intuition for this is that if the share of green-action firms in the market increases, the cut-off level compatible with it decreases (because the green-action firms have lower marginal costs as compared to punished brown-action ones), and this makes the market competition tougher. Hence, at the current industry structure, firms start making losses and some of them will exit the industry in the long run. This process will continue until the expected profits of firms does not make the free-entry condition hold again.

We can now analyze the shape of the equilibrium. For this, we first make the following technical assumption:

$$\textbf{Assumption A}:\ \left[\beta-\varphi c_B\right]^2>\frac{4\gamma F}{L}>\left[\lambda-\varphi\right]^2c_B^2.$$

This assumption ensures two things. The first inequality ensures that the degree of substitutability between the numeraire good and the differentiated varieties β is large enough to get a positive demand for the differentiated products under free entry (i.e. $\beta>c_D^e$). The second inequality ensures that competition consistent with free entry is not too intense (i.e.

$c_D^e > \lambda c_B$), ensuring that the punished acting brown firms are not driven out from the market.

Let's start first with the relationship $m = \overline{m}(N)$, described by the equation

$$m^e = 1 - \frac{\Psi'(NE^e)}{H}.$$

This relationship describes the fraction of green-acting firms m^e consistent with a free entry industry equilibrium with N active firms and an NGO effort of E^e. Given that the cost of monitoring effort $\Psi(.)$ is convex, $m = \overline{m}(N)$ is monotonically decreasing, and takes the value equal to zero at the point

$$N^0 = \frac{\Psi'^{-1}(H)}{E^e}.$$

At point N^0, we hit the corner solution $m^e = 0$. No firm adopts the green technology because of the strong dilution effect on NGO monitoring. The probability of being discovered (and, consequently, being punished) is too small to induce firms to act green. This threshold N^0 is increasing in the visibility gain of the NGO H and decreasing in the convexity of the NGO cost function $\Psi(.)$.

Let's now turn to the relationship $N = \overline{N}(m)$. This curve describes the free entry market structure N, given a fraction m^e of firms with costs φc_B (i.e., acting green), a fraction $(1 - m^e)\, E^e$ of firms with costs λc_B (i.e. acting brown and being punished) and a fraction $(1 - m^e)\,(1 - E^e)$ of firms with costs c_B (i.e. acting brown and remaining undiscovered).

Using (17) we can show (see Appendix) that $\overline{N}(m)$ takes an hyperbolic decreasing form:

$$N = \overline{N}(m) = \frac{2\gamma(\beta - c_D^e)}{\Omega_1(c_D^e)m - \Omega_0(c_D^e) + c_D^e},$$

where $\Omega_0(c_D^e)$ and $\Omega_1(c_D^e)$ are two positive constants with $\Omega_0(c_D^e) < c_D^e$ under Assumption A. At $m = 0$, this function takes the value

$$\overline{N}(0) = \frac{2\gamma(\beta - c_D^e)}{c_D^e - \Omega_0(c_D^e)} > 0.$$

We also show (in the Appendix) that under Assumption A, there exists at least one free-entry industry equilibrium with NGO monitoring. Figure 6 describes the long-run industry equilibrium graphically.

[Insert Figure 6 about here]

The equilibrium is interior when $N^0 > \overline{N}(0)$. This condition can also be written as

$$H > \Psi' \left(E^e \frac{2\gamma(\beta - c_D^e)}{c_D^e - \Omega_0(c_D^e)} \right). \tag{19}$$

In this case, the free-entry equilibria will exhibit a strictly positive number of firms acting green (i.e. $m^* > 0$). On the other hand, when (19) is not satisfied, the situation with no firm acting green (i.e. $m^* = 0$) is necessarily a free-entry industry equilibrium. Intuitively, condition (19) requires that if no firm acts green ($m = 0$) and free entry into the industry is allowed, the NGO has sufficient incentives to start monitoring. This will occur when the visibility benefit to discover brown firms H is large enough and/or its marginal cost curve $\Psi'(.)$ is not too steep (i.e. the cost function $\Psi(.)$ is not too convex).

Concentrating on the interior industry equilibria as shown in Figure 6, a necessary and sufficient condition to get a *unique* interior equilibrium is the fact that at the equilibrium, the $\overline{N}(m)$ curve is flatter than the $\overline{m}(N)$ curve, at the point of intersection of the two curves. This second condition can be interpreted as follows. Under NGO monitoring, the number of firms in the industry affects the cut-off cost level c_D in two ways. The first one is the direct (negative) Melitz-Ottaviano effect of competition. The second is the indirect positive effect: it comes from the fact that the higher number of firms in the industry induces the NGO to reduce its per-firm monitoring effort, and this leads to fewer firms acting green (i.e. lower m) and, consequently, to a higher *ex post* industry-average production cost (given that $\lambda > \varphi$). The second condition states that the first (direct) effect outweighs the second (indirect) one. Formally, the condition writes as

$$-\frac{\partial c_D}{\partial N} > -\frac{\partial c_D}{\partial m} \frac{\Psi"}{H} E^e, \tag{20}$$

where

$$\begin{aligned} \frac{\partial c_D}{\partial N} &= A'(N) + B'(N)\overline{c}(m, E^e) < 0, \\ \frac{\partial c_D}{\partial m} &= B(N) \frac{\partial \overline{c}(m, E^e)}{\partial m} < 0, \text{ with } A \equiv \frac{2\beta\gamma}{2\gamma + N}, \text{ and } B \equiv \frac{N}{2\gamma + N}. \end{aligned}$$

5.1 Comparative statics in the long run

How does an increase in the market size or a decrease in the fixed cost of entry affect the long-run equilibrium? Using our analysis above, we can now calculate these comparative statics. Consider an increase in L (a decrease in F has the same qualitative effect). Its first effect is on $\overline{m}(N)$ relationship: larger market size implies that the profit of any given firm increases, which in turn stimulates entry and increases the intensity of competition (i.e. c_D^e decreases). As shown above, in a more competitive environment, firms have relatively lower incentives to act green. A lower share of firms then chooses to act green, while the equilibrium level of NGO monitoring that makes the firms indifferent between acting green and acting brown should increase. In the long-run, as increased profits attract new entrants, the number of the firms in the industry increases. The impact of a larger market L corresponds to a counter-clockwise rotation in the $\overline{m}(N)$ line and a move from point A to B on Figure 7.

[Insert Figure 7 about here]

There is also a second effect, reinforcing the first one. An increase in the market size also affect the $\overline{N}(m)$ relationship. Indeed, again, as the market becomes larger and competition more intense, the equilibrium monitoring effort of the NGO E^e increases. Ceteris paribus, this increases the fraction of punished brown firms and consequently the average cost of production $\overline{c}$ in the industry. This, in turn, tends to soften the intensity of competition in the industry, inducing further entry of firms into the sector. Graphically, this comparative statics corresponds to an upward shift in the $\overline{N}(m)$ curve and the move from point B to C. Thus, the overall effect is the higher number of firms in the industry in the long run, a smaller share of them acting green, and more intense equilibrium monitoring by the NGO. These results can be summarized as:

$$\begin{aligned} \frac{\partial N^*}{\partial L} &> 0, \ \frac{\partial m^*}{\partial L} < 0, \ \frac{\partial E^*}{\partial L} > 0, \\ \frac{\partial N^*}{\partial F} &< 0, \ \frac{\partial m^*}{\partial F} > 0, \ \frac{\partial E^*}{\partial F} < 0. \end{aligned}$$

This analysis explains some of the patterns that we have discussed in the introduction. Increased globalization can be understood as larger markets. As we have shown, this leads to more firms, but fewer of them acting green, and, consequently, intensifies NGO activism targeting corporations. Thus, the concerns of anti-globalization movements are to some extent valid: a smaller share of firms acting green implies that globalization does indeed generate some undesirable consequences in terms of environmental harm or less socially responsible behavior of firms. Secondly, globalization seems to be one of the driving forces behind the rise of NGO activism.[12] However, this higher activism does not seem to able to

[12] Krautheim and Verdier (2012) find a similar effect, but through a different mechanism in the context of credence goods.

neutralize fully these negative consequences of globalization.

Another interesting comparative statics concerns the effect of increased visibility benefit H of the NGO. This could reflect a more sensitive public opinion (to the NGO's advocacy activities) or a larger value that the NGO's donors associate with successful watchdog campaigns. Simple inspection shows that an increase in H only affects the curve $\overline{m}(N)$. As H increases, the NGO has more incentives to monitor the industry. In order to re-adjust downward this monitoring effort to the level E^e that makes firms indifferent between acting brown or green, there should be an increase in the fraction of firms acting green in the sector. Graphically, the shift associated with an increase in H corresponds to a clockwise rotation in the $\overline{m}(N)$ line and a move from point A to B on Figure 8. The new equilibrium in B has a lower number of firms N in the industry and a larger fraction of firms acting green. The monitoring effort of the NGO in equilibrium is unaffected:

$$\frac{\partial N^*}{\partial H} < 0, \ \frac{\partial m^*}{\partial H} > 0, \ \frac{\partial E^*}{\partial H} = 0.$$

The finding that an exogenous increase in the incentives for the NGO to carry out watchdog campaigns leads to a smaller number of firms in the sector, alongwith better adherence to social responsibility by the remaining firms, is consistent with recent empirical results of Harrison and Scorse (2010). They show that in Indonesian districts with more intense NGO activism, the probability of plant shutdown (for smaller firms) in the TFA (textile, footwear, and apparel) sector is significantly higher than in districts with less intense activism.

[**Insert Figure 8 about here**]

5.2 Multiple equilibria

When $N^0 > N(0)$ and the condition (20) is not satisfied, our model may deliver multiple equilibria. Under NGO monitoring, the number of firms in the industry affects the cut-off cost level c_D in two ways. The first one is the direct (negative) Melitz-Ottaviano effect of competition: more firms in the industry lead to more intense competition. The second is an indirect positive effect: a higher number of firms induces the NGO to reduce its per-firm monitoring effort. This leads to fewer firms acting green (i.e. lower m) and as a consequence, to a higher *ex post* industry-average production cost (given that $\lambda > \varphi$), relaxing the intensity of competition. This softening of competition, in turn, stimulates entry in the industry. When (20) does not hold, the second effect may dominate the first (direct) conventional effect and this creates a source of multiple equilibria. As shown in Figure 9, there can be one stable equilibrium at point C with few firms, a moderate level of competition, a relatively large fraction of firms acting green and a low level of NGO monitoring, and another stable equilibrium at point A (with more intense competition, a smaller fraction of green firms and a more intense NGO monitoring).

[**Insert Figure 9 about here**]

Even when condition (20) is satisfied, but $N^0 < \overline{N}(0)$, there still might be multiple equilibria in the long run. As we know, one equilibrium is the corner equilibrium (point A) with $\overline{N}(0)$ firms (all of which act brown). As Figure 10 shows, there might also exist (at point C) an interior stable equilibrium (m^e, N^e), with a smaller number of firms, some of which act green.

[**Insert Figure 10 about here**]

Interestingly, in such a situation, a small change that reverts the order $(N^0 > N(0)$ instead of $N^0 < N(0))$ can lead to a dramatic change in industry structure. Consider an increase in NGO visibility H or a reduction in the marginal cost of monitoring $\Psi'(.)$. Such a shift will lead to a clockwise rotation in the $\overline{m}(N)$ line around the point $(1, 0)$ in Figure 11. A sufficiently large change in one of these parameters destroys the corner equilibrium at point A (with only brown acting firms and a market structure at $N(0)$). The increased NGO visibility will immediately result in higher NGO activity and monitoring, inducing some firms to adopt the green technology. As the fraction m of green firms increases in the industry, this reduces average costs of production in the industry and intensifies competition. This, in turn, induces some firms to exit the sector, relaxing market competition, and inducing an even larger fraction of firms to adopt the green technology. As this happens, the level of NGO monitoring decreases to adjust to its new long run situation which is a point C'. Importantly, the long-run observational response of the NGO monitoring may be different from its short-run reaction, as it interacts endogenously with the evolution of the industry market structure.

[**Insert Figure 11 about here**]

6 Conclusion

In their recent survey of the economics of corporate social responsibility, Kitzmueller and Shimshack (2012) state:

> "Both the theory and empirics of CSR in an international context are underdeveloped [...] Directions for future theoretical research include the role of NGOs in a globalizing economy with CSR, the development policy implications of CSR, and the relationship between CSR and institutions, supply chains, and firm locations" (pp. 76-77).

In this paper, we contribute to closing this gap by presenting a model of NGO-firm interaction embedded in an industry environment with endogenous markups, which can be thought of as an industry with multinational firms operating in a developing country. We have studied the effect of NGO activism on the industry equilibrium, in particular, on the intensity of competition, market structure, and the share of firms acting in socially responsible manner. In addition to analyzing the short-run effects of an exogenous change in NGO payoffs, production costs, market structure, or consumer preferences, we have derived the long-run behavior of the industry and the NGO pressure. We have found that multiple long-run equilibria can exist (one with fewer firms and a larger share of them being socially-responsible, and the other with more firms but fewer (or none) of them acting socially responsibly.

What are the social or policy implications of our findings? Consider citizens' welfare in a developing country, in which a large share of workers is employed in manufacturing. Our long-run analysis indicates that a policy-driven increase in H does not necessarily improve the welfare of the workers in the developing country. This occurs because such a change will engender two effects: on the one hand, it will lead to more intensive monitoring by the NGO (and thus more firms acting in a socially-responsible manner), but, on the other hand, it will lower the number of firms staying in the sector. The first effect unambiguously increases the welfare of workers, while the second one reduces it. Thus, if the second effect is sufficiently large, promoting or subsidizing watchdog NGOs' activity in developing countries can reveal itself counterproductive.

We conclude by suggesting one direction for future research. The choice of acting green or brown in our model is assumed to be irreversible. In a more realistic model, firms would change their actions over time, which would imply that any given firm solves an optimal stopping problem, i.e. when to switch from the brown action to the green one. Exploring the robustness of our findings in a more general model constructed along these lines is a promising avenue for future theoretical work.

7 Appendix

7.1 Proof that $\frac{\partial \bar{c}(m, E^*(c_D))}{\partial m} < 0$

Note that at the equilibrium value of NGO monitoring, the marginal cost of the brown-action firms is, on average, equal to

$$[E^*(c_D)\lambda + (1 - E^*(c_D))]\, c_B = \left[\frac{(\varphi - 1)\,[2c_D - (\varphi + 1)c_B]}{[2c_D - (\lambda + 1)c_B]} + 1 \right] c_B.$$

As $\lambda > \varphi$, we have

$$\frac{2c_D - (\varphi + 1)c_B}{2c_D - (\lambda + 1)c_B} > 1.$$

Hence

$$\left[\frac{(\varphi - 1)\,[2c_D - (\varphi + 1)c_B]}{[2c_D - (\lambda + 1)c_B]} + 1 \right] c_B > (\varphi - 1)c_B + c_B = \varphi c_B,$$

and

$$[E^*(c_D)\lambda + (1 - E^*(c_D))]\, c_B > \varphi c_B.$$

From here, it follows that

$$\frac{\partial \bar{c}(m, E^*(c_D))}{\partial m} = \varphi c_B - [E^*(c_D)\lambda + (1 - E^*(c_D))]\, c_B < 0.$$

QED.

7.2 Proof of existence and uniqueness of an equilibrium for a given N

First, note that

$$\lim_{c_D \to \infty} E^*(c_D) = \widehat{E} = \frac{\varphi - 1}{\lambda - 1} < 1.$$

Given the assumption that $c_D \geq \lambda c_B$,

$$E^*(c_D) < E^*(\lambda c_B) = \frac{(\varphi - 1)(2\lambda c_B - (\varphi + 1)c_B)}{(\lambda - 1)(2\lambda c_B - (\lambda + 1)c_B)}.$$

Therefore, $m = \widetilde{m}(c_D)$ is increasing in c_D, with

$$\lim_{c_D \to \infty} \widetilde{m}(c_D) = 1 - \frac{\Psi'(N\widehat{E})}{H} < 1,$$

and

$$\widetilde{m}(\lambda c_B) = 1 - \frac{\Psi'(NE^*(\lambda c_B))}{H}.$$

At the same time, for the second relationship ($c_D = \widetilde{c}_D(m)$), we have

$$\frac{\partial \widetilde{c}_D(m)}{\partial m} = \frac{B(N)\frac{\partial \overline{c}(m,E^*(c_D))}{\partial m}}{1 - B(N)(1-m)(\lambda-1)c_B\frac{\partial E^*(c_D))}{\partial c_D}} < 0,$$

where

$$A(N) = \frac{2\beta\gamma}{2\gamma + N} < \beta \text{ and } B(N) = \frac{N}{2\gamma + N} < 1.$$

Thus, $\widetilde{c}_D(m)$ is decreasing in m, and, moreover,

$$\begin{aligned}
\widetilde{c}_D(0) &= A(N) + B(N)\left[E\left(\widetilde{c}_D(0)\right)\lambda c_B + (1 - E\left(\widetilde{c}_D(0)\right))c_B\right], \\
\widetilde{c}_D(1) &= A(N) + B(N)c_G.
\end{aligned}$$

Next, denote as $\Theta(m) = \widetilde{m}\left[\widetilde{c}_D(m)\right] - m$. This function has the following properties:

$$\Theta'(m) = \widetilde{m}'\left[\widetilde{c}_D(m)\right]\widetilde{c}_D'(m) - 1 < 0,$$

with $\Theta(0) = \widetilde{m}\left[\widetilde{c}_D(0)\right] > 0$ and $\Theta(1) = \widetilde{m}\left[\widetilde{c}_D(1)\right] - 1 < 1 - \frac{\Psi'(N\widehat{E})}{H} - 1 < 0$. Thus, there exists a unique value $m^{SR} \in (0,1)$ such that $\Theta(m^{SR}) = 0$. Consequently, there is a unique fixed point m^{SR} and a unique equilibrium $m^{SR}(N)$, c_D^{SR} and E^{SR}, given by

$$\Theta(m^{SR}) = 0; \quad c_D^{SR} = \widetilde{c}_D(m^{SR}); \quad E^{SR} = E^*(\widetilde{c}_D(m^{SR})).$$

QED

7.3 Proof of existence of an industry equilibrium with free entry

- The curve $N = \overline{N}(m)$ **:**

Consider first the relationship $N = \overline{N}(m)$. Note first that using the first equation of (13), the industry-average cost $\overline{c}(m, E)$ writes as:

$$\begin{aligned}
\overline{c}(m,E) &= \left[m\varphi + (1-m)(E\lambda + (1-E))\right]c_B = \\
&= \left[1 + E(\lambda-1) + m((\varphi-1) - E(\lambda-1))\right]c_B = \\
&= c_B\left[1 + \frac{(\varphi-1)(2c_D - (\varphi+1)c_B)}{2c_D - (\lambda+1)c_B} + m\left((\varphi-1) - \frac{(\varphi-1)(2c_D - (\varphi+1)c_B)}{2c_D - (\lambda+1)c_B}\right)\right] \\
&= \Omega_0(c_D) - \Omega_1(c_D)m,
\end{aligned}$$

where

$$\Omega_0(c_D) \equiv c_B\left[1 + E(\lambda - 1)\right] = \frac{c_B\left[\varphi(2c_D - \varphi c_B) - \lambda c_B\right]}{2c_D - (\lambda + 1)c_B},$$

and

$$\Omega_1(c_D) \equiv c_B\left[(\varphi - 1) - E(\lambda - 1)\right] = \frac{(\lambda - \varphi)(\varphi - 1)c_B^2}{2c_D - (\lambda + 1)c_B} > 0.$$

Note that as long as $\lambda c_B < c_D$, one has $\Omega_0(c_D) < c_D$. Indeed, as

$$E = \frac{(\varphi - 1)(2c_D - (\varphi + 1)c_B)}{(\lambda - 1)(2c_D - (\lambda + 1)c_B)} < 1,$$

then

$$\Omega_0(c_D) = c_B\left[1 + E(\lambda - 1)\right] < \lambda c_B < c_D.$$

Using the previous expression for $\overline{c}(m, E)$, (17) now becomes

$$\begin{aligned} c_D^e &= \frac{2\beta\gamma}{2\gamma + N} + \frac{N}{2\gamma + N}\overline{c}(m^e, E^e) = \\ &= \frac{1}{2\gamma + N}\left(2\beta\gamma + N\left[\Omega_0(c_D^e) - \Omega_1(c_D^e)m^e\right]\right). \end{aligned}$$

Solving this equation for N, we obtain

$$N = \frac{2\gamma(\beta - c_D^e)}{\Omega_1(c_D^e)m^e - \Omega_0(c_D^e) + c_D^e}.$$

Thus, the relationship $N = \overline{N}(m)$ is hyperbolic and decreasing. At $m = 0$ it takes the value

$$N(0) = \frac{2\gamma(\beta - c_D^e)}{c_D^e - \Omega_0(c_D^e)}.$$

- The curve $m = \overline{m}(N)$:

Let's now turn to the relationship $m = \overline{m}(N)$, described by the equation

$$m = 1 - \frac{\Psi'(N^e E^e)}{H}.$$

Given that the cost of monitoring effort $\Psi(.)$ is convex, $m = \overline{m}(N)$ is monotonically decreasing, which takes the value equal to zero at the point

$$N^0 = \frac{\Psi'^{-1}(H)}{E^e}.$$

and such that $\overline{m}(0) = 1$ (as $\Psi'(0) = 0$).

- Existence of a free entry equilibrium

(i) Consider the first case where $N^0 > \overline{N}(0)$. Denote the following function $\Theta(m) = \left(\overline{m} \circ \overline{N}\right)(m)$ for all $m \in [0,1]$. As is clear, given assumption A and the fact that $c_D^e - \Omega_0(c_D^e) > 0$, the functions $N = \overline{N}(m)$ is continuous for $m \in [0,1]$. Also the function $m = \overline{m}(N)$ is a continuous function of N. Now $\overline{N}(0) < N^0$ implies that $\overline{m}\left(\overline{N}\left(0\right)\right) > 0$ and $\Theta(0) = \left(\overline{m} \circ \overline{N}\right)(0) > 0$. Similarly given assumption A:, $\overline{N}\left(1\right) = \frac{2\gamma(\beta - c_D^e)}{\Omega_1(c_D^e) - \Omega_0(c_D^e) + c_D^e} > 0$. Hence $\overline{m}\left(\overline{N}\left(1\right)\right) < \overline{m}(0) = 1$. Therefore $\Theta(1) = \left(\overline{m} \circ \overline{N}\right)(1) < 1$. The function $\Theta(.)$ is continuous on the interval $[0,1]$ and such that $\Theta(0) > 0$ and $\Theta(1) < 1$. By Brower fixed-point theorem, there is a at least a fixed point $m^* \in]0,1[$ such that $\Theta(m^*) = m^*$. The point $\left(m^*, \overline{N}\left(m^*\right)\right)$ corresponds to a free entry industry interior equilibrium.

(ii) Consider now the case $N^0 \leq \overline{N}(0)$. Then trivially $\overline{m}\left(\overline{N}\left(0\right)\right) = 0$ and the point $\left(0, \overline{N}\left(0\right)\right)$ corresponds to a free entry industry (corner) equilibrium. **QED.**

Therefore, two conditions are jointly sufficient for the existence of a unique stable interior equilibrium: (i) that $N^0 > N(0)$, and (ii) at the equilibrium, the $\overline{N}(m)$ curve is flatter than the $\overline{m}(N)$ curve.

References

[1] Aldashev, G., Verdier, T. 2009. When NGOs Go Global: Competition on international markets for development donations. *Journal of International Economics* **79**: 198-210.

[2] Aldashev, G., Verdier, T. 2010. Goodwill bazaar: NGO competition and giving to development. *Journal of Development Economics* **91**: 48-63.

[3] Baron, D. 2001. Private politics, corporate social responsibility, and integrated strategy. *Journal of Economics & Management Strategy* **10**: 7-45.

[4] Baron, D. 2003. Private politics. *Journal of Economics & Management Strategy* **12**: 31–66.

[5] Baron, D. 2010. *Business and Its Environment*, 6th ed. Upper Saddle River, NJ: Prentice Hall.

[6] Baron, D., Diermeier, D. 2007. Strategic activism and nonmarket strategy. *Journal of Economics & Management Strategy* **16**: 599-634.

[7] Besley, T., Ghatak, M. 2005. Competition and incentives with motivated agents. *American Economic Review* **95**: 616-636.

[8] Besley, T., Ghatak, M. 2007. Retailing public goods: The economics of corporate social responsibility. *Journal of Public Economics* **91**: 1645-1663.

[9] Bottega, L., DeFreitas, J. 2009. Public, private and nonprofit regulation for environmental quality. *Journal of Economics & Management Strategy* **18:** 105–123.

[10] Cai, H., Liu, Q. 2009. Competition and corporate tax avoidance: Evidence from Chinese industrial firms. *Economic Journal* **119**: 764-795.

[11] Dixit, A., Stiglitz, J. 1977. Monopolistic competition and optimum product diversity. *American Economic Review* **67**: 297-308.

[12] Doh, J., Guay, T. 2004. Globalization and corporate social responsibility: How non-governmental organizations influence labor and environmental codes of conduct. *Management International Review* **44**: 7-29.

[13] Feddersen, T., Gilligan, T. 2001. Saints and markets: Activists and the supply of credence goods. *Journal of Economics & Management Strategy* **10**: 149-171.

[14] Fernandez-Kranz, D., Santalo, J. 2010. When necessity becomes a virtue: The effect of product market competition on corporate social responsibility. *Journal of Economics & Management Strategy* **19**: 453-487.

[15] Guha, B., Roy Chowdhury, P. 2013. Micro-finance competition: Motivated micro-lenders, double-dipping and default. *Journal of Development Economics* **105**: 86-102.

[16] Harrison, A., Scorse, J. 2010. Multinationals and anti-sweatshop activism. *American Economic Review* **100**: 247-273.

[17] Kitzmueller, M., Shimshack, J. Economic perspectives on corporate social responsibility. *Journal of Economic Literature* **50**: 51-84.

[18] Krautheim, S., Verdier, T. 2012. Globalization, credence goods and international civil society. CEPR Discussion Paper No. 9232.

[19] Immordino, G. 2008. Fairness, consumer consciousness and the welfare of less developed countries. *Global Economy Journal* **8**(1).

[20] Limardi, M. 2011. Non-governmental regulation: NGO monitoring and firm compliance with social standards. Paris School of Economics, mimeo.

[21] Melitz, M., Ottaviano, G. 2008. Market size, trade, and productivity. *Review of Economic Studies* **75**: 295–316.

[22] O'Rourke, D. 2003. Outsourcing regulation: Analyzing non-governmental systems of labor standards and monitoring. *Policy Studies Journal* **31**: 1-29.

[23] Ottaviano, G., Tabuchi, T., Thisse, J.-F. 2002. Agglomeration and trade revisited. *International Economic Review* **43**: 409-436.

[24] Shleifer, A. 2004. Does Competition Destroy Ethical Behavior? *American Economic Review* **94**: 414-418.

[25] Yaziji, M., Doh, J. 2009. *NGOs and Corporations: Conflict and Collaboration*. Cambridge, UK: Cambridge University Press.

Figure 1. Nash equilibrium

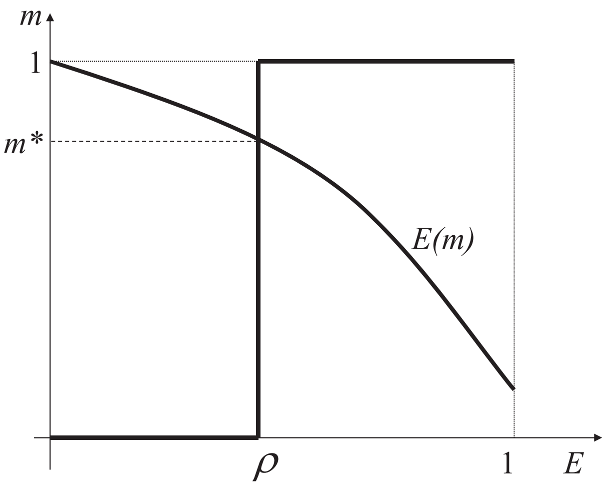

Figure 2. Comparative statics for Nash equilibrium

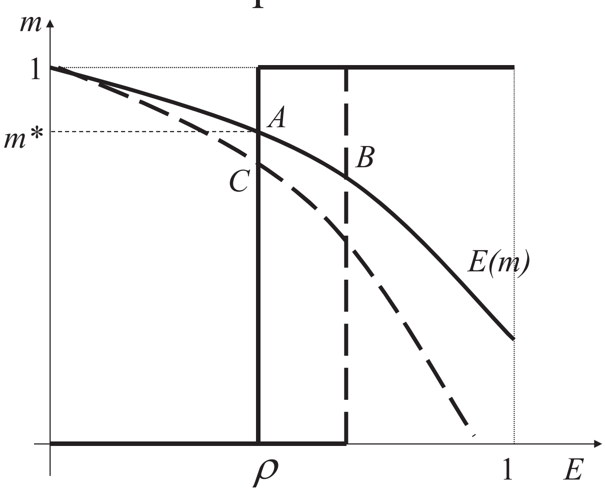

Figure 3. Profit functions under monopolistic competition

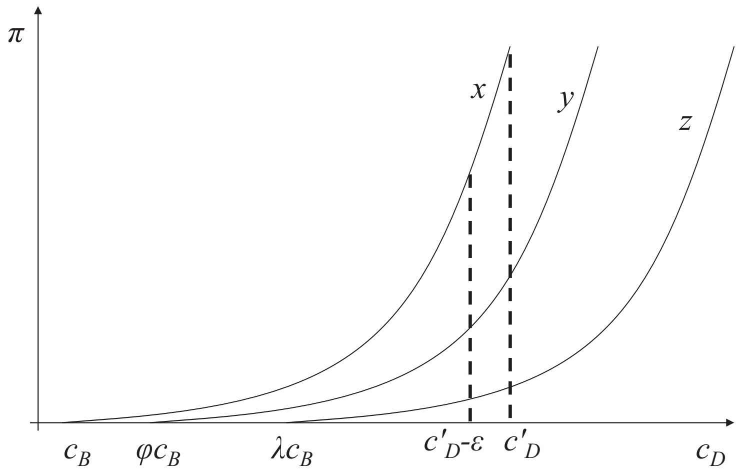

Figure 4. Short-run industry equilibrium

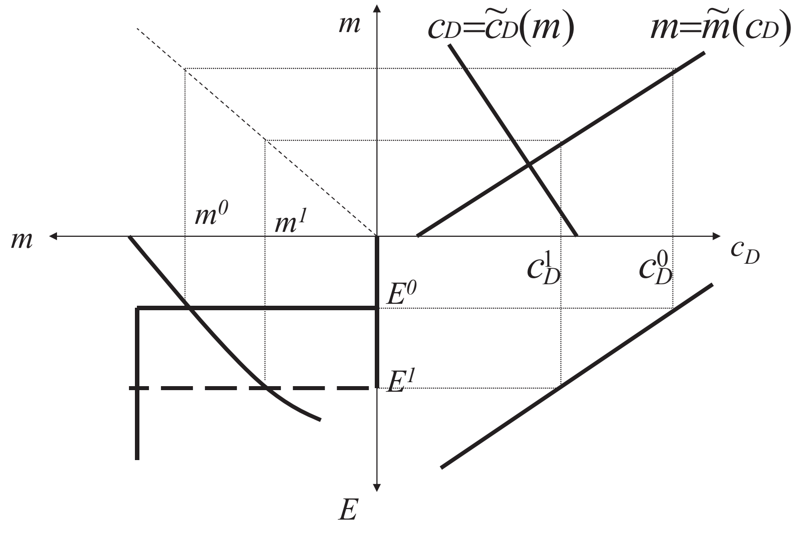

Figure 5a. Effect of a change in the NGO payoffs

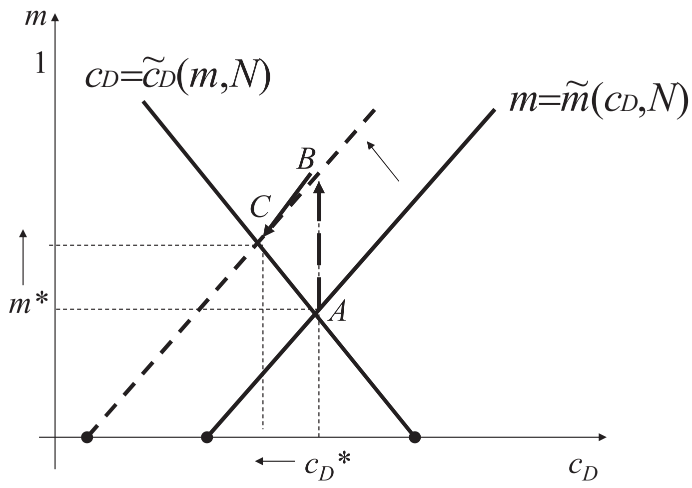

Figure 5b. Effect of a change in (relative) production costs

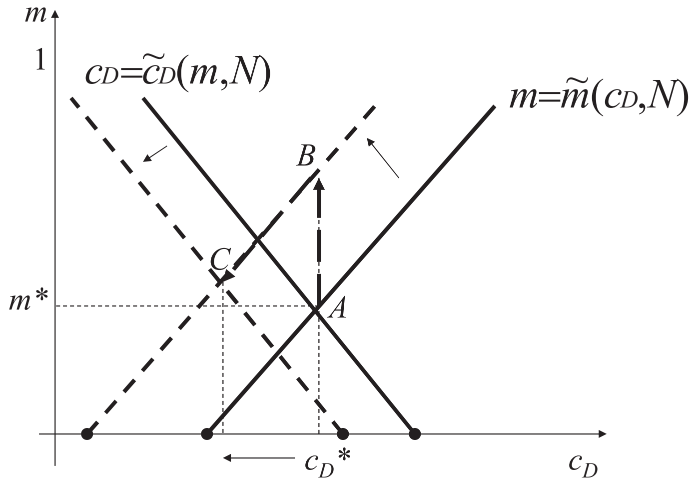

Figure 5c. Effect of a change in market structure

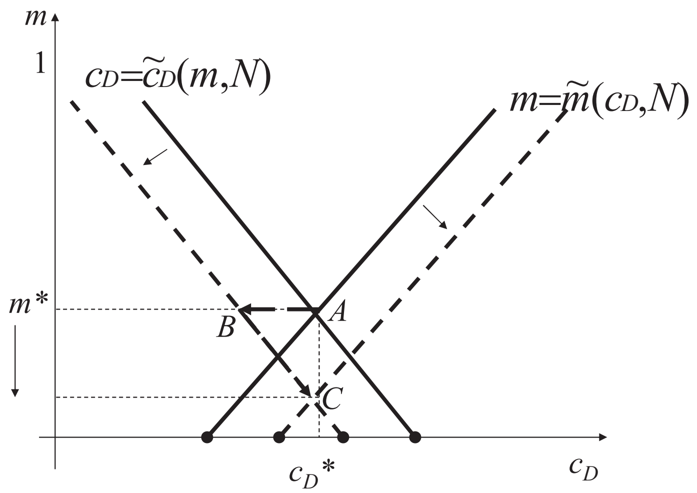

Figure 5d. Effect of a change in consumer tastes

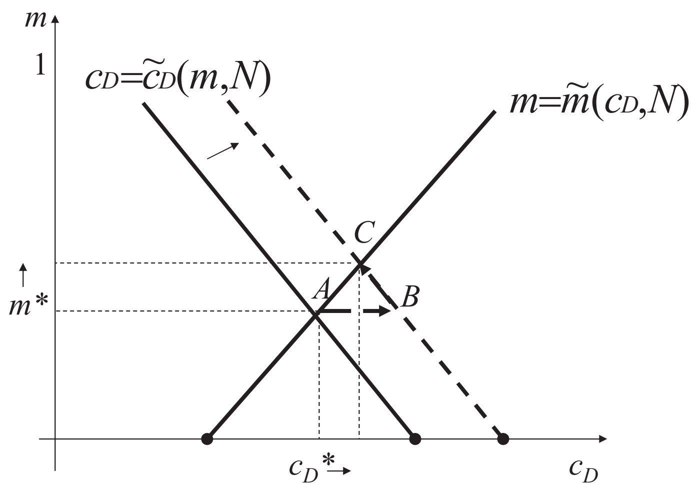

Figure 6. Long-run industry equilibrium

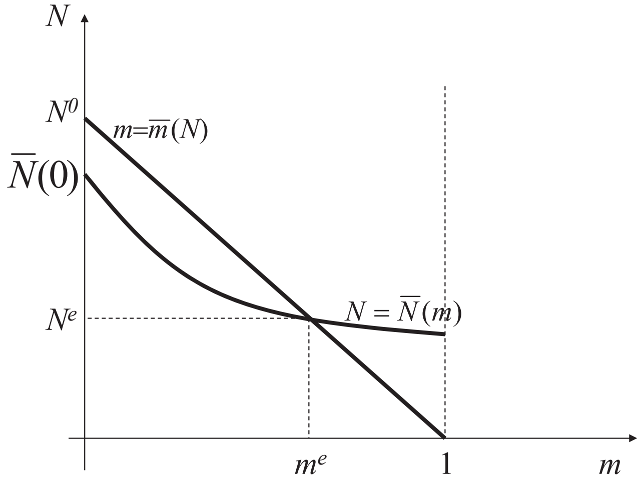

Figure 7. Long-run comparative statics: effect of a change in market size or fixed cost of entry

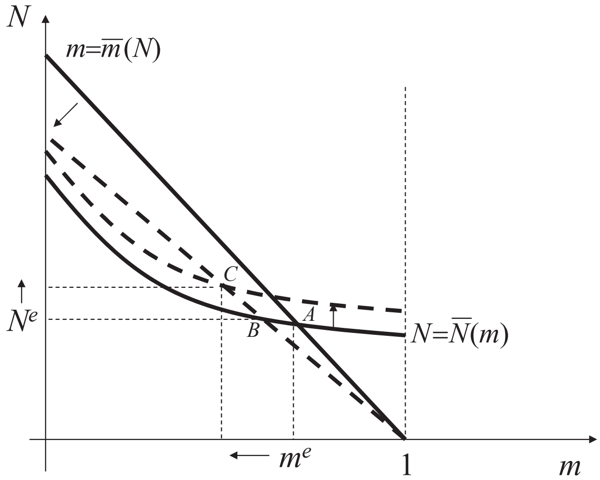

Figure 8. Long-run comparative statics: effect of a change in NGO payoffs

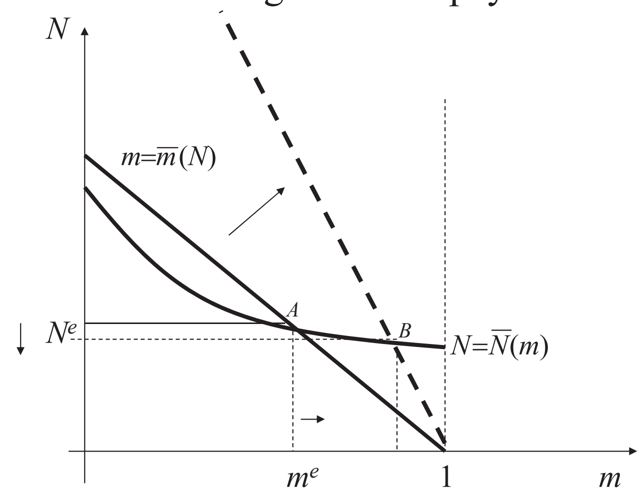

Figure 9. Multiple equilibria

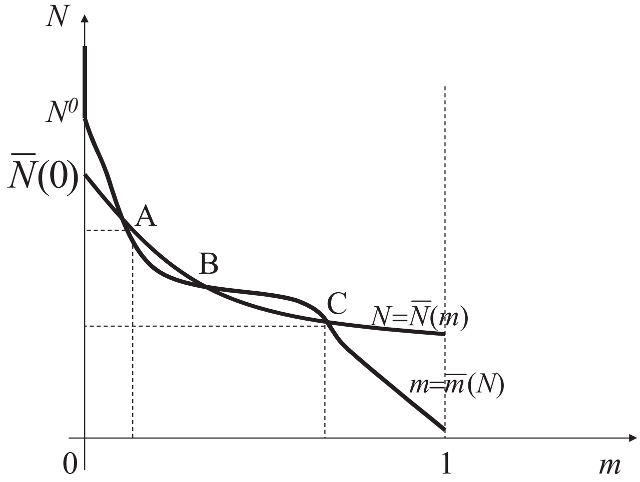

Figure 10. Multiple equilibria

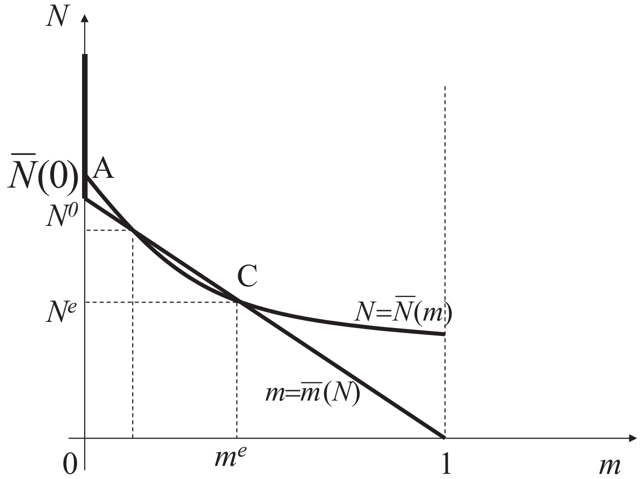

Figure 11. Multiple equilibria and shift of parameters