Are consumer boycotts effective?

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Abstract

This paper derives the conditions of success of a consumer boycott generated by environmental preferences. Overall the chance of success of this kind of boycott appears to be small. First, coordination issues and free riding reduce considerably the likelihood of boycott success. Second, it appears that consumers the most able to hurt the targeted firm's profit also have the highest opportunity cost of boycotting. Thus they are less likely to participate in the boycott. Conversely, consumers the most involved in the boycott have high environmental preferences and small amounts of consumption, which prevent them from hurting the firm's profit enough.

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1 Introduction

A new consumption pattern has emerged recently. Nowadays citizens often use consumption as a political act, "a new way to save the world" (Mc Laughlin, 2004). Indeed, these consumption practices constitute a way to signal preferences and to conciliate consumption with social, environmental or health considerations. Among this tendency, consumer boycotts are for unsatisfied consumers a way to compensate for governments inactivity. They constitute a substitute to public policies. The objective is to put enough pressure on the target to make it adopt fair practices.

"Economic consumer boycotts" (Friedman, 1999), i.e. the individual or collective choice of not buying some product, is now a frequently used tool by NGOs or lobby groups to protest against unfair marketing, social or environmental practices. For example, in 1959, a group of South African exiles and their British supporters called for a boycott of fruits, cigarettes and other goods imported from South Africa to oppose apartheid. More recently, a boycott of Israeli products and tourism followed decades of refusal to abide by UN resolutions, International Humanitarian law and the Fourth Geneva Convention.

Consumer boycotts upon environmental arguments are a strategy commonly used by many environmental NGOs. A first example is the boycott of cosmetic firms (e.g: Procter and Gamble, Colgate-Palmolive), because of their use of animal testing. Another case is the boycott of major oil companies (e.g: Total, ESSO, Shell), for their environmental damages and their supposed lobbying efforts to deter climate change policies. Some large fast-food companies (e.g: McDonald's) have been targeted by boycott campaigns because of their supposed environmental unfriendly way to produce meat. Finally, some NGOs support the boycott of non-certified tropical timber, to protest against unsustainable harvest practices and corruption. In 2004, WALHI, the Indonesia's largest environmental group, and several other environmental groups, have called for a boycott of timber from Indonesia, Malaysia, Singapore and China, countries where illegal logging plagues local development and environmental indicators.

Most researchers have focused on field studies (Miller and Sturdivan, 1977; Pruitt and Friedman, 1986; Garrett, 1987; Koku et al., 1997; Teoh et al. 1999) or history of consumer boycotts (Friedman, 1985, 1995; Smith, 1990). Tyran and Engelmann (2005) provide an

experimental analysis of consumer boycotts. Overall, most papers conclude a weak impact of consumer boycotts on the firms behavior.

Only few papers provide theoretical analysis of consumer boycotts. First, Innes (2006) considers a duopoly choosing between a clean and a dirty technology, while environmental organizations (EO) may invest in consumer boycotts to deter the choice of the dirty technology. The boycott effectiveness is determined by the EO's investment. Second, Baron (2002) considers that the action of boycotting by some consumers provides information to the other citizens about the seriousness of a situation. Boycotting constitute a way for consumers to signal their private information. Finally, Diermayer and Van Mieghem (2005) describe coordination between boycotting consumers as a stochastic process with threshold effects.

Analyzing under which conditions a consumer boycott is effective, this paper makes a simple point: boycott successes are quite unlikely. First, free riding and coordination failures are major problems of collective action, such as boycotts. Moreover, even if these problems may be avoided, a simple trade off between the opportunity cost of boycotting and the boycott potential to hurt the firm's profit reduces considerably the boycott potential for success.

We consider a boycott effective if it induces a change in the targeted firm's behavior consistent with the boycotting group's objective. Therefore, we do not discuss the case of a boycott of which the aim is only to signal disapproval to its target. We focus on environmental boycotts, but consumer boycotts upon social and health considerations follow roughly the same analysis.

Consider a firm producing a good with a polluting technology, with no government intervention to internalize the negative externality. This firm could opt for another technology, less or not polluting, but more expensive. The choice of the cheap and polluting technology is the result of a profit maximization. The success of an environmental boycott is therefore determined by its capacity of hurting the firm's profit enough to make the second technology more profitable. In this context, the main factor determining the success of the boycott is the consumer preferences, which induce the demand structure.

Conditions of success of an environmental boycott depend on several market characteristics. First, the consumers environmental preferences may create some scale for ecological certification and product differentiation. With free entry, a second firm may enter the market

and provide the good with clean production. Market structure is not considered explicitly in this paper. Only one firm is boycotted and the existence of an imperfect substitute is considered, of which the production is clean but which provides lower utility.

Second, information is crucial on both sides of the problem. On the one hand, the firm needs to have complete and perfect information of the demand side and of the consumers preferences in its profit maximization (for otherwise, there is room for signaling boycott). On the other hand, consumers also need good information on the demand characteristics, available technologies and the boycott's modalities.

Finally, coordination issues and strategic considerations are to be taken into account. Indeed, even a potentially successful boycott may fail because of coordination failures. Moreover, boycotting is subject to free riding. Any individual consumer, even if unsatisfied with the use of the polluting technology and hoping for the boycott to succeed, has an incentive to free ride and to consume the good anyway. Anonymity of consuming behaviors reinforces this incentive.

Of course, with perfect information, no coordination issue and no free rider behavior, one could only witness successful boycotts. Indeed, in that case, the perfectly informed consumers would only participate in a boycott if its success is certain. However, we will consider this best case scenario, in order to determine which patterns of the demand provide room for successful environmental consumer boycotts. We assume therefore that both consumers and the firm have perfect information about the demand patterns and the producing process. Moreover, by assumption, the unsatisfied consumers behave as one community, which avoid coordination failures and free riding. We only introduce a boycott efficiency parameter, which considers the environmental organization's capacity to overcome coordination problems. Imperfect information and strategic behaviors are to be introduced more explicitly later in this paper.

In this context, an environmental consumer boycott resembles a complete information war of attrition with asymmetric preferences between the targeted firm and the boycotting consumers. Complete information war of attrition models were first introduced by Maynard Smith (1974, 1982), studying animal behavior. Economic applications of war of attrition models include predatory pricing (Roth, 1996), exit in oligopoly (Fudenberg and Tirole, 1986) and the provision of public goods (Bilodeau and Slivinsky, 1996). Kornhauser et

al. (1989) and Fudenberg and Tirole (1986) proposed criteria for selection among potential perfect equilibria.

Burton (2004) first considers asymmetry in the players motivations in a war of attrition model. A group of environmentalists decides to blockade the access to an indivisible resource in order to preserve it, while a firm projects to harvest it. The player winning the conflict has *de facto* property rights on the resource. The following model is an application of Burton's asymmetry in the context of a consumer boycott. A group of consumers decides to stop consuming a good produced with a polluting technology, to induce the targeted firm to opt for a clean technology. The firm prefers the use of the polluting technology because it is profit maximizing. Overall, potential for success of a consumer boycott depends on the trade off between the hurting capacity of the boycotting group and the opportunity cost of boycotting. Consumers the most able to hurt the firm's profit have large amounts of consumption. Thus, their opportunity cost of boycotting is high. Overall, this simple tradeoff makes the likelihood of boycott success low.

Section 2 underlines the fact that free riding is a major problem of consumer boycotts and section 3 analyzes coordination patterns of heterogeneous consumers, with imperfect information. Section 4 presents a complete information war of attrition model. Finally, the analysis is applied to real life boycotts in section 5. Section 6 concludes.

2 Boycott and free riding

The aim of this first part is to show simply that free riding is the major cause of boycott failures. Consider a firm producing a good with a polluting technology, while a clean technology is available. An environmental NGO announces a consumer boycott, requiring for any consumer unhappy with the use of the dirty technology to stop consuming the good. The existence of an imperfect substitute is assumed.

Any individual consumer considers two potential choices and four related outcomes. First, the consumer can continue to consume the good. Second, he can decide to boycott. In each case, the boycott could succeed or fail. Boycotting is costly in terms of welfare, since the consumer has to switch his consumption for an imperfect substitute, providing less utility. A better substitute induces a lower cost of boycotting. Moreover, the boycott success is highly

uncertain, and individual participation of any consumer only has a marginal impact on the probability of success. In other words, any individual has an incentive to free ride, i.e not to participate in the boycott while hoping for it to succeed.

There are N environmentalists who would prefer the firm to switch for the clean technology. We introduce here some heterogeneity between environmentalist consumers. We consider the fact than consumers can have different costs of boycotting and gains from a boycott success[1]. Consumer i's individual choice is boycotting ($B_i = 1$) or not boycotting ($B_i = 0$). The number of boycotting consumers is therefore:

$$n = \sum_{i=1}^{N} B_i \tag{1}$$

In this case, any individual environmentalist participates if the expected payoff of participating exceeds the expected payoff of not participating, conditional on the boycott success. Basically, boycotting consists of paying a cost (C_i) for sure (i.e not consuming the good) to receive a potential gain G_i (i.e the technology switch). In contrast, there is no direct cost of not boycotting, but this strategy also provides a potential gain: the boycott may be successful even if any particular individual does not boycott.

The firm would switch technology if the boycotting population is greater than or equal to n^s. This threshold at which the boycott is successful is unknown to the environmentalists. They only have a probability of success, which is conditional on the boycott importance: $p[n \geq n^s]$. The boycott success probability is zero if nobody boycott: $p[0 \geq n^s] = 0$. Moreover the boycott would be successful for sure if every environmentalist was boycotting $p[N \geq n^s] = 1$. [2] Thus the boycott is potentially successful, but the environmentalists need to avoid free riding. Overall any environmentalist i boycotts $B_i = 1$ if:

$$p[\sum_{i \neq -i} B_{-i} + 1 \geq n^s]G_i - C_i \geq p[\sum_{i \neq -i} B_{-i} \geq n^s]G_i \tag{2}$$

[1]Consumers are classified according to their environmental preferences: consumer 1 has the highest environmental preferences and individual N has the lowest environmental preferences.

[2]The beliefs formation is not considered here. This belief structure can be due to the firm's reputation or other boycott experiences.

Therefore the choice of boycotting depends on the impact of the individual choice of boycotting on the probability of withdrawal for the firm:

$$p[\sum_{i\neq -i} B_{-i} + 1 \geq n^s] - p[\sum_{i\neq -i} B_{-i} \geq n^s] \geq \frac{C_i}{G_i} \tag{3}$$

Overall the probability of the boycott success only increases marginally with the choice of an individual consumer. Thus, the difference between the two probabilities is close to zero, and only consumers with very small $\frac{C_i}{G_i}$ ratios participate in the boycott. Overall, very few environmentalists are expected to boycott in this case, and the boycott success is highly improbable.

Solving free riding issues is difficult in this case. Indeed, consumption behaviors are not easily observable. Thus social control is not possible. NGO communication may help reduce this concern, if trying to emphasize individual responsibility in the boycott. However, even if free riding is avoided, consumers still need to coordinate.

3 Coordination failure

A second crucial issue concerning boycott successes is coordination, as a consequence of imperfect information. Let assume that free riding is not a problem anymore. Individual consumers still make their choice of boycotting considering two strategies: boycotting or not boycotting. In contrast with the precedent section, individual consumers do not consider a boycott success if they do not participate.

Consumer i's individual choice at time t is boycotting ($B_i(t) = 1$) or not boycotting ($B_i(t) = 0$). The number of boycotting consumers at time t is therefore:

$$n(t) = \sum_{i=1}^{N} B_i(t) \tag{4}$$

Boycotting consumers accept to pay a certain cost of boycotting C_i, to receive a gain G_i in case of success. Overall, consumer i decides to boycott at time t if his potential gain from a boycott success exceeds his cost of boycotting. Overall the individual choice of boycotting depends on the probability of the boycott success.

$$\begin{cases} B_i(t) = 1 \ if \ p[n(t) \geq n^s]G_i - C_i \geq 0 \\ B_i(t) = 0 \ if \ p[n(t) \geq n^s]G_i - C_i < 0 \end{cases} \tag{5}$$

Considering this equation, one can derive the participation threshold $\overline{p}_i = \frac{C_i}{G_i}$ at which consumer i decides to boycott.

$$\begin{cases} B_i(t) = 1 \ if \ p[n(t) \geq n^s] \geq \overline{p}_i \\ B_i(t) = 0 \ if \ p[n(t) \geq n^s] < \overline{p}_i \end{cases} \tag{6}$$

A first comment is that environmentalist consumers will enter sequentially in the boycott. Strong environmentalists, who have low costs of boycotting and small participation thresholds, will participate first. As the boycott importance and the probability of success grow, consumers with higher thresholds of boycotting decide to participate. Thus the first consumers deciding to boycott are those with negative costs of boycotting. Their participation threshold is therefore: $\overline{p}_i = 0$. As time goes on, the boycott importance grows as long as the probability of success gets larger than or equal to the probability threshold of some consumers.

Therefore the last consumer $\overline{n}$ deciding to boycott is defined as follows. It defines also the equilibrium boycott participation.

$$\overline{n} : \ p[\overline{n} \geq n^s] = \overline{p}_n = \frac{C_n}{G_n} \tag{7}$$

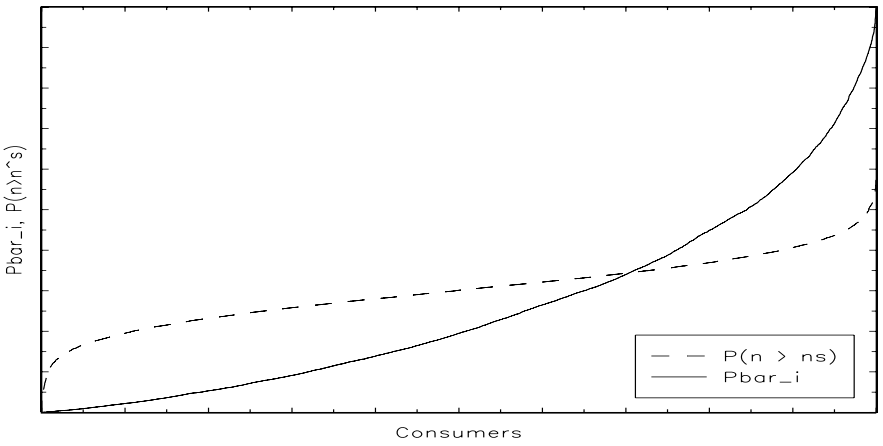
Figure (1) gives a representation of the equilibrium boycott population, which is the intersection between the two curves $p[n(t) \geq n^s]$ and $\overline{p}_i$. The boycott is successful if $\overline{n} \geq n^s$. Overall, this equilibrium boycott participation and thus the potential for success depend on the distribution of boycotting costs and the beliefs structure. Coordination needs optimistic consumers about the firm's withdrawal threshold n^s. Moreover, the consumers distribution needs to have fat tails, i.e. a large number of strong environmentalists, with low participation thresholds.

Figure (2) gives an example of coordination failure. The boycott would be successful if every environmentalist would participate. However, the consumers distribution (uniform in the case of figure (2)) and the beliefs structure (normal distribution) is such that nobody decides to boycott in equilibrium.

Overall one can easily see that even a potentially successful boycott may be ineffective due to coordination failures, even if a boycott success could be an equilibrium.

Coordination failures are also difficult to avoid by environmental NGOs. Large communication trying to enhance optimistic beliefs and information raising environmental preferences

Figure 1: **Equilibrium boycott population**

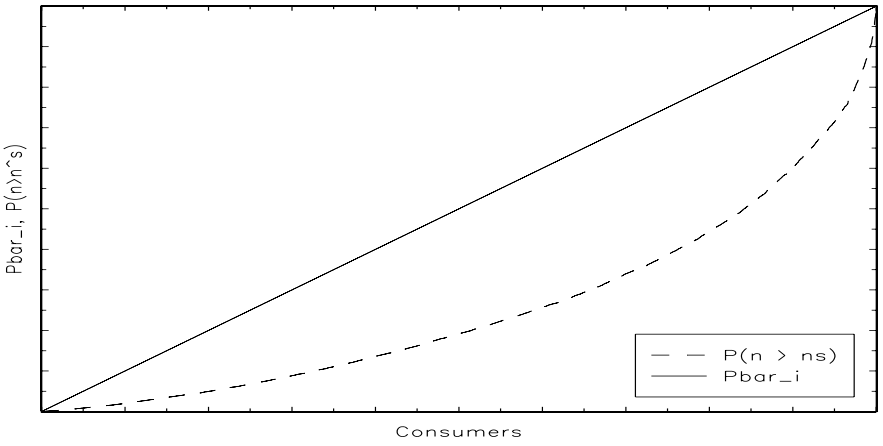


Parameters: $\overline{p}$: *Chi*^{2} *distribution*

$p[n(t) \geq n^s]$: *normal distribution*

$N = 10000, \overline{n} = 7296$

Figure 2: **Unsuccessful boycott due to coordination failure**



Parameters: $\overline{p}$: *uniform distribution*

$p[n(t) \geq n^s]$: *normal distribution*

$N = 10000, \overline{n} = 0$

may help to solve those issues. Finally, even if free riding problems and coordination failures are solved, boycott successes are not that likely.

4 Boycott as a war of attrition with perfect information

Assume now that free riding is not a problem anymore, and that NGO manage somehow to coordinate environmentalists consumers. Moreover, information is now assumed to be perfect. Thus we consider a best case scenario. At this point, consumer boycotts can be considered as a war of attrition between a group of consumers and the firm.

A war of attrition is a model of aggression between two players. The game takes the form of a succession of identical periods. Each period, the two players choose simultaneously between remaining in the game or withdrawing. The model is stationary: each period represents the same type of problem for both players, with no information gain nor change in costs or benefits. The winning player is the one able to remain longer in the game.

This model differs from usual war of attrition models, because it considers asymmetric motivations and payoffs. In the context studied here, the two players are a group of consumers and a firm. Some consumers refuse to consume the firm's good as long as it is produced with a polluting technology. The consumers considered act as one single group. Potential coordination failures between consumers are now only considered through a boycott efficiency parameter.

Overall, both players compare their maximum conflict duration, which is the point in time after which they would never plan to remain in the game. Indeed, with net cumulative payoffs decreasing with time, there is a point in time at which these payoffs become negative. Basically, if the maximum boycott duration of the consumers is larger than the maximum conflict duration of the firm, the boycott is likely to succeed. Moreover, we assumer perfect information. Thus, the two maximum durations are common knowledge. Therefore, the player with a smaller maximum duration withdraws immediately.

The outcome of the game is therefore determined at the first period. The best response for consumers with a maximum duration smaller than the firm's is to never boycott. Conversely,

the best response for a firm with a smaller maximum duration is to withdraw immediately. The boycott is successful in that case.

4.1 Technology choice and consumers behavior

Firm's technology choice: The firm has chosen between two technologies. Technology 1 (T1) is cheap but polluting, while technology 2 (T2) is clean but more expensive. We consider the case in which the firm has chosen technology 1, which implies that it generates larger profit than technology 2, i.e. $\pi_1 > \pi_2$. The profit schedules, π_1 and π_2, differ simply because the production costs, the price of the good and the demand structure are not the same whether the good is produced with the dirty or the clean technology. We assume that the firm can only use one technology. Thus it cannot diversify its production process, producing the good with both technologies at the same time.

Consumption patterns: The consumers population is of size 1, with two homogeneous groups. The environmentalists represent a share α, exogenously given, of the population. The utility of an environmentalist increases with his individual consumption and decreases with the total amount of pollution. The environmentalists are unsatisfied with technology 1 and would prefer the firm to produce with technology 2: $U_1 < U_2$. U_1 is the utility derived by an environmentalist if the good is produced with T1, and U_2 is the utility for a good produced with T2.

A share $(1-\alpha)$ of consumers only considers individual consumption in its utility function. Therefore these consumers prefer the firm to use T1, because they do not care about pollution and T1 is cheaper. Thus they would never participate in an eventual boycott. Moreover, they do not moderate their consumption of the good, because they do not care about the pollution induced by their consumption. Therefore they consume larger amounts of the good.

Boycott as a war of attrition: The environmentalists would prefer the firm to use technology 2. An environmental organization announces a consumer boycott, requiring for any consumer unsatisfied with the use of technology 1 to stop consuming the good. Boycotting consumers switch their consumption of the good for the consumption of an imperfect sub-

stitute that provides lower utility, but of which the production is clean. The utility derived when boycotting is U_b.

As an extreme case, the targeted firm is in a monopoly position, and there is no substitute available on the market. As another extreme, if the market is very competitive and differentiated, there is room for ecological certification: a firm may provide the good considered with a clean production. In that case, boycotting is costless. More generally, a better substitute provides higher utility of boycotting. Moreover, the action of boycotting may have an utility by itself. Boycotting has therefore an opportunity cost, which is the difference between the utility derived by the consumption of the good, and the utility of boycotting: $\Delta U = U_1 - U_b$.

$\lambda\underline{\pi_1}$ is the residual profit of the firm under boycott. $\underline{\pi_1}$ is the residual profit when every environmentalist boycott and λ is an exogenous efficiency parameter measuring the environmental organization's capacity to coordinate consumers: $1 \leq \lambda \leq \frac{\pi_1}{\underline{\pi_1}}$. The EO is totally efficient in coordinating consumers if $\lambda = 1$, and there is full coordination failure if $\lambda = \frac{\pi_1}{\underline{\pi_1}}$. The success of the boycott consists of hurting the firm's profit enough to make technology 2 more profitable. In this context, a consumer boycott represents a kind of war of attrition, with an asymmetry in the players motivations.

The set of strategies is the following. Each period, the environmentalists choose whether to continue the boycott or to stop it, while the firm chooses whether to keep on using T1 or to switch for a T2 production. Switching technology is costless, but there can be no switch back.

The game proceeds as follow. Both players consider how long they could stay in the game without making loss. The maximum boycott duration of the consumers and the maximum conflict duration of the firm are the point in time at which their cumulative net payoffs become negative. There is perfect information, which means that both maximum durations are common knowledge. The player that has the shortest maximum duration will therefore choose to withdraw immediately. Therefore the boycott is successful if the maximum boycott duration is larger than the maximum conflict duration (see Appendix A).

Conditional on the parameters values, two kinds of outcome are possible. First, if the maximum boycott duration of the consumers is shorter than the maximum conflict duration of the firm, the best response for an environmentalist is to never boycott, while the firm's best response is to always keep T1. Conversely, for a maximum boycott duration longer than

the firm's maximum duration, the best response for the consumers is always to boycott, while the firm's best response is to switch immediately for T2.

Thus the boycott outcome is reached at the first period. This result is somehow disappointing to describe real life boycotts. Nevertheless, this set up describes the necessary conditions of the demand patterns for a successful boycott. Introducing imperfect information and coordination issues will allow for multi-periods boycotts.

4.2 Maximum conflict duration of the firm

Consider first the firm's net cumulative payoff of winning the conflict after T periods. It consists of the smaller profit received during the boycott for T periods and the larger profit of keeping T1 forever. This cumulative payoff is net of the alternative strategy, which is the cumulative discounted profit of switching immediately to T2. ρ is the discounting factor.

$$B^f(T) = \sum_{t=0}^{T-1} \rho^t \lambda \underline{\pi_1} + \sum_{t=T}^{\infty} \rho^t \pi_1 - \sum_{t=0}^{\infty} \rho^t \pi_2 \tag{8}$$

The net benefit of winning the conflict is zero for:

$$T^f = \frac{1}{\ln \rho} \ln\left(\frac{\pi_2 - \lambda \underline{\pi_1}}{\pi_1 - \lambda \underline{\pi_1}}\right) \tag{9}$$

Therefore, T^f is the maximum duration after which the firm would never plan on continuing the conflict. For T^f to be strictly positive, the full profit under technology 1 must be larger than under T2: $\pi_1 > \pi_2$. Of course, if the profit derived under T2 is larger than under T1, the firm would never choose to use T1 and nobody would consider boycotting. Note that if the residual profit under boycott is larger than the profit under T2, the payoff is always positive and the maximum duration would go to infinity: $\lambda \underline{\pi_1} > \pi_2$. In that case, indeed, the boycott is not costly enough to make T2 more profitable. The boycott could last forever and the firm would never switch to T2.

4.3 Maximum boycott duration

The environmentalists net payoff of winning the game after T periods consists of the discounted utility of boycotting for T periods, plus the cumulative utility of having the good

produced with T2 forever. It is net of the alternative strategy, which is the discounted cumulative utility of never boycotting:

$$B^c(T) = \sum_{t=0}^{T-1} \rho^t U_b + \sum_{t=T}^{\infty} \rho^t U_2 - \sum_{t=0}^{\infty} \rho^t U_1 \tag{10}$$

This net payoff is zero for:

$$T^c = \frac{1}{\ln \rho} \ln(\frac{U_1 - U_b}{U_2 - U_b}) \tag{11}$$

The environmentalists would never plan to boycott longer than T^c periods. T^c is positive if the utility derived with a T2 production is larger than with a T1 production: $U_2 > U_1$. Obviously, the environmentalists would never consider boycotting if they derive a larger utility with T1. Similarly, T^c goes to infinity if the utility of boycotting is larger than the T1 utility: $U_b > U_1$. Indeed, in that case, boycotting by itself provides a positive net utility. The boycott could last forever even if the firm never switches to T2.

4.4 Outcome of the game

As shown before, the outcome of the game depends on the two maximum durations. If $T^f > T^c$, the consumers know that they couldn't stay long enough in the game to induce a change in the firm's behavior. Thus they will choose to withdraw immediately and will never boycott. Conversely, if $T^c \geq T^f$ [3], the firm knows that it cannot stay longer in the conflict than the consumers. Thus its best response is to switch immediately to T2.

There are several extreme cases, which lead to different outcomes (see table 1). First, if $\pi_2 > \pi_1$, technology 2 is more profitable than technology 1, and the boycott has no reason. Second, if $U_1 > U_2$, T1 is preferred by the consumers. There is therefore no boycott and the firm keeps using T1.

Third, for $\pi_2 \leq \lambda \underline{\pi_1}$, the boycott is not costly enough (or coordination is too weak) to induce the technology change. Indeed, if the decrease in the firm's profit is too small, the firm always chooses to keep the polluting technology whatever is the behavior of the environmentalists. In that case, if the opportunity cost is positive, the environmentalists know that their pressure is too weak to induce the technology change, and they never boycott.

[3] We assume implicitly that for $T^c = T^f$, the firm would be the one to withdraw. Let call it the firm's implicit preference for compromise. Thus we focus on pure strategies.

Table 1: Outcome of the boycott

Utility	Profit	T^c	T^f	Outcome
	$\pi_2 > \pi_1$		$T^f < 0$	Technology 2 chosen by the firm
$U_1 > U_2$		$T^c < 0$		T1 preferred by the consumers, no boycott
$U_1 > U_b$	$\pi_2 \leq \lambda\underline{\pi_1}$	$T^c > 0$	$T^f \to \infty$	T1 always kept, No boycott
$U_1 < U_b$	$\pi_2 \leq \lambda\underline{\pi_1}$	$T^c \to \infty$	$T^f \to \infty$	T1 always kept, always boycott
$U_1 > U_b$	$\pi_2 > \lambda\underline{\pi_1}$	$T^c > 0$	$T^f > 0$	Boycott successful if $T^c \geq T^f$
				T1 kept if $T^c < T^f$

Fourth, if $U_b > U_1$, the environmentalists always boycott, whatever is the firm's strategy. In that case, the opportunity cost is negative, which means that consumers derive positive net utility from boycotting. This case can explain why one may often witness unsuccessful boycotts that never end. If the boycott is costless for some consumers, they always will participate. But in that case, they are likely to have small amounts of consumption, which generate a too small decrease in the firm's profit to make it change its behavior.

Outcome for $U_1 > U_b$ and $\lambda\underline{\pi_1} < \pi_2$: For otherwise, i.e. for $U_1 > U_b$ and $\lambda\underline{\pi_1} < \pi_2$, the outcome of the game is determined by the value of the parameters. In this case, we can analyze which factors influence the two maximum lengths T^f (see Appendix B) and T^c (Appendix C).

First, a more profitable clean technology decreases the maximum conflict duration of the firm T^f: $\frac{\partial T^f}{\partial \pi_2} < 0$. Conversely, a more profitable dirty technology increases T^f: $\frac{\partial T^f}{\partial \pi_1} > 0$. Finally, T^f is larger if the residual profit under boycott is small and the EO inefficient to coordinate consumers: $\frac{\partial T^f}{\partial \underline{\pi_1}} > 0$, $\frac{\partial T^f}{\partial \lambda} > 0$.

Second, a larger utility derived from the clean technology increases T^c: $\frac{\partial T^c}{\partial U_2} > 0$. Moreover, a smaller T1 utility also increases T^c: $\frac{\partial T^c}{\partial U_1} < 0$. Finally, a higher utility of boycotting increases the maximum boycott duration, by decreasing the boycott opportunity cost: $\frac{\partial T^c}{\partial U_b} > 0$.

4.5 What make a boycott successful?

4.5.1 Quality of the substitute

The quality of the substitute increases the potential for success, by decreasing the opportunity cost of boycotting. Our specification does not consider the market structure explicitly. However, considering an imperfect substitute allows for flexibility in the analysis. As an extreme case, if the firm is in a monopoly position, there is no substitute and $U_b = 0$ (assuming boycotting provides no utility by itself). As another extreme, if the firm plays in a very differentiated market, , there is room for ecological certification or labeling, and another firm may enter and provide the good with a clean production. The exploitation of this niche would imply $U_b \geq U_2 > U_1$. Then the environmentalists would always choose to boycott, because the boycott would be costless. Therefore, boycotts are more likely to succeed if the targeted firm plays in a very differentiated and competitive market than if the firm is a monopoly, because the opportunity cost is likely to be smaller. Moreover, boycotting a single firm should be more efficient than boycotting an entire sector, because it gives more chance to find a good substitute.

Moreover, this specification of the utility of boycotting has some interesting implicit implications. First, boycotting may have an utility *per se*. Indeed, collective action participation to improve the quality of the environment may provide positive utility for an environmentalist, which would be positively correlated with U_b. Second, the utility of boycotting is likely to be positively correlated with the number of consumers participating in the boycott. Indeed, being a part of a large community with noble objectives may increase a consumer's utility. In the context described here, the utility of boycotting is directly related to the share of environmentalists (α) in the population. Third, the substitute, even if of good quality, may be quite difficult to find on the market, which creates potentially important transaction costs and thus reduces the utility of boycotting.

4.5.2 Demand structure

Overall, the chances of success of a consumer boycott depends on the ability to hurt the firm's profit enough. Thus if the share of environmentalists consumption in the firm's profit

is large, the residual profit under boycott will be low, because the boycott deprives the firm of a large share of its profit.

The residual profit depends on the residual consumption. It is therefore decreasing in the number of consumers participating in the boycott (α). Moreover, it is also decreasing in the environmentalists consumption. Finally, it is increasing in the non-environmentalists consumption.

The share of environmentalists in the population: A large number of environmentalists (α) unambiguously raises the boycott potential for success. First, as mentioned before, it may increase the utility of boycotting. Thus, it is negatively correlated with the opportunity cost of boycotting and positively correlated with the maximum boycott duration of the consumers (T^c). On the other hand, a large boycotting population decreases the residual profit $\underline{\pi_1}$. Therefore, it decreases the maximum duration of the firm (T^f).

The environmentalists consumption: The amount consumed by the environmentalists has an ambiguous effect on T^f. Indeed, it decreases the profit from technology 1 under boycott (which has a negative impact on T^f), but it increases the full profit under technology 1 (which tends to increase T^f). Overall, the amount consumed by environmentalist is likely to decrease the maximum duration of the firm because it increases the pressure of the boycott, by increasing the difference between π_1 and $\underline{\pi_1}$. Thus it decreases T^f.

The impact of the amount consumed by environmentalist consumers on T^c is less straightforward. On the one hand, a larger amount consumed decreases indirectly the residual pollution, which tends to decrease the opportunity cost. On the other hand, a consumer used to consume large amounts of the boycotted good is likely to have a larger opportunity cost than a small-amounts consumer, simply because he has a larger amount to renounce. A larger environmentalist consumption thus increases directly the opportunity cost, because it increases the amount to transfer for the substitute consumption. Overall the environmentalists consumption tends to decrease T^c, because the direct consumption effect is likely to dominate the indirect pollution effect.

Overall, it appears that the consumers the most able to hurt the firm's profit are also those with the highest opportunity cost. Therefore, they are less likely to participate in the boycott.

In the light of this proposition, it is easier to understand the existence of infinite consumer boycotts that never succeed. Indeed, people participating in boycott campaigns are usually those who are the most aware of and highly sensitive to their own pollution. Therefore, they are likely to be in small number, because of their high sensibility to their environment, and to be relatively small consumers, because they take into account the pollution induced by their own consumption. Boycotting is costless for them, but their consumption only represents a marginal share of the targeted firm's profit, and thus do not hurt the firm's profit much.

Take the example of the boycott of major oil companies because of their lobbying effort to deter climate change policies. Consumers the most likely to boycott these companies are those who feel the highest negative utility from pollution. Even if no boycott is announced, these consumers are likely to prefer using their bicycles or public transports to the frequent use of their car, and their capacity to hurt the companies' profit is small. Conversely, consumers the most able to hurt the firms profit consume a lot of oil, and thus have high opportunity cost, which make their participation to the boycott unlikely.

Its seems therefore interesting for NGOs willing to implement an environmental boycott to work on the α, i.e. informing and educating non-environmentalist consumers to increase their awareness of and sensitivity to their responsibility in the degradation of their environment.

Finally, the EO's capacity to coordinate environmentalist consumers is important. Coordination issues have only been considered through a boycott efficiency parameter. Coordination can be introduced more relevantly by relaxing two restrictions of this model. First, the environmentalists may not be perfectly aware of the threshold at which the firm decides to switch technology. Moreover, these consumers may have heterogenous preferences, which would induce heterogenous boycotting behaviors.

5 Case studies

5.1 Shell and the Brent Spar case

In 1995, Shell Oil was planning to sink a 14 500 ton oil platform in the North Atlantic sea. The environmental organization Greanpeace initiated a vast protestation movement to oppose this practice. Activists occupied the Brent Spar platform, 200 Shell service stations were

threatened in Germany and a widespread boycott of Shell took place. After a few months, Shell canceled its plan for deep sea disposal and decided to recycle the entire structure.

Several insights given in this paper can help to explain this boycott success. First, oil is quite an homogeneous good, and oil stations are easy to find almost anywhere. Therefore, one can consider that the non-polluting substitute (i.e oil companies not sinking the platform) is perfect, and the only transaction cost is going from any Shell station to the next oil station, which is likely to be quite low. Overall, boycotting shell was costless ($U_b \geq U_1$).

Moreover, sinking costs (π_1) were estimated at 11.8 million pounds, while the alternative method costs (π_2) were estimated at 46 million pounds. Considering the fact that Shell is a worldwide multinational, maybe this difference in costs was quite small compared to the size of the boycotting population, which reduces the maximum duration of the firm.

In other words, Shell was almost costless to boycott and easy to hurt, which can explain why the Brent Spar case is often considered as an example of successful boycott.

5.2 Cosmetic firms and animal testing

Animal testing (on invertebrates, rabbits, primates) is a commonly used practice in several industries (e.g: cosmetics, pharmaceutical companies). This practice is considered as incompatible with animal rights by many environmentalists. Several environmental organizations provide lists of companies using animal testing, in order to induce consumer boycotts.

Following this paper analysis, this type of consumer boycott has very few chances to succeed. Indeed, boycotting firms using animal testing is almost equivalent to boycott the entire cosmetic sector. Good substitutes (cosmetic firms not using animal testing) are therefore difficult to find and transaction costs are likely to be high. For example, "Ahimsa", a French organization lobbying for animal protection, lists more than 200 firms testing their products on animals (cosmetic firms and others). Note first that it is difficult to perfectly memorize a 200 firms list. There is therefore a problem of clarity of the boycott, which reduces considerably the utility of boycotting.

However, focusing on cosmetic firms, one can find good substitute on the market. For example, "bodyshop" provides products free of animal testing. But even in this case, there may be important transaction costs: although getting more and more important, bodyshop

is not a trademark very easy to find worldwide. For instance, it can be very difficult to find bodyshop shops for people not living in large cities.

Overall, boycotting firms using animal testing should not be very effective, especially because of high transaction costs, due to a lack of clarity in the boycott and difficulties to purchase good substitutes. It is thus likely that only strong environmentalists participate in this type of boycott and their hurting capacity is probably quite small. Moreover, alternative strategies to animal testing, although an important research topic (see Johns Hopkins Center for Alternatives to Animal Testing) may be still probably far from profitability.

5.3 Boycott of non-certified timber

Several NGOs militate for a boycott of non-certified tropical timber. Indeed, illegal logging in developing countries plagues local development and degrades forest resources. This type of boycott first appears to be a perfect case for a success. Indeed, timber is quite an homogeneous good. Moreover, ecological timber certification offers good substitutes. Overall, the opportunity cost of boycotting non-certified tropical timber seems to be quite low.

However, a second look mitigates this first impression. First, quite a few ecological labels exist (SmartWood, Scientific Certification Systems, Certified Wood Products Council, Good Wood, Forest Stewardship Council), which may create confusion and decrease the clarity of the boycott. Consumers might be lost in determining which label is the most environmental-friendly, which creates an indirect cost of information searching.

Moreover, boycotting consumers stand mainly in developed countries, while the most important part of tropical timber is consumed in the country of production. The World Resource Institute estimates that only 20% of the wood produced is exported (Rezende de Azevedo et al., 2001). Potential impact of the boycotting population is thus fairly small, because tropical timber offers multiple markets options, which reduces the boycott influence. Finally, boycotting tropical timber may have adverse effects on the land use. Indeed, the aim is to decrease forest over-exploitation, by decreasing the value of non-certified timber. However, if the value of the exploited forest decreases too much, it may create an incentive for land use change and thus increase deforestation. Indeed, the landowner may choose to convert devaluated forest land into agriculture or pasture.

Overall, the boycott of non-certified timber, although presenting small opportunity cost, does not offer much potential for success, mainly because of a too small concerned population.

6 Conclusion

This paper explores the conditions under which a consumer boycott upon environmental considerations may be successful. First, free riding and coordination issues reduce considerably the potential for success of such action. Second, it appears that even if those two problems are solved, consumer boycotts are not likely to succeed. A boycott is presented here as a war of attrition between a firm and a group of consumers, for the choice of the producing technology.

The model presented is quite simple. Indeed, assuming perfect information, no coordination issue, nor free riding, the outcome of the boycott is known as soon as it begins. For the most common case, with a positive opportunity cost of boycotting, boycotts never really happen: either the threat of the boycott is enough to induce an immediate change in the firm's behavior, or this threat is too weak and consumers do not boycott. Moreover, environmentalist consumers act as one community, which is quite different from real life boycotts.

However, even with this very simple set up, some interesting implications can be derived. The ability of the boycotting group to hurt the firm's profit enough is the main element determining the chance of success of such type of action. Thus the share of the boycotting group's demand in total demand is crucial. Nevertheless, this share is directly related to the boycott opportunity cost. Indeed, the boycotting group needs to be composed of important consumers to hurt the firm's profit (especially if the group is of small size). However, boycotting is more costly for a large-amount consumer, who has to renounce to a higher utility of consumption.

Overall, it appears that this tradeoff makes consumer boycotts unlikely to succeed. This might explain why one can witness so few successful boycotts in real life: boycotting groups are usually composed of consumers with small opportunity costs, whose boycott does not hurt the targeted firm's profit enough to make it change its behavior.

A potentially more efficient policy for NGOs would be to work on the share of the population sensitive to the quality of the environment. Indeed, the game presented here is static, but informing and educating consumers may increase their awareness of environmental degradation, especially the degradation they are responsible of. The objective of this policy would have two main consequences in the long run. First, it would induce a decrease in overall consumption, which would reduce environmental degradation. Second, this would increase the population likely to participate in environmental boycotts. In the long run, the combination of education and boycott would increase the potential for environmental friendly technology adoption.

Although this model does not consider explicitly the market structure, it seems reasonable to assume that competition increases the chances for the clean technology to be present on the market. Indeed, if there is free entry, there is room for ecological certification and green labeling: a firm may choose to enter the market and to produce the good with the clean technology, if it is profitable. In that case, there is a perfect substitute on the market. In a monopoly case, consumer boycotts are less likely to succeed, because there is no good substitute for which the environmentalists could switch their consumption. Finally, even if the demand structure allows for boycott success, consumers need to coordinate and avoid free riding.

Considering a public choice approach, being confident in such consumers actions would be a tempting consideration: governments could just let citizens take their destiny in their own hands to make firms adopt fair practices. However, in the light of this paper, it seems that consumer boycotts do not constitute a good substitute to public policies. Indeed, if the emergence of political consumption practices may be a good tool to signal citizen preferences, its effectiveness considering firms practices and environmental quality is doubtful.

A potentially effective policy for governments willing to increase the influence of this political consumption could be to facilitate the emergence of credible and trustful ecological certification, giving comprehensive and clear set of rules defining labeled products. Another policy that could enhance boycott successes is to tax more heavily polluting technology, or to subside clean technology. Indeed, this type of policy would reduce the difference between the profits derived by the dirty and the clean technology, which would decrease the firm's maximum conflict duration. Increasing taxes on polluting technology would increase boycotts

success likelihood. Thus, environmental policies and consumer boycotts do not seem to be good substitute, but they may be effective complement.

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Appendix A: maximum durations and game equilibrium

This appendix follows Burton's (2005) application. We consider first responses to each player's conjectures, and then consider which duration both players actually choose.

Response to conjectures: Consider that the firm believes that the consumers have chosen as strategy to boycott for a strictly positive duration $\hat{D}^c$, and then withdraw. This strategy cannot be distinguished from the "always boycott" strategy.

The firm must decide to remain in the conflict for $\hat{D}^c + 1$ periods, or to withdraw immediately. Indeed, withdrawing immediately is preferable that remaining less than $\hat{D}^c$ periods. If the maximum duration of the firm is less than or equal to the conjecture on the consumer boycott length, $T^f < \hat{D}^c$, the best strategy for the firm is to withdraw immediately.

Similarly, the consumers may conjecture that the firm has chosen to remain in the conflict for $\hat{D}^f$ periods, and then withdraw. If the maximum boycott duration is smaller than this conjecture $T^c < \hat{D}^f$, the best strategy for the consumers is not to boycott at all.

Strategy choice: To succeed, both players have to choose a longer duration than its conjecture: $D^f > \hat{D}^c$, $D^c \geq \hat{D}^f$. This is known to both players, which also know the maximum durations T^f and T^c.

"A rational player will use those strategies that are best responses to some beliefs he might have about the strategies of his opponents" (Fudenberg and Tirole, 1991). Therefore it is not rationalizable to both player to conjecture a duration that is shorter than the shortest maximum duration ($min(T^c, T^f)$).

Thus, if the firm has the shortest maximum duration $T^f < T^c$, both can conclude that the consumers would choose a larger duration: $\hat{D^c} > T^f$. In this case, the firm would be better off withdrawing immediately and the boycott would be successful in that case.

Appendix B: factors influencing T^f

Note that ρ is likely to be smaller than 1, thus $\frac{1}{\ln \rho} < 0$.

$$\frac{\partial T^f}{\partial \pi_2} = \frac{1}{(\pi_2 - \lambda \underline{\pi_1}) \ln \rho} < 0 \tag{12}$$

$$\frac{\partial T^f}{\partial \pi_1} = \frac{-1}{(\pi_1 - \lambda \underline{\pi_1}) \ln \rho} > 0 \tag{13}$$

$$\frac{\partial T^f}{\partial \underline{\pi_1}} = \frac{\lambda(\pi_2 - \pi_1)}{(\pi_2 - \lambda \underline{\pi_1})(\pi_1 - \lambda \underline{\pi_1}) \ln \rho} > 0 \tag{14}$$

$$\frac{\partial T^f}{\partial \lambda} = \frac{\underline{\pi_1}(\pi_2 - \pi_1)}{(\pi_2 - \lambda \underline{\pi_1})(\pi_1 - \lambda \underline{\pi_1}) \ln \rho} > 0 \tag{15}$$

Appendix C: factors influencing T^c

$$\frac{\partial T^c}{\partial U1} = \frac{1}{(U_1 - U_b) \ln \rho} < 0 \tag{16}$$

$$\frac{\partial T^c}{\partial U2} = \frac{-1}{(U_2 - U_b) \ln \rho} > 0 \tag{17}$$

$$\tag{18}$$

The quality of the substitute has a positive impact on T^c:

$$\frac{\partial T^c}{\partial U_b} = \frac{U_1 - U_2}{(U_1 - U_b)(U_2 - U_b) \ln \rho} > 0 \tag{19}$$