Evaluating the Efficacy of Information Campaigns and Ecolabels by Environmental Non-Governmental Organizations in Mitigating Environmentally Harmful Components

Dr. Selina M. Rathwen
Department of Environmental Policy, Wageningen University & Research, Wageningen, Netherlands

Dr. Leoric D. Faelburn
Centre for Environmental Policy, Imperial College London, United Kingdom

ABSTRACT

Environmental Non-Governmental Organizations (NGOs) are increasingly stepping up their game, using clever strategies like public awareness campaigns and eco-friendly labels to nudge both consumers and businesses toward a greener path. This deep dive explores just how effective these non-market approaches are in getting rid of harmful ingredients from our products and their supply chains. We'll blend insights from economic theories about information, market signals, and the quiet power of "private politics" to build a clear picture of how NGOs, as trusted third parties, can fix market glitches. They help spark demand for and supply of products that are better for our planet. While getting the word out can really open people's eyes and change what they buy, we also acknowledge that the sheer number of eco-labels out there can sometimes confuse folks. Beyond that, this article carefully looks at the intricate dance between NGO activism, how companies react, and the bigger picture of government regulations. It highlights the tricky bits, the surprising wins, and ultimately, the limits of relying mostly on non-government efforts to protect our environment. Our goal is to offer a clear understanding of when these NGO-led strategies truly make a difference and when they might hit a wall.

Keywords: Environmental NGOs, information campaigns, ecolabels, environmental protection, consumer behavior, corporate social responsibility, private politics, market mechanisms, two-dimensional product differentiation, consumer heterogeneity.

INTRODUCTION

The clock is ticking on global environmental challenges – from climate change to vanishing species and dwindling resources. This urgency has pushed environmental Non-Governmental Organizations (NGOs) right into the spotlight, making them key players in driving change. But they're not just about protests and lobbying anymore. NGOs have become incredibly smart about influencing markets, using tools like information campaigns and ecolabels. This shift shows a clever move towards harnessing market power to achieve environmental goals [17, 30]. It's a recognition that every choice we make as consumers, and every decision companies make, profoundly shapes the health of our planet.

At the heart of these NGO strategies lies a simple but powerful idea: information. Often, when we buy products, we don't really know their full environmental story. Are there hidden harmful components? How sustainable was the production? What's the true ecological footprint? These are often "credence attributes" – qualities that are hard, if not impossible, for us to verify, even after we've bought and used the product [3, 22]. This lack of information creates a problem in the market: we can't easily reward products that are truly green or penalize those that are harmful. NGOs, because they're seen as independent and driven by a mission, are perfectly placed to fill this gap. They become the trusted messengers, giving us the knowledge we need to make better choices [36, 40].

Information campaigns, a cornerstone of NGO activism, are a bit like playing "private politics" [4, 5, 6]. Unlike government regulations or taxes, private politics is about non-government groups directly influencing companies. NGOs do this by sharing information, sometimes publicly shaming bad practices, or even calling for boycotts [2, 3, 6, 19, 20, 29]. Think about Greenpeace's campaign against Nestlé in 2010, highlighting palm oil's link to deforestation. This kind of public pressure, often amplified through social media, can really hit a company's reputation, leading to boycotts or a general loss of trust. That's a powerful incentive for companies to change their ways [2, 3, 19, 20, 21, 29]. The main goal is to push companies to get rid of or replace ingredients that hurt the environment, even if those ingredients might be cheaper or give the product a certain texture, like palm oil in some foods.

Working hand-in-hand with information campaigns, ecolabels act as clear, standardized signals of

environmental performance. These labels, usually given out by independent groups (often NGOs), certify that a product meets specific environmental standards – maybe it's "component-free" like paraben-free cosmetics, or it contains "certified sustainable" ingredients like Certified Sustainable Palm Oil (CSPO) [15, 25, 41]. For us consumers, ecolabels simplify complicated environmental facts, making it easy to spot the products we want. For businesses, they're a way to stand out, attract eco-conscious customers, and maybe even charge a bit more [10, 11, 13]. But for an ecolabel to really work, it needs to be trustworthy, easy to understand, and something we, as consumers, believe in [10, 14, 31].

This article aims to really dig deep into when these NGO-led information campaigns and ecolabels actually succeed in getting rid of harmful product components. We'll explore the intricate dance between what consumers know, how companies respond, and the overall market structure. Our insights come from a solid theoretical model that looks at products in two ways: their inherent quality (like taste) and their environmental quality (like whether they contain harmful ingredients). We'll consider different scenarios, like when consumers are clued in about environmental quality and when they're not. By doing all this, we hope to figure out the best strategies for NGOs and pinpoint the key factors that make these increasingly popular non-market efforts either a big win or a tough uphill battle in building a more sustainable economy.

METHODS

To figure out how effective environmental NGO strategies are, this study takes a two-pronged approach: we build a theoretical model, and we also thoroughly review and combine insights from existing academic research. Think of our "materials" as the established economic theories about how information affects markets, how companies behave, and the subtle art of non-market strategies. We also draw heavily from the core ideas and findings of the foundational research provided on this topic. Our "methods" involve creating a formal economic model that captures the key interactions between NGOs, companies, and us, the consumers. Then, we analyze what happens in the market when the NGO makes different strategic choices.

Theoretical Foundations and Literature Review

Our analysis rests on several fundamental ideas from economics and strategic management. These ideas help us understand why NGOs do what they do and what kind of impact they can have:

● Information Asymmetry and "Credence Goods": A core idea here is that in markets for environmentally sensitive products, we often don't have all the information. We, as consumers, struggle to truly know the environmental quality of what we're buying. Things like whether a product is free of harmful chemicals or if its supply chain is truly sustainable are often "credence attributes" [3, 22]. This means we can't easily check their quality, even after we've bought them or used them. This lack of information creates a market problem: we can't effectively reward the truly green products or punish the harmful ones. This is where NGOs step in. They become crucial players, acting as independent information providers and certifiers to bridge this knowledge gap [36, 40]. Research on how third parties reveal information and certify products, like Lizzeri (1999) [37], helps us understand how these groups can make markets work better by fixing information problems.

● Advertising and Spreading the Word: When NGOs try to inform us, it's a lot like advertising [1]. But unlike typical ads that try to persuade us or build brand loyalty, NGO campaigns are mostly about sharing facts [35]. They want to correct any wrong ideas we have about environmental quality or to reveal hidden harmful aspects of products [22, 30]. Heijnen (2013) [30] specifically modeled how environmental groups use informative advertising to boost our willingness to pay (WTP) for environmental quality. The concept of "salience games" (Heyes et al., 2018) [32] is also important here. It tells us that in today's information-packed world, NGOs have to be smart about grabbing and holding our attention for their campaigns to actually work.

● "Private Politics" and Non-Market Strategies: A big chunk of the research looks at how non-government groups, especially NGOs, influence companies without relying on government rules. This is often called "private politics" [4, 5, 21] or "non-market strategy" [5]. NGOs can put pressure on companies in various ways: by revealing information, publicly shaming bad practices, or even calling for boycotts [2, 3, 6, 19, 20, 29]. Baron (2009, 2011, 2016) [2, 3, 4] has done a lot of work on how social pressure and activism can push companies to act more responsibly. The "radical flank effect" (Baron et al., 2016) [6] even suggests that more extreme forms of activism can, surprisingly, make the demands of more moderate NGOs seem more reasonable and easier to accept. How companies react to this kind of pressure is a key area of study (Eesley & Lenox, 2006; Lenox & Eesley, 2009) [20, 36]. Often, companies make internal changes to avoid damaging their reputation or to get ahead of stricter regulations. Gupta and Innes (2014) [27] explore how this "private politics" influences how companies manage their environmental impact.

● Product Differences and "Green" Competition: When environmental features are added to products, it fundamentally changes how companies compete. Products can now stand out not just by their basic qualities (like taste or performance) but also by how good they are for the environment [18, 44]. This leads to what's called "vertical differentiation" models, where everyone agrees on which product is environmentally "better," but we might differ in how much we're willing to pay for that green quality [16, 24, 32]. Ecolabels are super important here because they clearly signal a product's environmental

quality [10, 11, 23, 25, 41]. The presence of both informed and uninformed consumers, as explored by Buehler and Schuett (2014) [16] and Sartzetakis et al. (2012) [40], adds another layer of complexity to market dynamics, affecting how companies set prices and how much of the market they can capture. We also consider the possibility of "label wars" or competition between different sustainability standard setters (Poret, 2019) [38], which can impact how effective and trustworthy ecolabels are.

● Consumer Behavior and What We're Willing to Pay: Ultimately, the success of any NGO strategy depends on how we, as consumers, react. Factors like our environmental awareness, whether we're willing to pay a bit more for green products, and our ability to understand complex environmental information are all crucial [14, 31]. Brécard (2014, 2017) [14, 15] specifically points out the problem of "consumer confusion over the profusion of eco-labels" and "consumer misperception of eco-labels," showing how these can mess up the intended market signals. Research also looks at how "social awareness" affects price competition (Ben Elhadj et al., 2015) [7] and how changes in our social responsibility influence market outcomes (Garcia-Gallego & Georgantzis, 2009, 2010) [24, 25].

Model Setup and Assumptions

Our analytical framework is built on a model that looks at product differences in two ways, drawing ideas from Garella and Lambertini (2014) [26] and Mantovani et al. (2016) [39]. This model helps us examine in detail how a product's basic quality (like taste or texture) and its environmental quality (like whether it has harmful ingredients) interact in our preferences as consumers and in companies' strategies.

Products and Attributes:

We imagine a market where companies can offer different versions (i) of a product. These versions are defined by two key characteristics:

● Intrinsic Quality (q_i): This is a basic, consistent quality like taste or texture that everyone agrees on. For simplicity, we assume that products with the harmful ingredient (or its certified sustainable alternative) are just as good, or even better, in terms of this basic quality compared to "component-free" products. So, $q_B = q_M \geq q_G$. Here, "B" is for "brown" (has the harmful ingredient), "M" is for "medium" (has a certified sustainable ingredient), and "G" is for "green" (component-free). This reflects a real-world challenge: sometimes, taking out a harmful ingredient can actually make a product less appealing in terms of its basic qualities, like palm oil's role in texture.

● Environmental Quality (e_i): This is a quality that people value differently, and it shows how much a product contributes to the environment. We set a baseline environmental quality, e_G, for the "perfectly

clean" component-free product. Products with harmful ingredients make the environment worse, while those with certified sustainable ingredients offer an in-between level of environmental quality. This is shown as $e_B < e_M < e_G$. The "brown" product (B) uses a polluting ingredient, the "green" product (G) is "component-free," and the "medium" product (M) uses a certified, greener version of the controversial ingredient. The e_B value (which is negative) captures how much informed consumers dislike the harmful ingredient.

Consumers:

We assume there's a total of one unit of consumers. A crucial part of our model is dividing consumers into two groups based on what they know:

● Uninformed Consumers ($1-\alpha$): These consumers don't know about the environmental impact of the product ingredients. Their satisfaction comes only from the product's basic quality and its price: $U_{Uninformed}(\theta) = \rho q_i - P_i$. Here, ρ is a constant positive value representing how much they're willing to pay for basic quality.

● Informed Consumers (α): These consumers are fully aware of the different environmental impacts of the ingredients in each product. Their satisfaction includes both basic and environmental quality: $U_{Informed}(\theta) = \rho q_i + \theta e_i - P_i$. The θ value shows how much each informed consumer is willing to pay for environmental quality, and we assume it's spread evenly from 0 to θ. Having the lowest WTP for environmental quality at zero helps connect uninformed and informed consumers. A key point is that informed consumers "devalue" Product B because they dislike the harmful ingredient (that's why $e_B < 0$), while they like Products G and M. We also assume that the most environmentally sensitive consumer (with the highest θ) will always prefer Product G over Product B.

Firms:

We're looking at a market with just two companies (a duopoly), assuming it's too expensive for new companies to enter.

● Cost Structure:

○ Product B (Brown): The company making the product with the harmful ingredient (Firm B) has zero unit costs ($c_B = 0$) and zero fixed costs ($F_B = 0$). This makes it very competitive because it's cheap to produce.

○ Product G (Green): The company making the component-free product (Firm G) has to pay for research and development (R&D) as a fixed cost ($F_G \geq 0$) to create new technology or processes, but its variable costs are zero ($c_G = 0$). We assume F_G is low enough for the product to be profitable.

○ Product M (Medium/Certified): To switch to a certified product, a company has to buy a sustainable ingredient. This means higher variable production costs

($cM=ceM\geq C$, where C is a positive constant) because of the extra steps and certification fees involved. There are no fixed costs for adopting this in-between ingredient ($FM=0$).

● Profit Maximization: Each company wants to make the most profit possible, calculated as $\pi i(Pi)=(Pi-ci)di(Pi)-Fi$, where di is the number of consumers buying their product (market share).

Environmental NGO:

The environmental NGO is a non-profit group focused on one thing: making the environment better. It gets its money from donations, memberships, and charity, and it operates within a set budget (R).

● Information Campaign: The NGO's main tool is a campaign to inform people, which increases the number of informed consumers (α). This campaign costs money, and the more people are informed, the higher the cost, denoted $\sigma(\alpha)$. This is basically informative advertising, aiming to correct our understanding of environmental damage.

● Ecolabeling Strategy: The NGO might also decide to introduce and certify a sustainable ingredient, setting a minimum environmental quality standard (eM) for it. The cost of this certification is covered by the companies that use the ingredient, built into their variable costs.

● Objective Function: The NGO's goal is to maximize the overall quality of the environment. This is calculated by adding the baseline environmental quality (eG) to the improvements or degradations caused by each product: $\max\alpha,eM[(1-\sum i\in\{B,M\}di)eG+\sum i\in\{B,M\}eidi]$. This means the NGO views not consuming a product and consuming the green product (G) as having the same positive environmental impact. The choice between the two tools (information campaign and ecolabel) is simplified because eM only affects the environmental outcome, not the budget.

Sequence of the Game:

The interactions between the NGO, companies, and consumers unfold like a game with several steps. We figure out the best strategies by working backward from the end:

1. Starting Point: Before the NGO does anything, only a small number of consumers ($\alpha<\alpha0$) know about the harmful ingredient in Product B. Two companies are already selling Product B (with the harmful ingredient) and Product G (component-free).

2. NGO's Big Decision: The NGO then decides how much money to spend on its information campaign (which determines α) and whether to certify a sustainable ingredient with a certain quality eM.

3. Companies React: Companies respond to the NGO's campaign. They can choose to:

○ Keep things as they are (continue making B and G).

○ Switch Product G to Product M (Company G uses the certified ingredient).

○ Switch Product B to Product M (Company B uses the certified ingredient).

4. Market Competition and Our Choices: Finally, companies compete on price, and we, the consumers, decide whether to buy one unit of a product or nothing, based on what gives us the most satisfaction.

By analyzing this step-by-step process, we can pinpoint the "subgame perfect Nash equilibria" (SPNE) – the stable outcomes where no one has an incentive to change their strategy – and figure out the NGO's best moves under different market and consumer conditions.

RESULTS

Our analytical model paints a detailed picture of how NGO strategies, consumer differences, and company reactions all intertwine, leading to various market situations and environmental outcomes. The findings mainly come from working backward through the game's steps, figuring out the stable market situations (Nash equilibria) in different scenarios.

How Information Campaigns Shape the Market (Products B and G)

The number of informed consumers (α) is a huge factor in how the market behaves when only the "brown" (B) and "green" (G) products are available. As the NGO's information campaign boosts α, the market can go through distinct phases:

● Segmentation:

At first, when very few consumers are informed ($\alpha\leq\alpha0$), the market is split. Most uninformed consumers, who don't see the environmental harm in Product B, just keep buying it. Meanwhile, the smaller group of informed consumers either goes for the green product (G) or decides not to buy anything at all. In this phase, Firm B (making the brown product) acts like a monopoly for the uninformed group, setting prices to maximize profit from this big, captive market. Firm G (making the green product) also acts like a monopoly, targeting the environmentally conscious informed consumers. The prices and demands here simply reflect these independent monopoly behaviors. The environmental quality in this situation is pretty much stuck at a low level, dominated by the brown product due to the initial lack of informed consumers.

● Fragmentation:

As the NGO's campaign successfully gets more people informed, moving α past $\alpha0$ but staying below $\alpha1$ ($\alpha0<\alpha\leq\alpha1$), the market starts to break up, or "fragment." Uninformed consumers still mostly buy Product B. But the now larger group of informed consumers splits: those who care most about the environment buy the green product (G), while those who are somewhat aware but less

intensely so might still go for the brown product (B) if it's cheaper. And, importantly, some informed consumers with middle-ground environmental awareness might still choose not to buy anything. Here, Firm B has a reason to lower its price to attract some informed consumers, showing the first real impact of the information campaign on competition. While Product G's demand goes up with α, Product B's demand can surprisingly also go up. This happens if the drop in uninformed consumers is offset by newly informed consumers who still pick the cheaper brown option. This points to a potential "fragmentation trap" for the NGO: more information doesn't always lead to a better environment if consumers aren't strongly aligned in their environmental preferences.

● Complete Coverage:

When the NGO's information campaign is a big hit, pushing the number of informed consumers beyond $\alpha1$ ($\alpha>\alpha1$), the market achieves "complete coverage." This means everyone, informed or uninformed, is buying either Product B or Product G. This phase can look slightly different in two ways:

○ Corner Solution: If α is in a specific range ($\alpha1<\alpha\leq\alpha2$), the market is covered with a "corner solution." Prices are set so that no one leaves the market without buying. Firm G keeps its monopoly price, while Firm B adjusts its price to grab the rest of the market. As α increases here, Firm G tends to gain market share and profit at Firm B's expense.

○ Interior Solution: For very high numbers of informed consumers ($\alpha2<\alpha\leq1$), the market is covered with an "interior solution." Both companies are actively fighting for all customers. The final prices are set by this competition, and the demand for Products B and G depends on their environmental and basic qualities, as well as how many consumers are informed. Generally, a higher α means more demand for Product G, but lower prices can cut into both companies' profits.

The specific thresholds $\alpha0$, $\alpha1$, and $\alpha2$ are crucial. They depend on how varied consumers' environmental preferences are (θ) and how different the products are in terms of their basic and environmental qualities. For example, if consumers have wildly different environmental preferences, the market might quickly move to complete coverage, making the information campaign more effective at shifting demand to greener products. On the flip side, if preferences aren't very varied, the fragmentation phase might last longer, or even lead to that "fragmentation trap" where more information actually backfires. This is clearly shown in Figure 2 of the foundational research, illustrating how environmental quality changes with α under different levels of consumer heterogeneity.

How Much Effort Should the Information Campaign Put In?

The NGO's main goal is to improve environmental quality, which, in our model, means reducing how much of the brown product (B) is sold (assuming Product G is completely harmless).

● When More Information is Always a Good Thing: If consumers' environmental preferences are very diverse (meaning θ is large enough, specifically $\theta>\max\{-eB\rho qB,\theta2\}$), then getting more people informed (α) consistently leads to less demand for Product B, no matter how the market is structured. In this ideal situation, the NGO's best move is to inform as many people as possible, spending its entire budget to try and get 100% of consumers informed if that's achievable. This works because highly environmentally conscious consumers will always choose the greener option or simply avoid the harmful product.

● The "Fragmentation Trap" and Tricky Choices: However, if consumers' environmental preferences are only moderately diverse (meaning $eG\rho qG<\theta<\min\{-eB\rho qB,\theta2\}$), the link between α and environmental quality gets complicated and can even jump around. Increasing α beyond $\alpha0$ might actually lead to the "fragmentation trap," where demand for Product B increases, making the environment worse. This happens because newly informed consumers, who aren't as environmentally passionate, might still find the cheaper brown product appealing. In these cases, the NGO's best strategy isn't to inform everyone. Instead, it might be better to keep α at $\alpha0$ or to "leapfrog" over the fragmentation trap to a higher α (like $\alpha1'$) where environmental quality improves again. Also, pushing α beyond $\alpha2$ (when the market shifts to complete coverage with an interior solution) can also be bad, as Product B's price might drop sharply, causing a sudden spike in its demand. This means the NGO might not use its full budget if doing so would push α into these counterproductive zones. This finding goes against the common idea that more information is always better, highlighting how important consumer differences are.

What Happens When a Certified Alternative (Product M) Enters the Market?

The NGO might consider introducing a certified sustainable ingredient (Product M) as a backup or an alternative to its information campaign. This is especially relevant if its budget is tight or if the "green" product (G) is much worse in basic quality than the "brown" product (B).

● Two-Company Competition with Products B and M:

When Firm G thinks about replacing Product G with Product M, or Firm B considers replacing Product B with Product M, the market dynamics change. Product M has the same basic quality as Product B but is better for the environment ($qM=qB$ and $eM>0>eB$). Informed consumers will generally prefer Product M over Product B. Uninformed consumers, however, see B and M as identical. The variable cost of Product M (ceM) is higher than Product B.

○ Market Structures: Just like with the B-G competition, the B-M competition can show segmentation, fragmentation, and complete coverage, depending on α and eM. In segmentation, uninformed consumers buy B, and informed consumers buy M or nothing. In fragmentation, informed consumers split between B and M, with some choosing nothing. In complete coverage, everyone buys either B or M. The exact points at which these changes happen depend on Product M's environmental quality (eM) and its production cost.

○ Impact on Demand: Generally, a higher α means more demand for Product M. But if Product M's production cost is too high, the information campaign can, surprisingly, lead to more people buying the cheaper Product B.

● Two-Company Competition with Products M and G:

If Product M competes with Product G, the differences are more subtle. Product M has better basic quality (qM>qG) but is less environmentally friendly (eG>eM) than Product G. For informed consumers, this creates a "horizontal differentiation" – people don't all prefer the same product even at the same price. For uninformed consumers, Product M and G are still "vertically differentiated" (one is clearly better). This market can't fragment in the same way as B-G or B-M because uninformed consumers would always prefer Product B if it's available and cheaper. The market with M and G can only achieve complete coverage under specific conditions, meaning Product M can actually push Product B out of the market.

● Stable Outcomes (Subgame Perfect Equilibria - SPNE) with Product M:

The real market outcome depends on which company (if any) decides to adopt Product M. This is figured out by comparing the profits companies can make in different competitive situations.

○ Firm G Adopting Product M (replacing G with M): This happens when Firm 's profit (while competing with B) is higher than Firm G's profit (also competing with B). This is more likely when eM is low (making Product M cheaper) and α is low (making Product G less profitable due to its fixed costs).

○ Firm B Adopting Product M (replacing B with M): This is less common because Product B benefits from its large base of uninformed customers and zero production costs. This stable outcome only happens under stricter conditions, usually when eM is low enough (to keep costs down) and α is high enough and diverse enough (to make Product M profitable enough to outweigh the benefits of Product B's captive market).

NGOs Strategies When Certified Components Are Available

The NGO's choice to offer a certified ingredient (eM) is a

strategic one, based on how it expects this to impact environmental quality and whether companies will actually adopt it.

● Limited Campaign Budget: If the NGO has a very small budget for its campaign, meaning α stays below α0 (a segmented market), introducing a certified ingredient generally doesn't help the environment. If Product G (which is perfectly clean) gets replaced by Product M (which is less environmentally friendly), the environment gets worse. While replacing Product B with Product M would be good, Firm B is unlikely to do it because of the extra costs, as it makes good money from the uninformed segment. So, the NGO has no reason to offer the certified ingredient in a segmented market.

● Ecolabels: A Helping Hand, Not a Solo Act: For ecolabels to be effective, they need to work alongside a strong information campaign.

○ Replacing Product G with M (when B stays): If Product M replaces the green Product G, and the brown Product B is still on the market, environmental quality usually declines because eM<eG. The NGO would typically prefer not to offer the certified ingredient in this case, as it helps Firm G but harms the environment.

○ Replacing Product B with M (when G stays): This is the scenario where the certified ingredient can really boost environmental quality. If Firm B switches to Product M, the overall environmental quality improves because Product M is environmentally better than Product B. This stable outcome requires a high enough α (meaning a big campaign budget) and a low enough eM (meaning a less strict standard) to make Product M profitable for Firm B. In most cases, the positive effect of getting rid of the brown product outweighs any negative effect from some consumers switching from Product G (or not buying at all) to Product M. This clearly shows how the NGOs information campaign and its sustainable ingredient strategy work together.

● How Strict Should the Ecolabel Be? Surprisingly, if Product M has a higher environmental quality (higher eM), it can actually reduce its demand when competing with Product B. This is because higher quality often means higher production costs and higher prices. This also explains why companies are less likely to adopt Product M if eM is too high. So, for the ecolabel to actually get companies to switch, it can't be too strict. The NGO has to find a balance between the environmental benefit of the certified ingredient and how likely companies are to actually use it.

What About Overall Societal Well-being?

Looking at the impact of NGO strategies on overall societal well-being involves considering consumer satisfaction, company profits, the NGO's own benefits, and environmental quality. These factors often pull in different directions, making it complicated to figure out the best societal outcome, especially since it depends on how much

society values environmental quality (δ).

● Information Campaigns (Products B and G):

○ Low Heterogeneity: When consumers' environmental preferences aren't very diverse, environmental quality and economic well-being (consumer satisfaction + company profits) often move in opposite directions as α changes. For example, in the "fragmentation trap," environmental quality gets worse, but economic well-being might actually go up because of lower prices and more consumption of Product B. There can be sudden shifts when the market moves to complete coverage, causing big changes in profits and consumer satisfaction. In these cases, the NGO's best strategy (maximizing environmental quality) might not align with maximizing overall economic well-being, especially if society doesn't value the environment very highly (δ is low).

○ High Heterogeneity: When consumers' environmental preferences are very diverse, the NGO's best strategy of increasing α generally aligns more closely with boosting overall economic well-being, as long as the cost of information isn't too high. This is because more environmentally conscious consumers drive demand for Product G, leading to higher profits for Firm G and greater satisfaction for consumers who value environmental quality.

● Certified Components (Product M):

○ When Product M is introduced and improves environmental quality (e.g., by replacing Product B), it often comes at a cost to economic well-being. This is because certified products usually have higher production costs, which can mean higher prices for us or lower profits for companies, and potentially less consumer satisfaction if we're not willing to pay the full premium for the environmental benefit.

○ Therefore, the NGO's strategy of promoting a certified ingredient can only be truly beneficial for everyone (Pareto optimal – meaning it makes someone better off without making anyone worse off) if society places a very high value on environmental quality (δ). This means that for environmental improvements through these NGO efforts to be widely accepted, society must really prioritize the environment enough to justify any potential economic trade-offs.

In short, while NGO strategies can significantly improve our environment, they often involve balancing acts with economic well-being. Their success really depends on market conditions, who the consumers are, and how cleverly the intervention is designed.

DISCUSSION

Our theoretical model's findings offer crucial insights into how effective information campaigns and ecolabels are as tools for environmental NGOs to push for the removal of harmful product ingredients. The analysis clearly shows that these non-market strategies, though powerful, don't work in every situation, and their best application heavily depends on specific market dynamics and consumer traits.

A key discovery is the "fragmentation trap." It's counterintuitive, but simply getting more consumers informed doesn't always lead to a steady improvement in environmental quality. If consumers' environmental preferences aren't wildly different, newly informed buyers might still choose the cheaper, environmentally damaging "brown" product, especially if it tastes better or has a better texture and is priced low. This can, surprisingly, lead to more overall consumption of the harmful product, making the environmental situation worse. This highlights a critical challenge for NGOs: just spreading information isn't enough. The kind of information, how different groups of consumers receive it, and how the market competes are all equally vital. So, NGOs need to carefully study the consumer landscape and perhaps tailor their campaigns to reach groups most likely to turn information into green purchases. Or, they might need to ensure that the "green" alternatives are competitive enough on other fronts to overcome the price advantage of harmful products. This idea echoes Heyes et al. (2020) [31], who also found that more information doesn't always guarantee a better environment, even though their model looked at consumers actively seeking information about ecolabel strictness.

Our analysis also sheds light on the role of ecolabels. Our results strongly suggest that ecolabeling can't stand alone; it's primarily a supporting tool that works best with an intense information campaign. If an NGO's information campaign budget is small, meaning few consumers are informed (a segmented market), introducing an ecolabel is largely ineffective, or might even hurt the environment. In these situations, companies making the "green" product might switch to the "medium" certified product (which is less environmentally friendly than "green"), or the company making the "brown" product might not find it profitable to adopt the certified ingredient because of its higher costs. For an ecolabel to truly lead to the removal of harmful ingredients, it needs a substantial base of informed consumers who are willing to choose products based on environmental features. This means that the fundamental work of raising awareness through information campaigns is essential before eco labeling schemes can really take off and make an impact.

Furthermore, how strict an ecolabel is matters a lot. A label that's too demanding, while aiming for top environmental standards, might ironically discourage companies from adopting it because of sky-high production costs. This fits with the idea that market-based environmental policies need to strike a balance between ambitious environmental goals and what's economically realistic to achieve widespread impact. The NGO has to strategically set the environmental quality standard (eM) for the certified ingredient, ensuring it's both meaningful for the

environment and financially feasible for companies to use. This requires a deep understanding of how industries operate and what consumers are truly willing to pay.

The impact of these strategies on overall societal well-being is complicated, often involving trade-offs. While NGO efforts, especially those that lead to replacing harmful ingredients with certified alternatives, generally improve environmental quality, they can also reduce economic well-being. This often happens because sustainable ingredients cost more to produce, which can mean higher prices for us or lower profits for companies, and potentially less consumer satisfaction if we're not willing to pay the full price for the environmental benefits. This highlights a fundamental tension: making environmental gains through non-market means often requires society to absorb some economic cost. For these interventions to be truly beneficial for everyone (Pareto optimal – meaning no one is worse off and at least one person is better off), society needs to place a very high value on environmental quality (δ). This emphasizes the need for public discussions and policies that openly acknowledge these trade-offs. It might also mean using mechanisms that make companies pay for their environmental impact (like taxes or subsidies) to align private business goals with what's best for society, as explored by Sartzetakis et al. (2012) [40] and Stathopoulou and Gautier (2019) [46].

Our model, while offering significant insights, also opens doors for more research. We assumed consumers passively get information, but what if they actively (and perhaps expensively) seek out information about ecolabels, as in Heyes et al. (2020) [31]? Exploring this would add another layer to the NGO's best strategy, as they'd need to consider not just spreading information but also motivating consumers to engage with it. Also, the nature of partnerships between companies and NGOs, like the Roundtable on Sustainable Palm Oil (RSPO) which includes both, deserves more modeling. Understanding how these collaborations influence certification requirements and the spread of sustainable practices could offer valuable insights into hybrid ways of governing. The model could also be expanded to look at NGOs running "awareness-raising campaigns" that aim to increase our inherent willingness to pay for environmental quality (i.e., shifting the θ distribution), rather than just informing us about existing product features. Finally, exploring these dynamics globally, considering different consumer preferences, government rules, and supply chain complexities across various regions, would give us a more complete picture of how these strategies work in the real world.

CONCLUSION

This article has systematically explored when environmental NGOs' information campaigns and ecolabeling strategies actually succeed in getting rid of harmful product ingredients, especially when those ingredients contribute to a product's basic quality. By using a model that looks at product differences in two ways, we've analyzed the strategic interactions between NGOs, companies, and diverse consumers, giving us a nuanced understanding of how markets behave.

Our findings emphasize that how effective an NGO's information campaign is really depends on how varied consumers' environmental preferences are. While informing a lot of people is generally good when environmental awareness is high, a "fragmentation trap" can pop up if consumers are only moderately sensitive to environmental issues. In such cases, simply giving out more information can, surprisingly, lead to more consumption of the harmful product. This means NGOs need to be more careful and targeted in their approach. It highlights that just raising awareness isn't always enough; how well consumers understand the information and how they act on it afterward are incredibly important.

Furthermore, we've shown that ecolabeling mostly supports strong information campaigns, rather than replacing them. Ecolabels don't work very well, and can even hurt the environment, if not many consumers are informed. For an ecolabel to successfully push companies to replace harmful ingredients with certified sustainable ones, it needs a solid base of environmentally aware consumers and a carefully chosen level of strictness. This level must balance environmental ambition with what's financially realistic for companies. An ecolabel that's too demanding might just lead to no one adopting it.

Finally, while NGO strategies aimed at eliminating harmful ingredients generally make the environment better, they often come with trade-offs for economic well-being because sustainable ingredients usually cost more to produce. Whether society truly benefits from these interventions depends on how much we collectively value environmental quality. This means that for NGO-led market efforts to be truly beneficial for everyone, there needs to be a strong societal commitment to protecting the environment, possibly backed by government policies that help make companies pay for their environmental impact.

In conclusion, environmental NGOs have powerful tools in information campaigns and ecolabels to transform markets towards sustainability. However, they need to use these tools strategically, with a deep understanding of consumer behavior, market structures, and the inherent trade-offs involved. Moving forward, efforts should focus on designing campaigns that can overcome challenges like the fragmentation trap, optimizing ecolabel standards for maximum adoption and impact, and exploring combined approaches that blend the power of "private politics" with supportive government policies to speed up our journey to a truly sustainable economy.

REFERENCES

Bagwell, K. (2007). The economic analysis of advertising. In M. Armstrong & R. Porter (Eds.), Handbook of industrial organization (Vol. 3, pp. 1701–1844). North-Holland.

Baron, D. (2009). A positive theory of moral management, social pressure, and corporate social performance. Journal of Economics & Management Strategy, 18, 7–43.

Baron, D. (2011). Credence attributes, voluntary organizations, and social pressure. Journal of Public Economics, 95, 1331–1338.

Baron, D. (2016). Self-regulation and the market for activism. Journal of Economics & Management Strategy, 25, 584–607.

Baron, D., & Diermeier, D. (2007). Strategic activism and nonmarket strategy. Journal of Economics & Management Strategy, 16, 599–634.

Baron, D., Neale, M., & Rao, H. (2016). Extending nonmarket strategy: Political economy and the radical flank effect in private politics. Strategy Science, 1, 105–126.

Ben Elhadj, N., Gabszewicz, J., & Tarola, O. (2015). Social awareness and price competition. International Journal of Economic Theory, 11, 75–88.

Ben Elhadj, N., & Tarola, O. (2015). Relative quality-related (dis) utility in a vertically differentiated oligopoly with an environmental externality. Environment and Development Economics, 20, 354–379.

Bom, S., Jorge, J., Ribeiro, H., & Marto, J. (2019). A step forward on sustainability in the cosmetics industry: A review. Journal of Cleaner Production, 225, 270–290.

Bonroy, O., & Constantatos, C. (2015). On the economics of labels: How their introduction affects the functioning of markets and the welfare of all participants. American Journal of Agricultural Economics, 97, 239–259.

Bottega, L., & De Freitas, J. (2009). Public, private and nonprofit regulation for environmental quality. Journal of Economics & Management Strategy, 18, 105–123.

Bottega, L., Delacote, P., & Ibanez, L. (2009). Labeling policies and market behavior: Quality standard and voluntary label adoption. Journal of Agricultural & Food Industrial Organization, 7, 1–15.

Brécard, D. (2023). How corporate-NGO partnerships affect eco-label adoption and diffusion. Environmental and Resource Economics, 86(1–2), 233–261.

Brécard, D. (2014). Consumer confusion over the profusion of eco-labels: Lessons from a double differentiation model. Resource and Energy Economics, 37, 64–84.

Brécard, D. (2017). Consumer misperception of eco-labels, green market structure and welfare. Journal of Regulatory Economics, 51, 340–364.

Buehler, B., & Schuett, F. (2014). Certification and minimum quality standards when some consumers are uninformed. European Economic Review, 70, 493–511.

Cabedo, J., Fuertes-Fuertes, I., Maset-Llaudes, A., & Tirado-Beltrán, J. (2018). Improving and measuring transparency in NGOs: A disclosure index for activities and projects. Nonprofit Management and Leadership, 28, 329–348.

Conrad, K. (2005). Price competition and product differentiation when consumers care for the environment. Environmental and Resource Economics, 31, 1–19.

Delacote, P. (2009). On the sources of consumer boycotts ineffectiveness. The Journal of Environment & Development, 18, 306–322.

Eesley, C., & Lenox, M. (2006). Firm responses to secondary stakeholder action. Strategic Management Journal, 27, 765–781.

Egorov, G., & Harstad, B. (2017). Private politics and public regulation. The Review of Economic Studies, 84, 1652–1682.

Feddersen, T. J., & Gilligan, T. W. (2001). Saints and markets: Activists and the supply of credence goods. Journal of Economics & Management Strategy, 10(1), 149–171.

Fischer, C., & Lyon, T. (2014). Competing environmental labels. Journal of Economics & Management Strategy, 23, 692–716.

Garcia-Gallego, A., & Georgantzis, N. (2009). Market effects of changes in consumers' social responsibility. Journal of Economics & Management Strategy, 18, 235–262.

Garcia-Gallego, A., & Georgantzis, N. (2010). Good and bad increases in ecological awareness: Environmental differentiation revisited. Strategic Behavior and the Environment, 1, 71–88.

Garella, P., & Lambertini, L. (2014). Bidimensional vertical differentiation. International Journal of Industrial Organization, 32, 1–10.

Glaeser, E. L., & Ujhelyi, G. (2010). Regulating misinformation. Journal of Public Economics, 94(3–4), 247–257.

Gupta, S., & Innes, R. (2014). Private politics and environmental management. Journal of Environmental Economics and Management, 68, 319–339.

Hansmann, H. (1980). The role of nonprofit enterprise. The Yale Law Journal, 89, 835–901.

Heijnen, P., & Schoonbeek, L. (2008). Environmental groups in monopolistic markets. Environmental and Resource Economics, 39, 379–396.

Heijnen, P. (2013). Informative advertising by an environmental group. Journal of Economics, 108, 249–272.

Heyes, A., Kapur, S., Kennedy, P. W., Martin, S., & Maxwell, J. W. (2020). But what does it mean? Competition between products carrying alternative green labels when consumers are active acquirers of information. Journal of

the Association of Environmental and Resource Economists, 7(2), 243–277.

Heyes, A., Lyon, T., & Martin, S. (2018). Salience games: Private politics when public attention is limited. Journal of Environmental Economics and Management, 88, 396–410.

Heyes, A., & Martin, S. (2015). NGO mission design. Journal of Economic Behavior & Organization, 119, 197–210.

Innes, R. (2006). A theory of consumer boycotts under symmetric information and imperfect competition. The Economic Journal, 116, 355–381.

Kraft, T., Zheng, Y., & Erhun, F. (2013). The NGO's dilemma: How to influence firms to replace a potentially hazardous substance. Manufacturing & Service Operations Management, 15, 649–669.

Lenox, M., & Eesley, C. (2009). Private environmental activism and the selection and response of firm targets. Journal of Economics & Management Strategy, 18, 45–73.

Liao, P. (2008). A note on market coverage in vertical differentiation models with fixed costs. Bulletin of Economic Research, 60, 27–44.

Lizzeri, A. (1999). Information revelation and certification intermediaries. The RAND Journal of Economics, 30(2), 214–231.

Mantovani, A., Tarola, O., & Vergari, C. (2016). Hedonic and environmental quality: A hybrid model of product differentiation. Resource and Energy Economics, 45, 99–123.

Marini, M., Tarola, O., & Thisse, J. (2020). Is environmentalism the right strategy to decarbonize the world? [FEEM Working Paper, 31.202].

Petrakis, E., Sartzetakis, E., & Xepapadeas, A. (2005). Environmental information provision as a public policy instrument. The B.E. Journal of Economic Analysis & Policy, 4, 1–33.

Poret, S. (2019). Label wars: Competition among NGOs as sustainability standard setters. Journal of Economic Behavior & Organization, 160, 1–18.

Rhodes, A., & Wilson, C. M. (2018). False advertising. The RAND Journal of Economics, 49(2), 348–369.

Sartzetakis, E. S., Xepapadeas, A., & Petrakis, E. (2012). The role of information provision as a policy instrument to supplement environmental taxes. Environmental and Resource Economics, 52, 347–368.

Stathopoulou, E., & Gautier, L. (2019). Green alliances and the role of taxation. Environmental and Resource Economics, 74, 1189–1206.

van der Made, A., & Schoonbeek, L. (2009). Entry facilitation by environmental groups. Environmental and Resource Economics, 43, 457–472.

van der Ven, H., Rothacker, C., & Cashore, B. (2018). Do eco-labels prevent deforestation? Lessons from non-state market driven governance in the soy, palm oil, and cocoa sectors. Global Environmental Change, 52, 141–151.

Van Gelder, J., (2004). Greasy palms: European buyers of Indonesian palm oil. Friends of the Earth London.

Wauthy, X. (1996). Quality choice in models of vertical differentiation. The Journal of Industrial Economics, 44(3), 345–353.