Can labelling policies do more harm than good ? An analysis applied to environmental labelling schemes

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Can Labelling Policies Do More Harm Than Good? An Analysis Applied to Environmental Labelling Schemes[1]

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Abstract: In certain plausible circumstances, the introduction of labelling schemes can lead to adverse effects. In the case of ecolabelling, the adverse effects are an environmental degradation rather than an environmental improvement. To take into account the environmental sensitiveness or responsiveness of consumers, we introduce the concept of environmental elasticity which enables us to classify goods. In a basic analytical model, we describe the conditions under which different outcomes –overall impacts of change in environmental quality due to environmental labelling– arise after the introduction of an ecolabelling scheme. We show that an ecolabelling scheme can lead to an increase in purchases of environmentally sustainable products. The net effect on the environment can be worse than the initial situation without ecolabelling, because the environmental unit improvement is compensated by an over-consumption. We suggest several tests to detect this potential perverse effect, some policy implications to avoid it and stress the need for further research.

Key words: Labelling; Ecolabelling; Policy; Environmental elasticity.

JEL Classification Numbers: D11, L15, Q28.

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"I can sum up my notion of good practice in three injunctions.
1. Keep it simple.
2. Get it right.
3. Make it plausible."

Robert Solow (2001)

1. Introduction and review of the literature

The credible labelling of products is frequently considered as an accurate information-based policy to promote informed choices, notably in the case of credence products[2] such as light products, low-nicotine cigarettes, low-alcohol beers or protective solar filters. Following the same line, the ecolabelling of products is frequently presented as an appropriate, though partial policy tool to regulate environmental problems[3]. It is expected that ecolabels, by providing environmental information, will encourage consumers to discriminate between products and purchase products that have fewer environmental impacts than competing alternatives. Producers will have a greater incentive to manufacture environmentally friendly products. The net expected effect will be an improvement in overall environmental quality (Morris and Scarlett, 1997).

Similarly to other papers (Mattoo and Singh, 1994; Dosi and Moretto, 2001), we argue that ecolabelling schemes could, in certain plausible circumstances, lead to an adverse effect on the environment. This paper differs from the previous ones by the source of the perverse effect considered and the analytical framework. Mattoo and Singh (1994) distinguish between concerned and unconcerned consumers about environmental problems. Ecolabelling may stimulate concern for the environment and increase the demand for environmentally friendly products. In certain plausible cases, they show that the differentiation of products due to ecolabelling may lead to increased sales of products made by environmentally friendly and environmentally unfriendly methods. Dosi and Moretto (2001) consider the effects of an ecolabelling scheme on the incentives of firms to innovate and to invest in green technology. They argue that an ecolabelling scheme could increase investment in the conventional polluting technology even if green consumption is stimulated by the ecolabelling scheme. It is the case if there are image spillovers, i.e. if the ecolabel projects a positive image not only on the environmentally friendly product but also on the conventional product.

This paper argues that the introduction of an ecolabelling scheme may encourage people to consume more, and in certain cases, the overall effect on the environment may be worse than the initial situation, i.e. the situation without ecolabelling scheme. A simple example will make clear the intuitive rationale for such a result. Say the market for a particular good is in equilibrium at a certain price p with 100 units being supplied and demanded. This undifferentiated good has a negative individual impact on the environment of 0,5 and the total environmental impact of all the product market is 50. Now ecolabelling is introduced, which means that a product with a fewer environmental impacts is launched at the same

[2] Credence goods are goods for which consumers cannot determine quality either through search, inspection or experience. Consumers cannot determine quality even after they buy and consume the product. Frequently for these goods, one must rely on a third party (third party certification or governmental regulations) to provide credible information to the consumer whether the product is high quality or not.

[3] To make the exposition clear, we deal especially with ecolabelling, but the approach can be easily generalized to numerous other applications. Anyway, we deal with labelling schemes indicating to consumers attributes of the product having less negative impacts on diverse targets like the environment or health.

price as before. Its environmental impacts is only of 0,4. Let us assume, in a simplified approach, that there is a complete substitution, i.e. all the consumers have ecofriendly preferences and buy only the ecolabeled product which becomes the only product available in the market. *Let us further assume that the introduction of environmentally friendly products stops consumers feeling guilty and generates an increase in consumption.* If this increase exceeds a certain level, in our example 125 units, the overall impact on the environment will be greater after the introduction of the ecolabelling scheme. Indeed, if people consume now 130 units, then the overall impact is worse, i.e. 52 (130*0,4) which is superior to the initial level, i.e. 50. Although this example seems rather diagrammatic, these potential perverse effects correspond to a real concern of practitioners and policy-makers (Byron, 2001, p.6; European Environmental Bureau, 2003, p.11)[4]. In other words, the environmental improvement per unit of product is cancelled by a consumption increase. In our reasoning, consumers care about the environmental impact per product unit and do not compute the overall impact of their consumption. Manufacturers encourage consumers to buy the highest quantity of their products in order to maximise their profits. Consequently, manufacturers emphasise the individual qualities of their products, notably in their advertising. They have little incentives to highlight the potentially adverse effects of the total consumption[5].

The remainder of the paper is organised as follows : In the next section, the concept of environmental elasticity is introduced and some empirical tests in order to characterise the properties of goods are suggested. In section III, we examine the possible outcomes in terms of environmental quality after the introduction of an ecolabelling scheme in a basic model. We identify the conditions under which potentially perverse effect of introducing ecolabelling schemes can arise. Section IV outlines the relevance of the results for policy makers. Section V provides some concluding remarks, notably by stressing numerous potential extensions of this paper.

2. Environmental Elasticity of Demand and the Classification of Goods

The environmental elasticity e of demand for a given product measures the responsiveness of demand for this product to a given change in the environmental impact i of the product. Using the conventional equation in the case of a continuous and derivable function, the environmental elasticity e is given by:

[4] Byron, Neil, 2001, Environmental Certification and Labelling, The Common Property Resource Digest, 56, p.5-6. European Environmental Bureau, 2003, An Environmental NGO Vision Paper Towards a European Integrated Product Policy, 13p, March 2003.

[5] Several studies stress the potentially perverse effects resulting from diverse labelling schemes. For example, a French report of the National Council of Consumption (Rapport du Conseil national de la Consommation sur les produits cosmétiques de protection solaire, 2000) explains that the labelling of higher solar protection makes "consumers think they are well protected, notably products labeled with high Sunburn Protection Factor (…). Consumers tend to go out in the sun longer and adopt a risky behavior for their health".
We find the same line of reasoning for nutritional and functional claims, where the labelling of a specific improvement can lead to an over-consumption (See for example: Parliamentary Assembly of the European Union, 2002, Functional food : serving the interests of the consumer on the food industry? and European Commission, 2001, Discussion Paper on Nutrition Claims and Functional Claims). Lastly, according to Dr Pellae, "a study of Pr Apfelbaum have showed that people eat twice more because the products are light. When certain people read a claim "light" on a foodstuff, they perceive it like a miraculous product to lose weight (…)." (www.doctissimo.fr/html/nutrition/mag_2002/mag0607/nu_5559_faux_sucres_danger_itw.htm).
Another meaningful and well documented example relates to cigarettes labelled as "safer". Several studies show that these "safer" cigarettes frequently do more harm than good. According to a literature review (The Cigarettes Companies and "Safer" Cigarettes – A Long History of Exploiting Consumers Health Concerns to Keep Them Smoking, 2000, http://tobaccofreekids.org/research/factsheets/), "soon after the cigarette companies began selling low tar and nicotine cigarettes, it became clear the smokers that switched to these "light" brands were compensating for the lower nicotine levels by adopting new ways of smoking the cigarettes so they would still consume the same amounts of nicotine as they would with regular brands."

$$e = \frac{\frac{dx}{x_c}}{\frac{di}{i_c}}$$

dx corresponds to the variation in the quantity exchanged. For a discrete function, it is the difference between the quantity exchanged of environmentally friendly products (x_e) and the quantity exchanged of conventional products (x_c), before the introduction of the ecolabelling scheme ($\Delta x = x_e - x_c$).
di corresponds to a small change in the environmental quality of the products. For a discrete function, it is the difference between the environmental impact generated by the environmentally friendly product (i_e) and the environmental impact generated by the conventional product (i_c) ($\Delta i = i_e - i_c$). Note that $\Delta i < 0$ because we postulate an environmental improvement by diminishing the value of i, i.e. $i_e < i_c$.

In our introductive example, the absolute value of the elasticity is greater than one, i.e. -1,5. In a first approach, we consider that ecolabelling schemes only affect the environmental impacts (and the environmental perception) generated by the product and leaves unchanged the other qualities of the good.

According to the concept of environmental elasticity, we propose an intuitive classification of goods as indicated in table 1. For example, we can intuitively suppose that the demand of clothes is not influenced by the environmental qualities of the clothes ($e = 0$) while the demand of paper will increase substantially ($|e| < 1$) because of the introduction of an environmentally friendly paper, such as recycled paper[6].

Absolute value of the elasticity	e = 0	0 < | e | < 1	| e | = 1	| e | > 1
Effect on the demand of x	The demand is perfectly inelastic, i.e. there is no change in the consumed quantity x when there is a variation of i	The demand is inelastic., i.e. the proportional change in x is less than the proportional change in i	The demand is of unit elasticity, i.e. the proportional change in x is equal to the proportional change in i	The demand is elastic, i.e. the proportional change in x is greater than the proportional change in i

Table 1 : Types of goods according to their environmental elasticity[7]

The classification of goods according to their environmental elasticity is particularly relevant for policy makers who aim at maximising the efficiency of funds invested in ecolabelling schemes. This point is briefly developed in section IV. An empirical way to determine the environmental elasticity of goods is to realise well-designed surveys to simulate the reaction of consumers to the launch of ecolabeled products. Another way is to exploit data related from products launched for their environmental friendliness. A third way to test this environmental elasticity is to achieve pilot studies in supermarkets by proposing identical products (same price, brand name and other properties) with added environmental qualities. These different ways are neither exhaustive nor mutually exclusive and can be combined to get better results.

[6] Marketing literature uses the concept of salient attributes which are attributes taken into account in the purchase of a good. We could say that generally environmental attributes are not as salient for clothes as they are for paper.

[7] In developed countries, people have a high level of satiation with many purchased products and it is possible to argue that we will not really see significant changes in quantities purchased with most products. However, much of the argumentation developed in this article relies on the presence of obstacles leading people to limit their consumption. If these obstacles disappear (e.g. feeling guilty in the case of unsustainable consumption, fear of diseases related to solar exposition or nicotine level in cigarettes), people can naturally choose to increase their consumption.

3. The model

The basic results can be demonstrated in a very simple model. To keep the analysis simple and isolate the main effects, we consider, in a first approach, a change in the environmental quality of the product. We assume several restrictive hypotheses: (1) All consumers are equally concerned about the environment. Their preferences are perfectly homogeneous. (2) After the introduction of the ecolabelling scheme, all the manufacturers meet the criteria to have their products qualified. In other words, all the available products are environmentally friendly and ecolabeled. These criteria correspond to a certain level of environmental improvement relative to the conventional product. The conventional product has an environmental impact or performance per unit of i_c and the ecolabeled one has an environmental impact per unit of i_e, with $i_e < i_c$. (3) The perceived change in the environmental performances of the product shapes the quantities demanded. The perceived change corresponds to the real difference between i_e and i_c. We admit that marketing strategies and other parameters can influence the perceived environmental improvement. This effect would be captured by the concept of environmental elasticity. (4) The individual consumer perfectly perceives the environmental improvement per unit of product but does not care of the overall environmental impact of his total consumption. This hypothesis means that the consumer does not compare the overall environmental impact before and after the introduction of the ecolabelling scheme, but only takes into account the marginal improvement generated by the ecofriendly product. (5) Manufacturing ecofriendly products frequently implies higher production and transaction costs and consequently a price higher than the price of the conventional goods. Let us assume that the quantity demanded is a function of the environmental quality i and the price p. The price is itself a function of the environmental quality, i.e. $x = f(i, p(i))$. The rationale of this hypothesis is that every improvement in environmental quality will generate a cost increase for producers, which is integrally transmitted to the market price ($\frac{\partial p}{\partial i} < 0$).

The initial equilibrium quantity is x_c and after the ecolabel introduction the exchanged quantity is x_e. Formally, the new exchanged quantity and the environmental elasticity are given by :

$$x_e = x_c + dx = e\,\frac{di}{i_c}\,x_c + x_c \quad (1)$$

$$e = \frac{dx}{di}\,\frac{i_c}{x_c} \quad (2)$$

$$\frac{dx}{di} = \frac{\partial x}{\partial i} + \frac{\partial x}{\partial p}\,\frac{\partial p}{\partial i} \quad (3)$$

$$e = \left(\frac{\partial x}{\partial i} + \frac{\partial x}{\partial p}\,\frac{\partial p}{\partial i}\right)\left(\frac{i_c}{x_c}\right) \quad (4)$$

In the equation (3), the first term corresponds to the direct effect of the environmental improvement on the demand of x. This term is negative, given that people have environmentally friendly preferences ($\frac{\partial x}{\partial i} < 0$). Indeed by diminishing i, i.e. $i_c + di < i_c$, we get an increase in the quantity of x demanded.

The second term captures the indirect effect of i. Indeed, diminishing i or improving the environmental quality of the good leads to a price increase[8]. This price increase logically leads to a consumption decrease, i.e. ($\frac{\partial x}{\partial p} < 0$). Moreover, an improvement in environmental quality generates a price increase, i.e. ($\frac{\partial p}{\partial i} < 0$). Consequently, the second term, which captures the indirect effect is positive[9].

In other words, an environmental improvement leads to a consumption increase, but the price increase mitigates the direct effect. The quantity exchanged is a function of the relative magnitude of these both effects. If the direct effect is stronger than the indirect one, there is a net negative effect, which means an increase in the demanded quantity. If this quantity exceeds a certain level, it can generate a perverse effect on the environment.

An adverse effect on the environment, i.e. a worse net total effect on the environment arises if and only if the overall impact after the ecolabelling scheme introduction is superior to the overall impact in the original situation:

$$x_e \times i_e > x_c \times i_c \qquad (5)$$

By using (1) in (5) and arranging, an adverse effect on the environment occurs if and only if the environmental elasticity is lower than the opposite of the ratio of the original environmental impact to the improved impact:

$$e < -\frac{i_c}{i_e} \qquad \text{or} \qquad e < -\frac{i_c}{i_c + di} \quad (6)$$

In this case, the situation is better for the environment without ecolabelling scheme. We can now distinguish four cases by using (3):

A- If the indirect effect is stronger than the direct one, we get a consumption decrease, which results in a better overall environmental impact because of both marginal environmental improvement and consumption decrease.

B- If the direct effect is stronger than the indirect effect, *and* if the new quantity consumed is superior to a threshold quantity $\tilde{x}$ (for which the overall environmental impact is unchanged after the introduction of the ecolabel), we get a consumption increase that leads to an adverse effect on the environment.

C- If the direct effect is stronger than the indirect effect, *and* if the new quantity consumed is inferior to $\tilde{x}$, we get a consumption increase, but the overall environmental impact is less than the initial situation.

D- If the direct effect is as strong as the indirect effect, the new quantity consumed is $\tilde{x}$. Environmental quality remains unchanged and the labelling scheme introduction does not generate an environmental improvement[10].

[8] In certain plausible circumstances, if firms are not efficient, we can consider that improving environmental performance can be a "win-win" strategy by diminishing simultaneously i and p. In other cases of labelling (e.g. low-alcohol beer where i corresponds to the alcohol content), the direct and indirect effects can play in the same direction, reinforcing the likelihood of a consumption increase and an adverse effect.

[9] If the price of the conventional product and the ecolabeled one keeps unchanged, i.e. $p_c = p_e$, the indirect effect is nil and makes an adverse effect more likely to occur.

[10] Because of the costs of designing and implementing an ecolabeling policy, we can intuitively deduce that the introduction of an ecolabeling scheme is costly and environmentally useless.

An important implication is that an adverse effect is more likely to occur if the ecofriendly product can be produced with low cost technologies and if consumers value the environmental improvement per unit product. Indeed, if reaching the ecolabel criteria is accessible at low costs, the price effect is low and gives an advantage to the direct effect, i.e. a consumption increase due to the environmental improvement. If this consumption increase exceeds a certain level, it will generate an adverse effect on the environment.

The introduction of an ecolabel may lead to an adverse effect if the overall impact after ecolabel introduction is higher than the overall impact before ecolabel introduction: $I_e > I_c$. Indeed, there exists a threshold quantity $\tilde{x}$ for which the overall environmental impact is unchanged after the introduction of the ecolabel: $I_c(x_c) = I_e(\tilde{x})$.

$$\tilde{x} = x_c\left(\frac{i_c}{i_e}\right) \quad (7)$$

Figure 1 shows the values of $x_e > \tilde{x}$ for which ecolabelling may lead to an adverse effect. Three cases appear in which we note an interesting feature: $G = \tilde{x} - x_c$ is increasing with x_c. Figure 1 shows that if $x_c^1 < x_c^2$, then $\tilde{x}^1 - x_c^1 < \tilde{x}^2 - x_c^2$. The higher the quantity of units before ecolabel introduction, the higher the threshold quantity. This feature points to an interesting policy implication. *Indeed, the lower the level of consumption for a product before the ecolabel introduction, the quicker the threshold quantity will be reached, and the more likely perverse effects are to arise.*

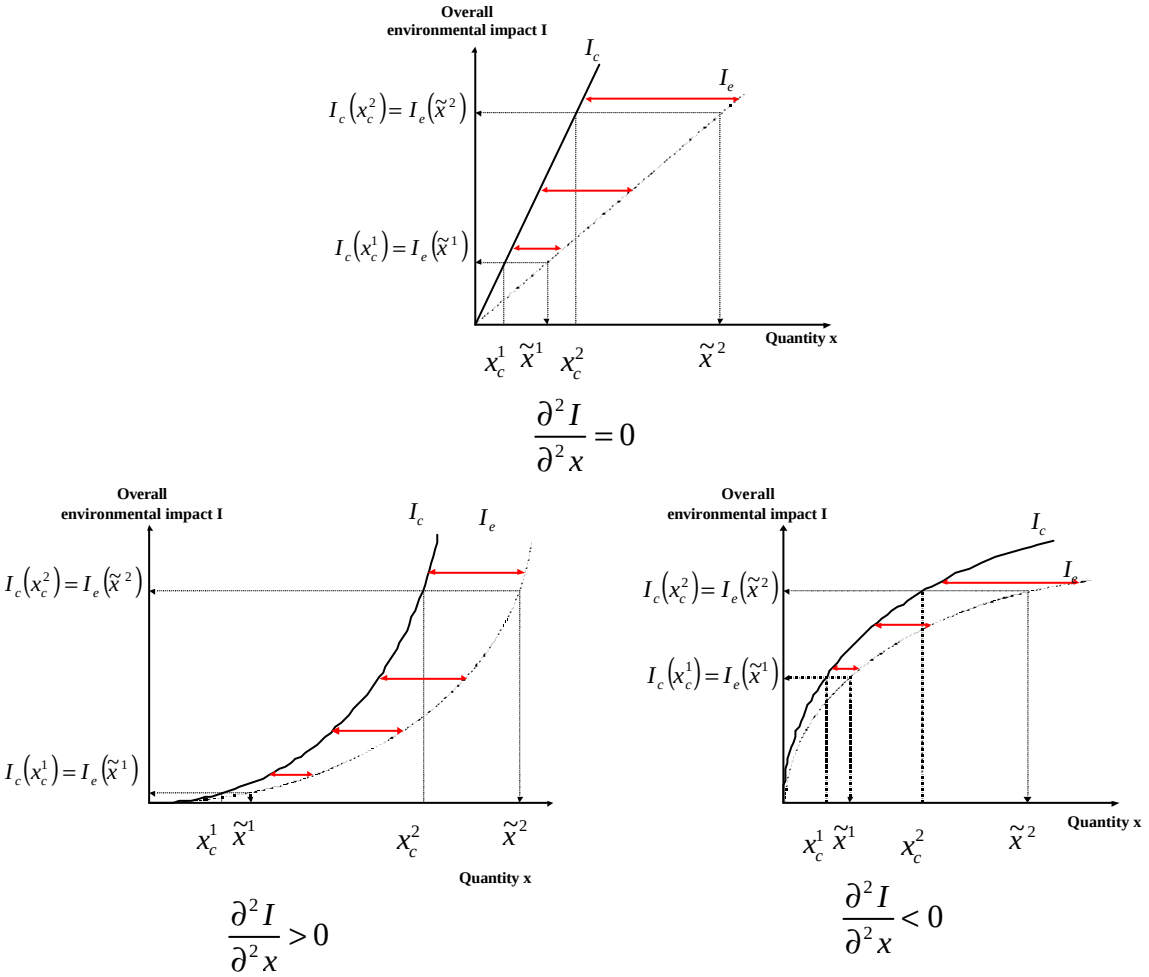

Figure 1 : The potentially perverse effects of ecolabelling

Some other extensions based on other effects (heterogeneity of consumers' preferences, co-existence of conventional and environmentally friendly products, etc.) can mitigate or reinforce the effects due to the environmental elasticity of the considered good. These extensions are briefly presented in the conclusive section.

4. Policy considerations for introducing ecolabelling schemes

There are many thousands of products categories available in the marketplace. The costs of generating a specific level of environmental improvement is not the same for all products categories. If we postulate that consumers want to allocate a fraction of their resources to purchase environmentally friendly goods, they will prefer choosing products categories, which will make the most significant improvement to the environment for a given contribution. Indeed, consumers have limited resources and will prefer the most cost-effective solutions. To maximise the environmental effectiveness and the economic efficiency of ecolabels, policy designers need to select the products categories for which ecolabels would make the most significant improvement to the environment. Conversely, profit maximising firms could be interested in awarding environmentally goods characterised by an elasticity leading to a consumption increase. Policy makers include here various kinds of institutions such as governments or environmental associations, which are frequently initiators of ecolabelling schemes. Knowing the environmental elasticity of goods can be useful for policy makers who can select product categories according to the overall expected environmental net effect. Using the empirical tests suggested in the second section can help policy designers to better allocate scarce resources and generate higher environmental improvement, or at least avoid a hidden perverse effect by introducing an ecolabel for an inappropriate product category. Our analysis does not conclude that policy makers have to ban certain product categories, but stresses the need of complementary measures e.g. educating consumers or taxing products to prevent over-consumption in certain cases. Moreover, there is also a temporal dimension in the policy intervention because ecolabelling criteria are regularly reviewed to strengthen the environmental effectiveness of the scheme (Morris et Scarlett, 1996). In a dynamic perspective, we can suppose that meeting ecolabel criteria will be accessible at low cost in the first period. In the following periods, the costs of meeting the updated criteria will generally increase, leading to a stronger price effect. Consequently an adverse effect is more likely to arise in the starting period, where the price effect is weak. That means that regulators have to take into account this timing. Indeed, an intervention is potentially more effective in the first stages of the ecolabel development than in the following ones. In the same line of reasoning, regulators have to take into account the initial level of consumption, which can provide a partial indication on the likelihood of perverse effects

Note that measures aiming at reducing demand potentially conflict with profit maximising strategies of manufacturers. Of course policy makers need to take into account other related effects, which will together shape the quantities consumed and consequently the net environmental effects. For example, as analysed in the section III, a price increase can attenuate the effect due to environmental improvement. By selecting ecolabel criteria accessible at high costs, government can reduce the risk of generating a perverse effect on the environment. However, high costs of complying with the ecolabel criteria may hinder firms' incentives to have their products awarded. This underlines the need to define environmental criteria as a trade-off between lowering the likelihood of perverse effects and maximising firms' incentives.

5. Conclusion

We have introduced the concept of environmental elasticity[11] and showed how ecolabelling schemes can generate an adverse effect on the environment. Although we have focused our attention on ecolabelling schemes, the framework and the results are generic and can be easily applied to many other topics, such as light products, low-nicotine cigarettes[12], low-alcohol beers or protective solar filters[13]. These products also provide a favourable field for empirical investigation, e.g. the evolution of consumption after the introduction of low-nicotine cigarettes and the combined effect of simultaneous quality and price changes. The main results have been derived under very simplifying assumptions. Many extensions can be analysed such as the combination of other related effects. Indeed, this paper has assumed consumers and firms behave somewhat rigidly by postulating identical consumers' preferences and the sole presence of the environmentally friendly product. All consumers do not react in the same way to the introduction of ecolabelling schemes. The co-existence of two identical products differing only by their environmental quality and two kind of consumers –unconcerned consumers and concerned ones – will make the model closer to the real world. The perverse effect argument relies on the quantity change and ignores offsetting effects that may occur when a quantity increase in one products results in decrease in sales of other products through a substitution effect (between products rather than within different versions of the same product). Moreover, our reasoning is based on an informational policy instrument, which is market anchored and do not consider an eventual lifestyle change, e.g. substituting bike trips for car trips. Extending this setting and testing it empirically is a challenging topic for future research.

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[11] In many cases related to credence goods, note that the elasticity is based on consumers' perception resulting more from the information tool (i.e. labelling) than the objective perception of the quality change.

[12] Despite mandatory warnings, it is broadly admitted that tobacco firms have tested and devised manipulative strategies to lower consumer risk perceptions and increase demand, e.g. by introducing low-nicotine cigarettes.

[13] Note that ecolabelling relates to the private provision of a public good, i.e. an environmental quality improvement while other labelling schemes (e.g. low nicotine cigarettes or protective solar filters) mainly relate to the provision of a private good. An intuitive implication is that properties described in the case of ecolabelling will be more emphasized in the case of labelling schemes promoting private benefits.

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