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How consumers of plastic water bottles are responding to environmental policies?

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ABSTRACT

Although plastic induces environmental damages, almost all water bottles are made from plastic and the consumption never stops increasing. This study evaluates the consumers' willingness to pay (WTP) for different plastics used for water packaging. Successive messages emphasizing the characteristics of plastic are delivered to consumers allowing explaining the influence of information on the consumers' WTP. We find that information has a manifest effect on the WTP. We show there is a significant premium associated with recycled plastic packaging and biodegradable bioplastic packaging. As there is no consensus on the plastic which is the most or the least dangerous for the environment, we propose different policies for protecting the environment. We discuss about the impact of these policies on consumer's purchasing decisions: switching one plastic packaging for another, or leaving water plastic bottles market. We present the environmental policies that are effective according to the point of view adopted. Choosing between these policies then depends on the priorities of the regulator and pressure of lobbies.

1. Introduction

Plastic packaging is widely used everywhere in the world. This kind of packaging produces an important quantity of waste. One of the most common plastic used is polyethylene terephthalate abbreviated PET. This plastic is strong and durable, chemically and thermally stable. It has low gas permeability and is easily processed and handled. This almost unique combination of properties makes PET a very desirable material for a wide range of applications including food and beverage packaging, especially water bottles at a very cost effective price. Globally, 389 billion of PET bottles had been produced in 2010, 46% of them for water packaging (ELIPSO, 2012). But, this stability leads PET to be highly resistant to environmental biodegradation. Biodegradation of one PET bottle left in nature can last around 500 years. Thus, this causes many and varied environmental concerns for both terrestrial and marine areas. Its accumulation is particularly impressive in the world's oceans, where about 10% of global plastic production amass each year (Fitzgerald, 2011). A seafaring scientist named Captain Charles Moore discovered and confirmed the existence of the Great Pacific Garbage Patch in 1997. In 2010, another similar area has been discovered in the Atlantic Ocean: The North Atlantic Garbage Patch. Finally, in 2013, a French expedition named the 7*th* Continent expedition studied the Great Pacific Garbage Patch (Bossy, 2013) and started a new expedition in May 2014 in the North Atlantic Ocean.[1] The vast majority of all those marine debris is plastic materials and many of them are made of PET. According to Azzarello and Van Vleet (1987), Derraik (2002), Moore (2008), Saido (2014), and Sazima et al. (2002) plastic debris create a direct threat to wildlife, with many and varied species documented as being negatively impacted by those small plastic items. As very often concerning highly complex topics, the range of possible solutions for protecting the ecosystem of plastic pollution is wide. In Portugal, face to the continuous growth of waste produced by the population, the waste

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[1] For more details, see: http://expedition-7eme-continent-monsite.com/en/pages/-page.html.

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regulator decided to use the sunshine regulation, based on a set of performances indicators, to measure the operators' efficiency and effectiveness in the provision of their activities. Simões and Marques (2012) have studied the influence of this regulation on the performance of Portuguese urban waste utilities from 2001 to 2008. They have found that productivity declines in the urban waste utilities but the quality of service has improved. Recently on the 13th of March 2014, San Francisco municipality has made a step with an ordinance to ban the sale of PET water bottles on city-owned property (Timm, 2014). On the 2nd July 2014, the European Commission adopted the Packaging and Packaging Waste Directive 94/62/EC, which currently concerns plastic bags. However, as with plastic bags, plastic bottles are the most emblematic plastic waste, this directive could be extended to plastic bottles.

Suppliers are also working on the reduction of plastic waste. The significant environmental drawbacks of plastic disposal via both landfill and incineration are the driving force behind the development of plastic recycling processes (Paponga et al., 2014). PET is now recycled in many countries that are developing specific waste management policies. The recycled PET is named r-PET. In France, this solution has been used 20 years ago. In 2010, 310,000 tons of PET bottles have been collected in France: it represents a recycling rate of 51%. Around 30% of this collected PET can be used in order to produce food grade r-PET quality.[2] Another solution is the development of new plastics like bio-based (plant-derivative) plastics. The two most known biopolymers are polylactic acid (PLA) and polyethylene furanoate (PEF). They are derived from renewable biomass sources. PLA is produced from glucose and it is biodegradable. La Mantia et al. (2012) prove that there is a better impact on environment of PLA compared to PET. However, PLA production is still low because even if PLA is mentioned as biodegradable plastic it needs anaerobic conditions. Its degradation is a source of methane that is a very powerful greenhouse effect gas. In addition, PLA recycling processes are still in progress. Loopla[3] by Galatic uses PLA waste in order to recycle them but their process does not lead to 100% recycling of PLA. In addition, since the introduction of PLA in PET process recycling can lead to problems concerning PET recycling quality, few recycling companies invest in PLA recycling. Hence, in our study, we do not consider the recyclable property of PLA. By contrast, PEF is fully recyclable like PET but it is poorly biodegradable. PEF is made by converting sugars from sugarcane into plastic. Nowadays more than 2.5 billion plastic bottles made of biopolymers are already in use around the world, but this only represents less than 1% of global production. One of the main limiting aspects is the cost.

Today, 89 billion litre of water are bottled and consumed each year worldwide. Overall consumption of bottled water in the world in 2004 was almost double that of 1997.[4] Moreover, annual growth rate for plastic water bottle consumption in the world from 2008 to 2013 is at 6.2%.[5] So we wonder whether consumers care about plastic water bottles' environmental impacts. Which environmental policies could be proposed and which one(s) is(are) optimal? How environmental policies change consumers' purchasing decisions? To address these questions, we propose to study the consumers' perceptions through a willingness-to-pay (WTP) analysis. Indeed, consumers' perceptions are not only essential for packaging companies' choices but they are also for environmental policies.

Our approach relies on two building blocks. First, our paper is linked to the literature that examines the interaction between the WTP and information acquisition. Food experiments constitute some (for instance, on palm oil, Disdier et al., 2013; on milk, Marette and Millet, 2014, and on organic apples, Marette et al., 2012). Our paper contributes to this literature by investigating the precise impact of information on the plastic water bottles consumers' WTP. We believe to be the first study focusing on the consumer perception regarding plastic bottles. We first conduct an analysis to elicit the WTP for different kinds of plastic bottles with increasing levels of information on the use of various plastic bottles, and their environmental impacts. We find that information matters in terms of WTP. Bougherara and Combris (2009), Disdier et al. (2013), Marette et al. (2012), Marette and Millet (2014), and Yue et al. (2009) show that a significant proportion of consumers are willing to pay substantial premiums for environmentally friendly products. We then propose to analyse the premiums for organic, recyclable, and biodegradable plastic water bottles.

Furthermore, we contribute to the ecological economics literature on the reduction of pollution and waste on the environment. Contrary to questions about trade-off between regular and organic products in which regulator chooses to support organic products because they are safer for health and their production reduces damages on the environment, the question of plastic bottles packaging is more technical and complex. Indeed, there is no consensus on the plastic which is the most or the least dangerous for the environment, we propose four policies for protecting the environment: an information campaign on the characteristics of each plastic and their consequences on the environment, an organic policy favouring plastic bottles issued of renewable products, a biodegradable policy favouring biodegradable plastic bottles, and a recycling policy favouring recyclable plastic bottles. A lot of works have been done on the producer side essentially on the producer responsibility regulations based on the Extended Producer Responsibility (EPR) principle[6] to reduce waste and pollution in the environment (Cruz et al., 2012, 2014; Ferreira et al., 2016; Hage, 2007; Marques et al., 2014; Mayers, 2007; Numata, 2009; Palmer and Walls, 1997). Cruz et al. (2012) highlight that the extra cost of recycling is difficult to evaluate implying that the industry may be responsible for the possible cost-inefficiencies of waste management operators. However, from a cost and benefit analysis on recycling system, Marques et al. (2014) study the actual implementation of the EPR principle in Belgium and Portugal. They show that in Belgium, the industry supports all the extra-costs of recycling while in Portugal the industry is not always paying the net financial cost of packaging waste management. This depends whether diverting packaging waste from other treatment operations are taken into account as a benefit or a cost for the local authorities. The same conclusions than the one for the Portugal are obtained by Ferreira et al. (2016) for Italy and Belgium, and by Cruz et al. (2014) for France and Romania. But, none of these works have studied this issue from the consumers' side. In this paper, from the consumers' revealed and estimated preferences on plastic used for water bottles packaging, we analyse the impact of environmental policies on the social welfare. This allows us both to identify the effects of each policy on the consumers' and producers' welfare, and to recommend optimal environmental policies. Cruz et al. (2014) and OECD (2008) suggest that regulation and financial incentives for citizens are essential for habits changing in waste sector. We then discuss about the impact of these policies on consumer's purchasing decisions: switching one plastic packaging for another, or leaving water plastic bottles' market. We see that the environmental policies are effective according to the point of view adopted (consumer surplus, producer surplus, social welfare,

[2] For more details, see ELIPSO (2012).

[3] For more details, see http://www.loopla.org/cradle/cradle.htm.

[4] See: http://www.planetoscope.com/dechets/321-consommation-mondiale-de-bouteilles-d-eau-en-plastique.html.

[5] See: http://www.bottledwater.org/economics/industry-statistics.

[6] According to the Organisation for Economic Cooperation and Development (OECD), *the Extended Producer Responsibility (EPR) is a policy approach under which producers are given a significant responsibility – financial and/or physical – for the treatment or disposal of post-consumer products.*

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