

Sustainable consumption and preferences: an experimental analysis

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Abstract :

Sustainable consumption has recently been highlighted by numerous environmental programs like the United Nation Program for the Environment. Moving consumption patterns towards more sustainable ones imply a deeper understanding of consumers' behaviours. Insights about how consumers value the environmental attributes of private goods are necessary for firms to design and produce environmentally friendlier products as well as for public authorities to provide appropriate information and design efficient policy tools. This paper presents a real choice experiment investigating the individual valuations (or willingness to pay) of consumers for a red rose. Our results strongly support the existence of environmental preferences among consumers in the sense that consumers' choices were significantly affected by the environmental attributes of the products and therefore by the information provided about these characteristics. It highlights the critical role of information in consumers' decisions. Relevant environmental information about products and processes might link the production, consumption and regulatory systems and hence be one of the keys of the change towards a more sustainable society.

Key Words:

Sustainable consumption; environmental preferences; choice experiment.

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1. Introduction.

Developing an environmentally friendlier society has become one of the major political, economical and sociological challenges worldwide for the last decades. The ideology of sustainable development has driven politics to imagine new regulations to incite the various stakeholders to change their ways of producing and consuming. Initially focusing on the environmental performance of production processes, the current environmental debate has shifted towards the consumption patterns. Sustainable consumption has been highlighted as an important component of sustainable development in Rio de Janeiro in 1992 at the United Nation Conference for Environment and Development. One of the generally accepted definitions of sustainable consumption is *the use of goods and services that satisfy basic needs and improve the quality of life while minimizing the usage of irreplaceable natural resources and by-products of toxic materials, waste, and pollution* (OECD, 1998). In fact, this definition highlights the need to provide goods and services while reducing the environmental impacts associated with the production and distribution of these products. Sustainable consumption is not necessary about consuming less. It is about consuming differently and more efficiently from an environmental and social perspective. Promoting sustainable consumption has become a key area of national and international environmental programs (UNEP, OECD, WCED, etc.) which consider changes in industrial and consumption systems as inseparable issues. Indeed, it seems that consumer choices do have a significant effect on the environment and improving consumers' choices may therefore mitigate at least some environmental problems. If consumers are ready to pay for the environmental characteristics of goods, then firms are encouraged to produce such green products. These profit opportunities question the role of public authorities since they imply that some negative externalities could be internalized by market mechanisms. So far environmental problems have traditionally been considered as a public responsibility because of their collective dimension. The polluter pays principle has driven regulators to focus on industries by means of environmental taxes and subsidies. New forms of regulation are being implemented promoting voluntary approaches and involving the responsibility of consumers. Efficient consumer-oriented environmental policies need accurate information about the environmental preferences of consumers.

So far little is known about the value consumers place on the environmental attributes of products although both governments and firms need to assess the importance of this valuation among the bundle of attributes that makes a product in order to design the right policy or to launch the right product in the marketplace. In fact, beyond a policy perspective, a conjoint growth of the supply and the demand of environmentally better goods is required so that industries' environmental initiatives can meet consumers' needs and become real competition and differentiation factors. How much consumers are willing to pay for the environmental characteristics of products is critical information for industries considering the development of eco-friendly products. The main objective of this paper is to observe and measure the impact of the environmental characteristics on the consumption behaviours with a methodology based on a discrete choice experiment. We also analyse the informational conditions weighing on such environmental preferences.

The second section presents our analysis of green products as "impure public goods", i.e. goods generating simultaneously public characteristics, like the protection of the environment, and private characteristics linked to the use of the good. From this perspective the usual view of

rationality as a strictly welfare-maximizing behaviour should be replaced by a wider notion of rationality in which the welfare of others as well as the environmental quality also matter. The third section underlines the crucial role played by information in consumers' choices. If consumers derive utility from the characteristics of the products rather than the products themselves, information – and its reliability – about the environmental dimensions of goods is likely to have a great impact on the information-processing mechanisms used to solve preferential choice problems. Section 4 presents the methodology used in our study – the discrete choice experiment. This method provides efficient tools to elicit private values for specific attributes of a product like environmental characteristics. Finally section 5 provides the main results of our study and section 6 discusses the implications of these results.

2. Sustainable consumption and green products as "impure" public goods.

Various private goods affiliated with environmental characteristics have recently emerged in markets. Examples include eco-friendly electricity, organic produce, recycled paper, dolphin safe tuna, energy-saving electronic appliances... According to the OECD, thousands of products with an environmental certification are sold in more than 20 industrialized countries (OECD, 1997). In the United States, green products represent more than 9% of the new products put on markets (Hamilton and Zilberman, 2006).

This recent development of environmentally friendly products suggests that the environmental attributes of goods increasingly influence consumption decisions. According to a recent survey, 19% of the French consumers declare to make responsible purchases regularly and 19% affirm that they are ready to pay more for greener products¹. A recent European study confirms this growing environmental awareness of consumers (Eurobaromètre, 2004) Indeed a significant part of European citizens assert that they "*reduce waste by buying larger volumes, more concentrated products, or by avoiding products with too much packaging*", "*buy ecological products for the daily needs even they are more expensive*" and "*take into account the environmental aspects when they make important expenditures like a car*". Only 5% however are ready "*to pay a little more taxes in order to contribute to the protection of environment*".

Finally, there is growing evidence that green consumption can occur. The proliferation of "green products" indicates that a number of firms believe that consumers are willing to pay a price premium for environmentally friendly products. They are encouraged by numerous surveys and the success of certain niche markets like the organic market. However an important gap has been noticed between what consumers say in hypothetical surveys and their actual consumption behaviours. Some empirical evidence about environmentally conscious consumption choices has been found so far but it remains specific to certain products, mainly food products. For example, Teisl et al. (2002) analyse the effect of dolphin-safe labels on canned tuna and show that the dolphin-safe labelling significantly affected consumer behaviours. In the same spirit, Bjørner et al. (2004) found that the Nordic Swan label had a significant effect on consumers' brand choices for toilet paper with a marginal willingness to pay for the environmental label between 13 and 18% of the price. Numerous similar studies explore consumption choices and generally find out the existence of environmental preferences, i.e. a positive valuation of the environmental

¹ According to a survey financed by Ethicity and Aegis Expert Media, and carried out by TNS media intelligenceTM in partnership with the ADEME in 2008.

attributes of products. Such empirical results provide interesting insights on consumption behaviours related to the environment but they are related to some particular products. Besides, most studies focus on food products and involve a possible confound between health and environmental motives of choice. It appears critical to obtain additional empirical results to be able to infer more general conclusions about the environmental preferences of consumers.

Beyond empirical concerns, the development of green products also raises theoretical questions about consumers' preferences for environmental attributes of private goods. Green products have the same basic functions as conventional products but they are perceived as better for the environment. They can be considered as private goods affiliated with public (environmental) characteristics. In other words, they have the specificity to provide both a private benefit to the consumer and also an environmental benefit. Following Kotchen (2005), we consider these products as "impure public goods" characterized by both private and public characteristics. For example organic coffee provides private characteristics related to the intrinsic functions of the drink (taste, stimulant) along with public characteristics related to the safeguard of the tropical forests. According to this point of view, all individuals exhibiting environmental preferences obtain welfare gains from the resulting improvements in environmental quality.

In this context, it seems that the usual view of rationality as a strictly welfare-maximizing behaviour should be replaced by a wider notion of rationality where the welfare of others and the quality of the environment matters. Individuals not only care about their own interest but also take into account the well-being of others either directly or indirectly through the consideration of the environment. Such behaviours rely on *pro-social preferences* where the utility of others can either influence one's utility directly or influence one's utility partly because of the so called "warm glow" effect (for a survey of economic theories on pro-social behaviour, see Part I. in Meier 2006). In the case of green products purchases, these pro-social preferences are expressed through preferences for the environment. But sustainable consumption not only requires the existence of environmental preferences but also the production of real environmental attributes of products. In addition individuals need credible environmental information on the available goods.

Our main objective is thus to appreciate the impact of the environmental characteristics of a given product on consumption behaviours. Traditional economic analysis rests on the assumption that individuals are able to order the various options available in order to pick the one providing the greatest satisfaction. This capacity to compare the various goods supposes that consumers can allocate a value to each product in their choice set. Understanding this choice process is central to the analysis of consumption mechanisms since the global value of a product is generally seen as the aggregation of the values of a bundle of characteristics. It is then important to understand how consumers determine the global value of a product according to the different values of its various characteristics. We are particularly interested in the valuation process of the environmental attributes of products.

3. The role of information on consumers' behaviours

In the standard economic theory, consumers maximise their utility in a world of perfect information and market competition. The theory identifies three major factors influencing consumption: prices, income, and personal tastes. In fact, tastes or preferences are treated as a "black box." They are typically taken as exogenous, given and stable by nature. Since personal preferences fall outside the realm of traditional economics, analysis is restricted to the role of income and prices in determining consumption choices. Two other main assumptions of the demand theory suppose that desires are not satiable and that consumers are selfish and driven by their own interest. In this theoretical context each consumer seeks to maximize his private well being within budget constraints. The standard model also assumes that consumers have limitless cognitive capabilities so that they can obtain perfect knowledge about the alternatives they face.

As pointed by Witt (2001), the evolution of consumption is difficult to explain with the existing utility theory which focuses on the formal properties of utility functions rather than the "objects of desires" of consumers. A more elaborate theory is needed to understand sustainable consumption. The neoclassical approach has been criticised on several grounds and a shift towards new foundations in microeconomics has taken place with authors like Lancaster (1966) or Becker (1976). This *new approach to consumer theory* regards consumers as actors of the market who create their utility in the context of the household. The fundamental assumption of this approach is that goods and services are inputs of the consumption process. Consumers derive utility from the characteristics of the products rather than the products themselves. This transformation is defined as a "consumption technology":

"... in which goods, singly or in combination, are inputs and in which the output is a collection of characteristics. Utility or preference orderings are assumed to rank collections of goods indirectly through the characteristics they possess."
(Lancaster, 1966 p.133).

The innovation introduced by this approach is the definition of the relationship between goods and characteristics as well as the decomposition of the choice process resulting from this relationship. It helps to represent consumers' behaviours regarding goods with environmental properties, particularly when these environmental dimensions are linked to the production process. Indeed as Noussair et al. (2003) underline it, *"if a pro-social dimension - even attenuated - is introduced into purchasing and the consumer judges favourably or unfavourably the production process, then this process becomes a characteristic of the good itself"*. Our questioning relates precisely on the valuation of this environmental characteristic by consumers. In other words our study seeks to understand the importance of environmental attributes in the overall valuation of a product and the determinants of this valuation process.

Furthermore the availability of countless goods with multiple characteristics makes the consumer decision process a complex task. The concept of bounded rationality with lack of information and cognitive limitations implies that consumers cannot be efficient in their choices and that neoclassical economics fails to explain certain consumption behaviours (Simon 1955). In fact, even the "consumption technology" is bounded by the problem-solving skills of the consumer. The key question lies on how choices are made rather than which choices are made.

According to Payne and Bettman (2002), one of the oldest areas of decision making research concerns how people evaluate and choose among a set of multi-attribute alternatives.

According to these authors, individuals utilize a variety of decision processes to solve preferential choice problems. The information-processing strategies used are often "heuristics" in the sense that only a subset of potentially relevant information is processed. For instance, the information processing capabilities about a product's characteristics depend on the quality of information about this product, its brand and all competing products available. It has also been shown that well-informed customers focus more on objective information about the product attributes and functions while less informed customers rely on general information about the entire product category (Bettman and Sujan 1987). In this complex informational context it can be difficult for consumers to assess the environmental quality of a product. It requires clear signals on the environmental dimensions of products. Labels may be efficient when they represent specific and measurable characteristics. Clear information and learning of the label are necessary. Moreover consumers seem to trust more easily signals from independent and reliable information sources. Even environmentally concerned consumers affirm that accurate environmental information is either not available or difficult to interpret.

Finally the analysis of consumption behaviours needs to integrate the nature of information available at the time of purchasing. This information relates either to the product itself or to the environmental impacts generated by its production process. This seems necessary to characterize the heterogeneity of consumers' reactions to information in order to better understand the reasons of success or failure of private advertising strategies as well as public campaigns of certification.

4. Revealing environmental preferences by the discrete choice methodology: an experimental application

4.1. Value elicitation methods

Considering the importance of information in consumers' choices, our study intends to observe behaviours in a controlled information environment. This objective is achieved with the tools of experimental economics. The experiments, whose design is described hereafter, are conducted in laboratory conditions where information given to participants is strictly identical. This process allows to measure the effects of varying a piece of information on consumers' behaviours. The data obtained can therefore be considered as a complement to market data which reflect behaviours in much more complex informational contexts where multiple factors are likely to drive decisions. Moreover, our main interest lies in the preferences for the environmental dimensions of products. Existing market data do not provide precise information about these preferences since green products, although rapidly expanding, are still concentrated on niche markets. Experimental economics make it possible to gain insights about how individual value the environmental characteristics of products.

Experimental auctions have been gaining importance in studies devoted to the elicitation of individual values. They are typically conducted in laboratory environments where participants are required to bid for a commodity. The price and the winner(s) depend on the auction procedure. A commonly used institution is the Vickrey auction in which participants' best interest is to bid their true value for the commodity. Much theory supports the incentive properties of this kind of procedure and explains its popularity. However several drawbacks have been pointed out (see for example Harrison et al., 2004). As far as consumption issues are concerned, a major limitation of experimental auctions lies in the nature of the task. Indeed bidding may not be

familiar to consumers who are used to make purchase decisions with posted market prices. As a result experimental auctions require heavy learning in order to make participants understand the best strategy (i.e. bidding their true value for the good). An experimental session may not be enough for consumers to learn the auction mechanism and values elicited may therefore not reflect actual values. As a result if experimental auctions provide the advantage to obtain a direct measure of willingness to pay for a commodity, the reliability and the realism of these measures can nevertheless be seriously questioned.

A different method has been increasingly applied in valuation studies: discrete choice experiments. Participants are confronted to one or several choice sets including several alternative commodities defined in terms of their attributes. For instance consumers might be asked to choose between different products described by a list of characteristics, each characteristic being varied along several levels. The choice task is therefore closer to a typical shopping decision than the bidding task described earlier. Observing the choices allows to estimate the relative importance of attributes in consumers' valuations. One main advantage is the possibility to measure the tradeoffs between various characteristics of a commodity. Moreover if one of the attribute is the market price, marginal willingness to pay for the other attributes of the good can be obtained. Most choice experiments conducted so far have been made in hypothetical settings. However a large controversy has focused on the reliability of the values elicited in hypothetical surveys. The core of the debate concerns the contingent valuation (CV) method which has been extensively used during last decades in the field of environmental valuation. The main argument of the controversy is that most stated willingness to pay are overestimated and do not reflect actual values of participants. This problem is referred to as the hypothetical bias (for a review of the hypothetical bias in elicitation methods, see Harrison 2006). This bias might occur in any elicitation procedure – including the choice experiment procedure - conducted in a hypothetical setting. A solution to overcome this bias is to use economic incentive like those provided by experimental procedures. Considering these points we designed a choice experiment coupled with real economic incentives.

4.2. Experimental design

We carry out a real choice experiment involving choices among different types of red roses. We choose to use a non food product, red roses, in order to isolate the environmental motives of purchase. Indeed most studies devoted to the environmental valuation of private goods involve food products. It has been shown however that the main driver for the choices of environmentally better food products (like organic food products for instance) was health. Since our main interest lies in the environmental preferences of consumers we choose a non-food product so that no health concern intervenes in the choices.

In each experimental session participants are confronted to different decisions involving the choice between two different red roses and a “no purchase” option. Two environmental attributes characterize the roses in each choice situation. The first one is an eco-label certifying environmentally friendly production practices. Participants are informed about the FFP (Fair Flowers Fair Plants) label. Details about the criteria of this certification and about the certification organism are given. The roses for sale during the experiment are thus either FFP certified or not certified. The second environmental attribute is a relative carbon footprint. The information provided to subjects describes the results of a scientific report comparing the carbon dioxide emissions of two types of roses according to their production and transportation

conditions. In other words the roses available are associated either with a lower carbon footprint or with a higher carbon footprint. Finally all alternative roses are given a price between 1,50€ and 4,50€. Every piece of information is read aloud by the experimenters and is strictly identical for all participants. The three attributes are described in Table 1. They do obviously not represent the whole bundle of characteristics composing a rose. Many attributes are deliberately omitted to simplify the choice task to participants and to allow the implementation of the incentive compatible device. Consequently our results exhibit salient effects regarding the influence of environmental attributes on choices. However interesting *ceteris paribus* comparisons between the characteristics can be obtained.

Attributes	Definition	Attribute levels
Eco-label (LAB)	The FFP label (Fair Flowers Fair Plants) certifies cultivation conditions limiting the use of pesticides, fertilizers, energy and water. The certification is provided by the European organism MPS.	Yes No
Amount of carbon dioxide emissions (CAR)	A recent report from the Cranfield University (United Kingdom) states that flowers produced in Holland emit up to 6 times more carbon dioxide than roses imported from Africa because of the heating of hothouses. According to their origin roses can thus be differentiated in terms of carbon emissions.	Lower Greater
Price (PR)	Price of a red rose.	1,50€ 2€ 2,50€ 3€ 3,50€ 4€ 4,50€

Table 1 - Attributes of the roses

The choice task requires individuals to choose between two roses defined in terms of an eco-label, a more or less important carbon footprint and a price. Consumers could also choose not to purchase any rose. An example of a choice set is illustrated by Table 2.

	Rose A	Rose B	
Eco-label	Yes	Yes	
Carbon footprint	Lower	Higher	
Price	3.50 €	3 €	
Circle your choice	<i>I buy Rose A</i>	<i>I buy Rose B</i>	<i>I don't buy any rose</i>

Table 2 - Example of a choice set

Participants are required to complete 12 different choices. A specificity of our experimental design lies in the use of real economic incentives consisting in a random drawing of

one of the choice sets leading to a real purchase. In other words if a participant picks the choice set displayed by Table 2 and he had circled the "I buy Rose A" option, then he has to pay 3.50€ to purchase the Rose A. Since each choice has the same probability to lead to a real purchase, participants have to consider all decisions as real.

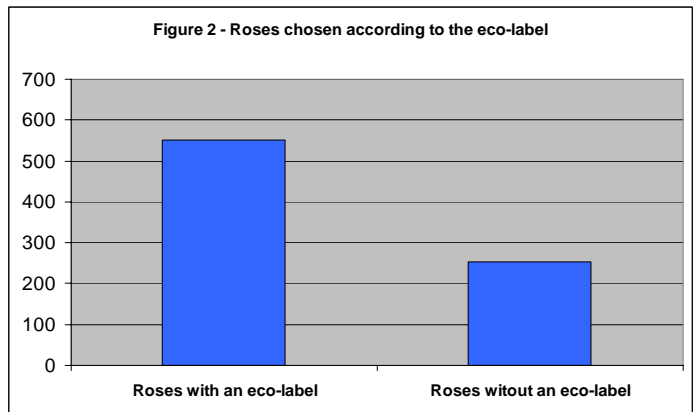
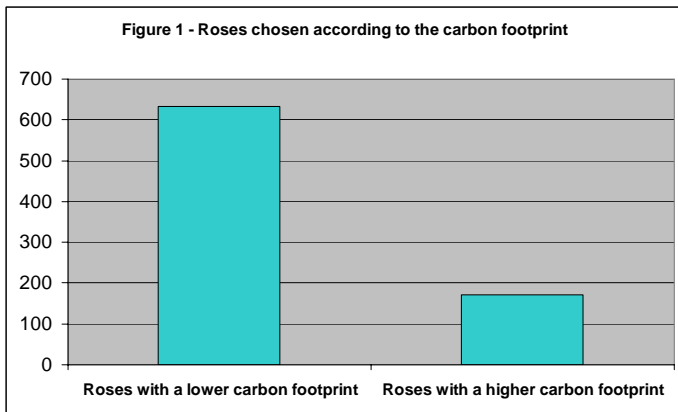
5. Results

Nine experimental sessions were conducted in Grenoble in February 2008. 102 representative consumers of red roses participated to our study. Socioeconomic characteristics of participants are given in Table 3. Each subject made 12 decisions so that we could collect $12 \times 102 = 1224$ observations. 33 observations had to be dropped because no response was provided (no option was circled on the choice card).

Variable	Mean	Standard deviation	Minimum	Maximum
Age (AGE)	39,74	18,80	18	85
Sex (SEX) 0 woman 1 man	0,49	0,50	0	1
Education (EDU) 1 No diploma 7 Master degree and more	5,75	1,36	1	7
Monthly income 1 Less than 1000€ 6 More than 5000€	2,15	1,22	1	6
Do you purchase organic products? 1 Never 4 Systematically	2,16	0,61	1	4

Table 3 - Socioeconomic characteristics of participants

Descriptive results show that consumers chose much more frequently roses with a better environmental quality. A total of 804 roses were chosen during the experimental sessions. Figure 1 shows that consumers had a tendency to choose roses associated with a lower amount of carbon emissions. 633 low carbon roses were chosen against 171 high carbon roses. As illustrated by Figure 2, consumers also tended to select more frequently certified roses than non certified roses: 552 eco-labelled roses were chosen against 252 roses without label.



The data collected during these experiments were analyzed with a discrete choice model (a nested logit model) which can explain the observed choices as a function of the attributes of the rose and of the individual characteristics of consumers. Nested logit models have been previously used to analyse discrete choice data when an opt-out option ("no purchase") is included in the choice sets (deBlaij et al, 2007). Table 4 presents the results of the nested logit regression.

Variable	Coefficient	Standard Error	p-value
Roses attributes			
Label (0 = Label; 1=No Label)	1,1618	0,1278	0,000
Carbon (0=Lower carbon; 1= higher Carbon)	- 1,5533	0,1516	0,000
Price (1,5; 2; 2,5; 3; 3,5; 4; 4,5)	- 0,5863	0,0658	0,000
Socioeconomic characteristics			
Age	0,0107	0,0042	0,011
Sex (0=female, 1=male)	0,3615	0,1272	0,009
Education	0,2859	0,0353	0,000
Activity	-0,0271	0,0305	0,376
Income	-0,1244	0,0632	0,058
Organic purchaser (0=no; 1=yes)	0,3450	0,1558	0,027
Inclusive Value Parameter (θ)	0,6337	0,0752	
Log-likelihood function value = - 927,22			
χ ² test of model significance = 224,07 (P<0,001)			

Table 4 - Nested Logit regression

We note that the eco-label attribute, the carbon attribute and the price attribute all have a significant effect on the choices. The probability of buying a rose increases if the rose is eco-labelled and if the rose is associated with a lower level of carbon emissions. Both environmental

attributes are valued positively by consumers. Besides, subjects are more likely to buy a given type of rose the lower its price. Interestingly we can note that the carbon attribute has the greatest impact on the probability of choosing a given type of rose. This result is supported by the comparison between the marginal willingness to pay of the two environmental attributes. The marginal willingness to pay for a given attribute is the ratio between the parameter estimate of this attribute and the parameter estimate of the price attribute. We found that the willingness to pay for a label is 1,98€ while the willingness to pay for a lower level of carbon emissions is 2,65€. It suggests that consumers are willing to pay more for roses exhibiting environmental attributes and are valuing the carbon emissions to a greater extent than the presence of an environmental label. These figures provide an interesting comparison between the respective weights of the two environmental attributes in consumers' choices. They also suggest that consumers are willing to pay more for an environmentally better product.

Nested logit models also include individual characteristics to explain the choice probabilities. In our study several socioeconomic characteristics were significant. Choices were influenced by the gender, the education level and the age of consumers. The fact that individuals were used to purchase organic products was also found significant to explain choices. This result highlights the fact that consumers' backgrounds drive their purchase decisions to a more or less important extent. A refinement of our results according to a typology of consumers is a suitable continuation of our analysis.

6. Discussion

Our study reveals that consumers are sensitive to the environmental characteristics of a private good in the sense that they chose more frequently environmentally better roses and were willing to pay significant premiums for both environmental attributes. Although no health concern was at stake in the purchase decisions, consumers preferred roses associated with a better environmental quality. As noted earlier our results might not reflect exactly actual shopping behaviors but make it possible to compare the valuations of two different environmental attributes. The use of an incentive compatible mechanism led to the observation of real choices rather than stated/hypothetical choices and therefore strengthens our conclusions. Indeed one of the roses chosen was eventually bought with real money so that participants had better to reveal their true preferences. Our results bring additional evidence that consumers do not act exclusively on selfish motives but are likely to behave in a pro-environmental way when adequately informed. In other words the environmental benefits linked to a green product purchase (or at least the perception of these benefits) increases individual utilities. Consumers' behaviours are nonetheless highly heterogeneous and linked to individual characteristics not clearly identified so far. Besides price also plays a significant role in the choices and should not be neglected.

Beyond the general existence of environmental preferences our study indicates that consumers might perceive (and value) differently distinct environmental attributes. Some qualitative data gathered during the experimental sessions help explain this observation. Indeed, after completing the choice task, participants answered a short questionnaire in which they stated that they were generally not aware about the environmental characteristics of red roses prior to the experiment. We can thus presume that their decisions during the experiment were mainly driven by the information provided by the experimenters. More general background knowledge (i.e. not specific to red roses) may have intervened in the choice process as well. The observation of a larger valuation of the carbon attribute than the eco-label could first be interpreted as a

greater sensitivity to global environmental issues than to local environmental issues. Indeed the FFP label is related to local agricultural practices while the carbon footprint is associated to global greenhouse gas emissions. Medias have been focusing lately on the global warming issue to a great extent so that most individuals are aware of this problem. Participants to our experiments could easily link the information related to the carbon footprint with their general knowledge about the global warming issue. They might have been less sensitive to the criteria of an unknown label, especially since none of them was directly concerned with the environmental effects of the flower industry.

Another interpretation of the differentiation between the eco-label and the carbon footprint could lie in a greater trust in public rather than private institutions. In fact participants were informed that the FFP label was certified by a private institution. On the opposite, the report comparing the carbon emissions of different types of roses was issued by a public research centre. As a result the latter information might have been more reliable to participants. Moreover previous studies have shown that consumers generally need time and education to trust a label. A single experimental session might not have been enough for them to trust the FFP label. Further research should compare the effects of private and public information.

A concern for the environment in private consumption choices is a phenomenon revealed by an increasing number of empirical studies. Our results bring one more piece of evidence with a specific experimental design. Although no personal – health related – interests were at stake, the participants of our study often chose to purchase the best environmental option. Interestingly their choices were influenced to a greater extent by the amount of carbon emissions resulting from a rose's production process than by an official environmental label. We think that information plays a critical role in this decision process. Indeed consumers need to have the right information about the environmental attributes of a product at the moment of purchase. Providing this information is the responsibility of both industrial actors and public authorities. As noted earlier consumers cannot be expected to process rationally the whole information surrounding a given product. This is especially true in the complex shopping environment where choices are made. Further research is necessary to know which kind of information will be taken and processed by consumers in order to lead them to the best choice from an environmental point of view.

7. Conclusion

Among many other definitions environmental preferences can be defined as a welfare gain resulting from the purchase of an environmentally better product. This phenomenon has been observed in many instances where consumers take into consideration the environmental attributes of a product in their choices. Our study supports the existence of pro-environmental consumption behaviors since participants chose the most environmentally friendly alternative in the majority of choice situations. Both environmental attributes – the eco-label and the carbon footprint – influenced the consumption choices. If these environmentally friendly behaviors were subject to a great heterogeneity among participants, they concerned nevertheless a great majority of them. An interesting insight is that the 'carbon' characteristic had more weight on consumers' decisions than the 'label' characteristic. The fact that the production process of a rose was emitting less carbon dioxide was perceived as more important than the certification of eco-friendly cultivation practices. This observation could be attributed to the role of the information provided during the experiment as well as to the prior knowledge of participants. In any case it

confirms the critical role of information, either direct or indirect, given to consumers by firms but also by public authorities. In the extremely complex information context surrounding the products nowadays, it is necessary to gain more understanding about the kind of environmental information processed by consumers. The multiplication of empirical studies shows that a significant part of consumers are willing to make environmentally wiser decisions as long as they can afford it. Helping consumers to move towards sustainable consumption patterns requires both the production of greener products and a clear signalling of the environmental quality of products. It recalls important questions for firms (on the greening of their production processes for instance) and public authorities (on environmental certification programs and education campaigns for example). Again, sustainable development can only be achieved through a conjoint change of production and consumption paths.

References

- Bettman, J. R. and M. Sujan (1987), "Effects of framing on evaluation of comparable and no comparable alternatives by expert and novice consumers", *Journal of Consumer Research*, 14 (2), pp. 141-154.
- Bjorner, T.B. L. G. Hansen and C. S. Russell (2004), "Environmental labeling and consumers' choice—an empirical analysis of the effect of the Nordic Swan", *Journal of Environmental Economics and Management*, 47, pp. 411-434.
- de Blaeij, A., P. A. L. D. Nunes, et al. (2007). "'No-choice' options within a nested logit model: one model is insufficient." *Applied Economics* 39: 1245-1252.
- Eurobaromètre (2004), Attitudes des citoyens européens vis-à-vis de l'environnement, Commission Européenne, *Eurobaromètre Spécial 217*.
- Hamilton Z.F. et Zilberman D. (2006) "Green markets, eco-certification, and equilibrium fraud", *Journal of Environmental Economics and Management*, 52, pp. 627-644.
- Harrison, G. W., R. M. Harstad, et al. (2004). "Experimental methods and elicitation of values." *Experimental Economics* 7: 123-140.
- Harrison, G.W. (2006). "Experimental Evidence on Alternative Environmental Valuation Methods" *Environmental and Resource Economics*, 34(1).
- Kotchen M.J. (2005), "Impure public goods and the comparative statics of environmentally friendly consumption", *Journal of Environmental Economics and Management*, 49, pp. 281-300.
- Lancaster K (1966), "A New Approach to Consumer Theory", *Journal of Political Economy*, 74, pp. 132-157.
- Noussair C., Robin S. et Ruffieux B. (2003), "Organismes génétiquement modifiés dans l'alimentation humaine : l'opinion publique contre les comportements des consommateurs", *Revue Economique*, vol. 54.
- OCDE (1997), *Eco-labelling: Actual Effects of Selected Programs*, GD 97
- Payne, J. W. and Bettman J. R. (2002), "Preferential choice and adaptive strategy use", in Gigerenzer G. and Selten R. (eds), *Bounded Rationality : the adaptive toolbox*, MIT Press.

Simon, H. A. (1955), "A behavioral model of rational choice", *Quarterly Journal of Economics*, 69, pp. 99-118.

M. F. Teisl, B. Roe and R. L. Hicks (2002), "Can Eco-Labels Tune a Market? Evidence from Dolphin-Safe Labelling", *Journal of Environmental Economics and Management*, 43, pp. 339-359.

Witt U. (2001), "Learning to consume – A theory of wants and the growth of demand", *Journal of Evolutionary Economics*, 11, pp. 23-36.