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How can environmental information align consumer behaviour with attitude? Evidence from a field experiment.

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Abstract

Using an incentive compatible field experiment, we investigate whether consumer attitudes translate into more corresponding environmentally friendly behaviour when one of the substantial barriers towards environmental food sustainability, i.e. low effectiveness of information provision, is removed. We develop multi-criteria environmental information cards and test their effectiveness in delivering and communicating information through an on-line choice experiment. The environmental information card that was found to be most effective in communicating information is then used in an experimental market and appears to have the potential to effectively steer consumers towards more environmentally friendly food purchases. When consumers shop in the experimental market with the most effective environmental information card installed, switching behaviour towards more environmentally friendly food products is observed. In addition, effective environmental information cards have the ability to increase the overall environmental friendliness of consumers' food baskets. These findings highlight the potential for policy makers to enlarge the environmentally friendly consumer segment through the provision of easy-to-interpret and standardized environmental information.

Key words: Food Experimental Economics, Field Experiment, Environmental Information Provision, Consumer Behaviour

JEL classification: C93, D12, Q18, Q56, Q57

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How can environmental information align consumer behaviour with attitude?

Evidence from a field experiment.

Vlaeminck Pieter, Jiang Ting, Vranken Liesbet

1. INTRODUCTION

Food consumption is one of the most important areas to improve environmental sustainability since it is responsible for one third of a household's total environmental impact (European Environment Agency, 2005). Hence, changing households' consumer behaviour may generate important environmental benefits. Although many studies indicate that most consumers claim to be willing to pay for environmentally superior food products, the share of environmentally friendly produced food in total consumption has remained low (Padel and Foster, 2005; Rousseau and Vranken, 2013). This gap between consumers' attitude and their actual buying behaviour has been referred to as the attitude/behaviour gap (Vermeir and Verbeke, 2006).

This gap exists because several barriers impede that environmentally friendly attitudes are translated into environmentally friendly purchasing behaviour. A substantial barrier towards environmentally friendly behaviour relates to the low effectiveness of environmental information provision in actual food markets. At present, a number of shortcomings restrain informed choice. First, the multitude of environmental food labels and their high degree of diversity make them less effective in the food market than theoretically predicted due to information overload and the potential adverse effects resulting from consumer indifference or misunderstanding (Verbeke, 2008). Second, people associate sustainable behaviours with various costs such as money, time, effort and inconvenience (Follows, 2000). The lack of transparent and factual information consequently turns consumers' buying decisions into a costly search (Teisl and Roe, 1998). Finally, the existing labelling schemes do not necessarily provide an indication of the overall environmental impact because they emphasize only one single environmental aspect (Ridoutt et al., 2011). As a result, consumers are not incentivized to consume a larger share of environmentally friendly products, and those who do want to consume more environmentally friendly need to rely on simple rule of thumbs.

Recently, the introduction of a multi-criteria environmental information scheme based on the life-cycle approach has been proposed as a possible solution to mitigate the lack of information, the credence heterogeneity and the costly search in consumer food markets (Etilé and Teyssier, 2011).

It is a challenge to understand how this information should be provided since consumers claim that labels should be understandable and more easily accessible to facilitate consumer understanding (Kehagia et al., 2007). Including too much information on the label can be confusing, whereas too little information can be misleading. We conjecture that standardized multi-criteria environmental information can identify the relevant environmental information, and consequently affect purchasing decisions through the minimization of several behavioural costs. Standardizing the information format across competing products may increase the number of products and product attributes considered when making a purchasing choice, and may provide more precision in trade-offs made by the consumer (Kleinmuntz, 1993). Standardization can also reduce the cognitive costs of extracting information, i.e. the information processing (Picot Coupey, 2006). In addition, the consumers' information search is more extensive if the costs of information search are low, i.e. when information is easily accessible (Zander and Hamm, 2012).

To our best knowledge, there is no scientific evidence yet that the introduction of a standardized multi-criteria labelling scheme will indeed change actual purchasing behaviour. Therefore, this paper explores whether the introduction of a more complete, easy-interpretable and standardized environmental information card (EIC) actively decreases the barriers towards environmentally friendly consumption. The plethora of studies examining consumers' attitude towards and willingness-to-pay for environmentally superior products rely on stated preference methods and lab experiments (Lusk et al., 2011). While these methods have many advantages, they also have some drawbacks. Stated preference studies are relatively easy to conduct but they only measure attitude, not behaviour. By asking more or less hypothetical questions, consumers are more likely to overstate their attitude (Cummings et al., 1995). Particularly for ethical issues, such as environmentally friendly products, there is a risk that respondents place themselves in a better light than they actual deserve, i.e. social desirability is present (Norwood and Lusk, 2011). Concerning lab experiments, several external validity issues have been raised and discussed in the literature, namely (1) the unfamiliar environment, (2) the nature of the decision task, (3) the participants not being representative, (4) the available information and attention given to information, (5) the presence of researchers that scrutinize participants' behaviour, and (6) high bids that do not necessarily imply repeated purchases (Alfnes and Rickertsen, 2011; Levitt and List, 2007). These issues illustrate the likelihood that participants' lab behaviour does not always translate into the actions in a real purchase setting, which inflates the attitude/behaviour gap.

Therefore, we use a controlled field experiment to analyse the role of environmental information in steering actual purchasing behaviour. In particular, we introduce an incentive compatible experimental food market in a natural consumer environment, namely the supermarket. A controlled field experiment combines the merit of the controllability of a lab with the heightened external validity of a field experiment (Harrison and List, 2004). Through the creation of an environment where participants make their food choices as undeliberately as possible, we try to overcome the hypothetical lab setting that may accentuate changes in peoples' behaviour (Benz and Meier, 2008). However, since our food market is still experimental, we preserve the power to control for possible noise. In addition, real products and actual cash are transacted, which makes the experimental market both non-hypothetical and incentive compatible, aligning attitudes closer with corresponding behaviour (Lusk and Shogren, 2007). Last, by offering different products to be transacted, the experimental market embodies an ideal setting to study substitution among different products since it enables the increase in the number of possible choices among several food products (Marette et al, 2008).

2. METHOD

Using a field experiment to study how environmental information affects actual consumer behaviour requires different research steps. First, one needs to decide which products to offer in the experimental food market. Next, the environmental impact of each selected product needs to be determined. Third, one needs to decide how this environmental information will be presented in the experimental market. Finally, the experimental procedure needs to be developed to ensure that we can estimate the pure effect of environmental information, particularly of a standardized multi-labelling scheme, on consumer behaviour. All four steps will be discussed in the remaining of this section.

2.1. Product choice

Three product stands make up the experimental food market so that substitution among products can be investigated: a vegetable stand, a fruit stand and a protein stand (see photo in appendix). These three categories were chosen since they represent a major share of consumers' daily purchases. To increase the reality of the experimental market, we use an open supermarket refrigerator for meat and meat substitute products, and the typical inclined supermarket stands for the presentation of fruit and vegetables. We place fruit and vegetables loosely (in units) without the original packaging in straw baskets for three reasons. First, people need to be able to freely pick the number of fruits and vegetables they desire. Second, we want to see whether quantities of products purchased change with the type of environmental information provided. Third, the original product packaging differs with respect to layout, information, etc. making it difficult to control for. For the protein stand, products are kept in their original packaging for food security reasons.

Tomatoes were chosen as the representative product for the vegetable stand. Tomatoes are well suited for this experiment since they are the most popular vegetable in Belgium with an average consumption of 10 kg per inhabitant (VILT, 2011). We offer participants three tomato variants based on their origin and production process: a conventional-local, an organic-local and a conventional-foreign[4]. In particular, we include a Belgian conventionally and organically produced tomato on the vine, and a Spanish conventionally produced tomato. These variants are offered since consumers are concerned with different product attributes such as price, taste, locality, organic production, etc. (McCluskey and Loureiro, 2003). The three tomato variants show strong product similarity with respect to their visual appearance.

For the fruit stand, apples were chosen as the representative product in our experimental market. Apples are the most popular fruit in Belgium with an average consumption of 16.2 kg per Belgian (VILT, 2011). We offer participants three apple variants based on their origin and production process: a conventional-local, an organic-local and a conventional-foreign. In particular, we include a Belgian conventionally and organically produced apple and a New Zealand conventionally produced apple. The two Belgian apples are from the Jonagold type while the New Zealand one is of the Gala variety. Therefore, product similarity is somewhat lower for apples than for tomatoes[5].

For the protein stand, two animal and one plant-based food products were chosen. We offer participants the choice of buying a beefsteak, a chicken breast or a vegetarian alternative, i.e. a veggie burger. In Belgium, beef consumption decreased over the period 2004-2009 from 20 kg to 18 kg per person. Chicken meat consumption, however, increased by 25% to 20.45 kg (VILT, 2011). Although the market share for meat alternatives shows a growing trend, they represent only 1% of the total protein market. These products are primarily chosen because they embody a direct trade-off linked to the environment as well as to other important attributes related to quality, taste, freshness and healthiness (Verbeke and Viaene, 1999). Accordingly, product similarity for the protein stand is small compared with the vegetable and fruit stand.

The total number of products in the experimental market amounts to nine. We keep the prices for the different products exactly the same as in the supermarket. We want to ensure that participants are faced with the same trade-off between price and other attributes in our experimental market as in their daily shopping atmosphere. The only element we alter is the information provided about the products' environmental impact. Products and prices are shown in Table 1.

[4] We wished to include the fourth possible variant namely organic-foreign to have a clean 2x2 factorial design. Product non-availability however prevented us from doing so.
[5] Nevertheless, by using a control group we can account for a possible initial preference difference (see further).

2.2. LCA analysis and creation of EICs

Recently, the introduction of a multi-criteria EIC based on the life-cycle approach[6] has been proposed by the European Food SCP Round Table (2012) as a solution to promote more environmentally friendly food choices. In order to create conceptual versions of the EICs, we start by making an assessment of the environmental impact of the different food products based on a review of the life-cycle analysis (LCA) literature. Although stand-alone environmental indicators such as the carbon and water footprint are becoming increasingly popular, they do not necessarily provide an indication of the overall environmental impact since trade-offs between CO2-emissions, water use and land use are common for agri-food products. Consequently, we collect environmental impact data on Global Warming Potential, Primary Energy Use, Water Use, Land Use, Pesticide Use, Acidification and Eutrophication Potential for our nine food products.

Using the LCA data, we assess the environmental impact of the products presented in the experimental food market and combine the available environmental information to create six different EICs (Figure 1). The EICs mainly vary in two ways. First, we alter the type of information provided and the degree to which the LCA data are aggregated and translated into environmental impacts. Second, we change the way the information is presented..

2.3. Selection of EICs to be used for different information treatments

For the information treatments in the experiment we select two EICs out of the six created. In the experimental food market we want to introduce one EIC that is very effective in communicating environmental information to the consumer. On the other hand, we need an EIC that is ineffective in communicating environmental information since previous studies have shown that receiving information, whatever its content, may already affect the purchasing decision (Bougherara and Combris, 2009). Hence, we want to control for a mere information effect by introducing an EIC that is ineffective in communicating environmental information, and we want to test whether this EIC has an effect on purchasing behaviour.

We pre-test the six EICs on their effectiveness in communicating and delivering the environmental information in an on-line survey using a choice experiment and ranking exercise. In the hypothetical choice experiment, especially the clarity and communication potential of the cards are of interest. We present respondents with six choices between two apples. They need to indicate which apple they prefer based on the information provided. The sole information that we provide are the six EICs and we ask participants to assume that price, origin and other characteristics are the

[6] Life-cycle analysis is a technique to assess environmental impacts associated with all stages of a product's life.

same for the two apples. Besides, the environmental impact of the two apples is kept constant but is communicated in different ways so that we get the pure effect of the cards' clarity itself on product choice. Last, we explicitly inform participants that we want to know which card they think is the clearest in case the environmental information were to be made available in the supermarket. After finishing their choices, we ask respondents to rank the six EICs from most clear to least clear. This allows us to identify the least and most effective EIC in communicating environmental information.

2.4. Experimental procedure and design of food market

The experimental food market is set up in a room adjacent to the main entrance hall of a Belgian retail store. Participants complete the questionnaires before and after participating in the experiment at a table in front of the room. The experiment proceeds as follows (Figure 2):

In step 1, all customers are recruited in the main entrance hall of the supermarket with the same message[7]: "Hello. We are from the KU Leuven and we are doing innovative research. We are interested in how we can better aid consumers in their shopping experience and how much information therefore needs to be present in the supermarket atmosphere. Therefore we ask whether you would like to participate in this research. In total it takes ten minutes and you will receive a 10 euro reward for your participation at the end of the study."

In step 2, participants fill in a pre-questionnaire. The questions relate to the participant's socio-demographics and a short version of the Marlowe-Crowne Social Desirability Scale (Marlowe and Crowne, 1960). We made sure the questions did not prime participants about sustainability issues.

In step 3, the participant is taken into the experimental food market in which the environmental information is varied. The researcher explains the rules of the experimental food market to the participant: (1) buy at least one product from every stand namely fruit, vegetables and protein (2) use the 10 euro reward as credit (3) take home the products you choose (4) consider the trade-off between leaving the study with more products or with more cash. The researcher makes sure the participant understands the objective and leaves the room so as to minimize the pressure a researcher might exert in pushing participants towards environmentally friendly products. There is only one participant at a time shopping in the experimental food market.

In step 4, the participant fills in a post-questionnaire that elicits individuals' food consumption habits, environmental knowledge and preferences for environmentally friendly food products. In step 5, the participant receives his purchases and the remaining budget in cash.

[7] The message is never changed throughout the experiment, which keeps selection consistent.

We only recruit people that enter the supermarket and hence have the intention to do grocery shopping. In this way, we limit the chance that the purchases in our market become redundant. The environmental information is switched after each participant so as to prevent a time of the day effect. We randomize the position of the food products in order to prevent a position effect. Last, we ensured that participants are exposed to equal amounts of products so as to prevent a product popularity effect.

3. DATA AND RESULTS

3.1. LCA analysis and creation of EICs

A summary of the LCA data for the nine food products can be found in Table A1 in the appendix[8]. Using the LCA data, we assess the environmental impact of the products presented in the experimental food market. Subsequently we combine different types of environmental information to create six EICs.

First 'raw' environmental information is presented (see card 2 in Figure 1). In particular, information on five product attributes is given: distance (km) and mode of transport, production (open air, greenhouse, intensive…), water use (litres per kg), land use (m2/kg) and pesticides (active substance/kg). We call the environmental information 'raw' because the attributes are neither translated into their resulting environmental impacts nor are they compared with the other products. The 'raw' information does not explicitly mention anything about the environmental friendliness of the product. The information is presented in words and numbers with no visualization at all.

Second, visual information about the environmental impact is presented (see card 3 in Figure 1). Again five product attributes are taken into account: carbon emissions, energy use, water use, land use and soil[9]. The product attributes are translated into their resulting environmental impacts and as such the environmental impact of each product can be compared with the impact of the other products. Every attribute is rated on a 10-point coloured scale where red indicates the product is not environmentally friendly for the attribute and green indicates it is environmentally friendly. The impact scale for a food product is thus a relative score compared with the scores of the other food products within one environmental impact category. The scale is inspired by the EU energy label (Directive 2010/30/EU); however the 7 coloured bars from the EU label are merged into a sole 10-

[8] For a detailed overview of the LCA data sources, please contact the corresponding author.
[9] We aggregate pesticide use, acidification and eutrophication into one impact term soil since acidification and eutrophication would probably not have a useful meaning to the average consumer.

point scale for each attribute to ensure the card's clarity. The 'impact' information thus explicitly entails environmental friendliness at attribute-level and the information is visualized.

Third, one environmental score is calculated for each product (see card 1 in Figure 1). In particular, an environmental friendliness score on ten is provided for the product in question. The score summarizes the five impact categories and enables swift comparison of the environmental friendliness of the nine products.

At present, there is no readily available methodology to relate and compare the LCA data of the different products, and to calculate the environmental 'score' of a product (cf. European Food SCP Round Table). Since the development of a harmonised methodology for the environmental assessment of food products is complex and outside the scope of this paper[10], we need to make a judgement about the weights to be used. In order to construct the 10-point rating scales and environmental friendliness scores, we base ourselves on a weight set, given in a paper by Gloria et al. (2007), specifically intended to assist environmentally preferable purchasing in the United States based on LCA results. The weight set is developed by a panel of 19 LCA experts, producers and users. As such it is clearly recognized that weighting of LCA is a value-based process that represents the scientific interpretation as well as ideological, political, and ethical principles. Although the weights are originally meant for the building and construction industry, panel lists agreed to modify the goal of the weights to "environmentally preferable U.S. purchasing" (Gloria et al., 2007)[11]. The panel weights 13 impact categories. We only use seven weights since they embody the major impact categories for agri-food products. Accordingly we rescale the seven weights back to 100%, taking pesticides, acidification and eutrophication together. Carbon emissions take the largest weight (42.1%), followed by soil (24%), energy use (13.9%), water use (11.2%) and finally land use (8.8%)[12]. In order to calculate the final environmental friendliness score, we use the transformed weights per impact category to construct a score on ten for every food product. An overview of the calculated input scores for each food product can be found in Table A3 of the appendix. Finally, we compile six EICs by combining different types of information[13].

3.2. Selection of EICs and the information treatments

An online survey to determine the most and least effective EIC was conducted in August 2012, and a total of 230 respondents completed the hypothetical choices and ranking exercise. We analyse the choices with the conditional logit model and compare them to the ranking results. The results are

[10] The creation of a harmonized methodology is the main goal of the European Food SCP Round Table.

[11] We recognize the possible concern on the suitability of the weights for agri-food products; however it is considered as a straightforward and pragmatic solution towards the creation of the EICs.

[12] A detailed weight conversion table can be found in the appendix, Table A2.

[13] An overview of all six EICs can be found in Figure 1, the sixth EIC is composed of card 1+2+3.

shown in Table 2. The two conditional logit estimations indicate that respondents prefer the EIC that combines information on environmental impact at attribute level with the overall environmental score at product level the most, and the EIC that only depicts raw information the least. The first conditional logit estimation takes the EIC with only 'raw' information as reference category. The EIC with information on environmental impact at attribute level as well as an overall environmental score at product level dominates the other cards since all the null-hypotheses of equal coefficients between this card and the other EICs are significantly rejected at the 1% level using a Wald test. In the second conditional logit estimation, when the EIC with information on environmental impact at attribute level as well as overall environmental score at product level is taken as reference category, the five other EICs are significantly less chosen as indicated by their negative and significant coefficients. These findings are confirmed by the relative ranking respondents attached to the cards. The results allow us to select the least and most effective card -- in their ability to communicate the environmental information -- for the information treatments used in the experimental market.

The experimental food market consists of three treatments. In *Treatment Control*, we do not provide extra information in our food market except for the information already available in the supermarket. *Treatment Control* thus serves as the base comparison group for the purchases participants make in the market. In *Treatment Least*, we install the EIC that only depicts 'raw' information, i.e. the EIC for which the results of the choice experiment indicate it has the least ability to communicate and deliver the environmental information clearly to consumers (see card 2 in Figure 1). *Treatment Least* is used to control for an information effect per se and to see whether the introduction of an EIC, although being the least effective in delivering the information, already has an effect on purchasing behaviour. In *Treatment Most*, we install the EIC that combines information on environmental impact at attribute level with the overall environmental score at product level, i.e. the EIC for which the results of the choice experiment indicate it has the best ability to communicate and deliver the environmental information clearly to consumers (see card 5 in Figure 1). We test whether the EIC which respondents found most effective in delivering the information also has the potential to influence actual consumer behaviour towards more environmentally friendly purchases in the experimental food market.

3.3. Experiment

4.3.1. Descriptive statistics

We conducted the experiment in a local supermarket in January 2013. A pilot study was run 6 months earlier to fine-tune the details of the experiment. The target of 150 participants (50 per information treatment) was reached during the ninth day of the experiment. 150 participants were randomly allocated over the three information treatments in the experimental food market. Except for the information treatment, the experiment remained exactly the same for all three groups.

Table 3 presents the socio-demographics and food consumption habits of the 150 participants within each treatment. We test for differences between treatment groups because the internal validity of a randomized design is maximized when one knows that the samples in each treatment are identical (Harrison and List, 2004)[14]. The treatment groups' socio-demographics, food consumption habits and health concerns do not differ between treatments. We also test for differences in levels of happiness, trust, political preference and environmental knowledge and find no significant differences between treatment groups[15]. The homogeneity between treatment groups thus allows us to identify the average treatment effect of the environmental information without bias.

4.3.2. Market shares and product choice per information treatment

We analyse the percentage of participants that buy a specific product (market shares) and investigate how these percentages change with the information treatment. The percentage change of *Treatment Most* over the *Control Treatment* indicates the effect of *Treatment Most* on consumers' purchases (Table 4). In addition, we evaluate product choice via multinomial logistic regression to understand how the likelihood of choosing a specific type of product within a food stand (product category) varies with the information treatment (Table 5). As a rule, we choose the most environmentally friendly product variety as base outcome when analysing product choice.

For vegetables, the *Control Treatment* shows a strong preference for local tomatoes compared with the Spanish variant with a market share of 82% versus 18% (Table 4). In *Treatment Least*, the share of the Spanish tomatoes drops further in favour of the organic local variant. *Treatment Most* creates a switch in the type of tomato chosen. The market share of Spanish tomatoes increases by 178% resulting in a total market share for the Spanish variant of 50%. In Table 5, the most effective EIC in *Treatment Most* pushes consumers' choices of tomatoes towards the most environmentally friendly option since both coefficients of the Belgian conventional and organic tomato in *Treatment Most* are negative and statistically significant ($p<0.01$). Participants choose Belgian conventional and organic tomatoes less often than more environmentally friendly Spanish conventional tomatoes in *Treatment Most* compared with *Treatment Control*. The insignificant coefficients in *Treatment Least* indicate that *Treatment Least* does not affect the choice between the Belgian conventional and

[14] We use the Pearson Chi-square test and consider a p-value of less than 0.1 to be significant.
[15] For a detailed overview of the participants' data and tests, please contact the corresponding author.

organic tomato relative to the Spanish conventional tomato, and hence that there is no mere effect of introducing an EIC whatever its content.

For fruit, the *Control Treatment* shows a strong preference for local apples compared with the New Zealand variant with a market share of 78% versus 22%. In *Treatment Least*, the market share of New Zealand apples remains unchanged and there is a small switch from the conventional local apple to the organic local apple. In *Treatment Most* the market share of New Zealand apples diminishes from 22% to 10%, in favour of the local conventional apple. Besides, consumers' probability to choose a Belgian conventional apple does not differ from the probability to choose a Belgian organic apple, regardless of the information treatment (Table 5). However, there is an indication that *Treatment Most* decreases the likelihood that consumers choose the least environmentally friendly option as compared with the most environmentally friendly option since the coefficient of the New Zealand conventional apple in *Treatment Most* compared with the Belgian organic apple is negative and statistically significant, although only weakly ($p<0.1$).

For protein, the *Control Treatment* shows a strong preference for steak and chicken, the animal based products, compared with the vegetarian alternative with a market share of 86% versus 14%. In *Treatment Least*, the market share of the vegetarian alternative increases relatively to the animal based products' market shares showing a switch from chicken to the vegetarian alternative. The introduction of the most effective EIC in *Treatment Most* further increases the veggie burgers' market share to 32% at the expense of both chicken and steak. Finally, *Treatment Most* decreases the likelihood of choosing steak and chicken compared with the veggie burger, as indicated by the negative significant coefficients of both the animal based products ($p<0.1$; $p<0.05$) (Table 5). Participants choose steak and chicken less often than veggie burgers in *Treatment Most* compared to *Treatment Control*. In *Treatment Least*, consumers' choices for steak compared with the veggie burger do not differ but consumers choose less chicken compared with a veggie burger ($p<0.05$).

4.3.3 Environmental friendliness of consumer baskets per treatment

Finally, we explore whether the information treatments affect the average environmental friendliness of consumers' total purchases in the experimental market. Optimally, the most efficient EIC (*Treatment Most*) stimulates consumers to buy a larger caloric share of environmentally superior food products compared to the amount of environmentally friendly calories in consumers' food baskets participating in the *Control Treatment* and *Treatment Least*. Therefore we analyse whether the calories bought by consumers stem from more or less environmentally friendly products and we investigate how the environmental friendliness of consumers' food baskets changes over information treatments. We define the environmental friendliness (EF) of an individual consumer basket as follows:

$$EF_{consumerbasket} = \frac{1}{\sum_{i=1}^{9} weight_i * Calorie_i} * \sum_{i=1}^{9} [Score_i * weight_i * Calorie_i]$$

where *i* stands for the nine products in the food market, *score* for the environmental impact score at product level, *calorie* for the amount of calories per kg product and *weight* for the amount of product (in kg) bought in the food market. The environmental friendliness of an individual consumer basket is thus represented by the sum of the LCA scores (Score $_i$) of the products in his/her basket weighted for their caloric share to total basket calories.

In Figure 3 we assess the distribution of the environmental friendliness of consumer baskets in the experimental market per information treatment[16]. Figure 3 shows that the distribution of the environmental friendliness of consumer baskets in *Treatment Most* is more left-skewed compared to the distributions of the *Control Treatment* and *Treatment Least. Treatment Most* thus stimulates consumers to buy a larger share of environmentally friendly food products. Besides, with the current level of environmental information in the market place, the distribution of consumers' environmental friendliness peaks around six (*Control Treatment*). Through the introduction of a more complete, easily-interpretable and standardized EIC however, the environmental friendliness of consumers' purchases shifts to seven (*Treatment Most*). Finally, the average environmental friendliness of consumer baskets per information treatment was compared using a two-tailed Mann-Whitney-Wilcoxon test. This test confirms that the EIC which respondents of the on-line choice experiment found most effective in delivering the information results indeed in a significant improvement of the environmental friendliness of the purchases. In particular, we find a significant difference between *Treatment Least* and *Treatment Most* (z=-2.054, p=0.039) and between *Treatment Control* and *Treatment Most* (z= - 2.461 and p= 0.014), but no significant difference between the *Control Treatment* and *Treatment Least* (z=-0.496, p=0.619). These combined findings thus validate the experimental causation and reaffirm the importance of more complete, easily-interpretable and standardized information provisioning in consumer markets.

4. DISCUSSION

We summarize the effect of *Treatment Least* and *Most*, with the least and most effective EIC installed, on product choice in Table 6. Treatment effects are compared with the *Control Treatment* where we do not provide any extra information in the experimental market apart from the information available in the supermarket.

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[16] We employ Epanechnikov kernel functions with bandwidth = 0.35 according to Silverman's rule of thumb.

In *Treatment Least*, we installed the EIC with only ‘raw’ information, i.e. the EIC for which the results of the on-line choice experiment indicated that it had the least ability to communicate and deliver the environmental information clearly to consumers. Looking at *Treatment Least* for vegetables and fruits, we indeed find no effect of the least effective EIC on the products chosen compared to *Treatment Control*. For protein, however, the least effective EIC already has an effect on the choice for chicken and veggie burgers. This effect stems probably from the degree to which the information on the least effective EIC is interpretable. For vegetables and fruit, the ‘raw’ information on the least effective EIC is not intuitive since absolute differences in the attributes are small and almost impossible to balance. For protein, however, the ‘raw’ information on the least effective EIC is slightly more intuitive (at least in magnitude) and therefore easier to interpret since absolute differences in the attributes are more pronounced. For example, while the water use for the Belgian organic apple and the New Zealand conventional apple is 146 and 220 litres/kg respectively, for steak and veggie burger the water use is 11000 and 1106 litres/kg respectively.

In *Treatment Most*, we installed the EIC that combines information on environmental impact at attribute level with the overall environmental score at product level, i.e. the EIC for which the results of the choice experiment indicated it had the most ability to communicate and deliver the environmental information clearly to consumers. Comparing the two treatment effects, we see that the most effective EIC in *Treatment Most* has a more pronounced influence on product choice compared with the least effective EIC in *Treatment Least*. This shows that the most effective EIC induces more informed food choices through the provision of more complete information in an easily processed form (Levy et al., 1996). Besides, in the post-questionnaire, only participants that did their purchases with the most effective EIC installed in our experimental market reported that they would effectively use the environmental information if it were to be installed in supermarkets. These findings imply that there is a clear lack of accurate and standardized information provision about the environmental impact of food products towards consumers within the agro-food market (Rousseau and Vranken, 2013).

Looking at *Treatment Most*, we find an overall effect of the most effective EIC on consumer purchasing behaviour in favour of the more environmentally friendly options over the three food market stands. However, the specific characteristics of each product stand determine how switching behaviour demonstrates itself.

For fresh produce, people in general buy local and/or organic because these are the heuristics they have learned, among other things, to use as indicators for the environmental friendliness of the food product.[17]. In our survey, 91% of the people indicate local produce as not or little detrimental for the environment, and 90% of the participants report organic produce as not or little detrimental for the environment. The high initial market shares for local and/or organic fruits (78%) and vegetables (82%) in *Treatment Control* confirm that people use the local-organic heuristic or are at least more attracted to products possessing these attributes in our experimental market. Thus, without introducing the most effective EIC, both groups behave in a very similar way. What happens when the most effective EIC is introduced?

With the most effective EIC installed in the vegetable group, people have the choice between two environmentally inferior (6.5/10) options, the local conventional and local organic, and one environmentally superior option (7/10), i.e. the conventional foreign. The most effective EIC consequently enters the vegetable market with the environmental scores being lowest for the products which participants bought most frequently in *Treatment Control* and *Treatment Least*. In addition, the environmental scores of the most effective EIC contradict the local-organic heuristic suggestions. Nevertheless, we observe that *Treatment Most* has the power to push consumer choices away from the inferior local options towards the environmental superior foreign option overruling consumers' prior beliefs.

With the most effective EIC installed in the fruit group, people have the choice between one environmentally inferior (7.5/10) option, being the conventional foreign, and two environmentally superior options (8.5 & 9/10), i.e. the local conventional and local organic apple. The most effective EIC thus enters the fruit market with the environmental score being highest for the products participants already bought most frequently in *Treatment Control* and *Treatment Least*. To find a significant behavioural switch is therefore more difficult since the margin is already narrow. Nevertheless, we see that *Treatment Most* drives consumer choices away from the inferior environmental option towards the most superior environmental option.

With the most effective EIC installed in the protein stand, participants can choose between an evidently inferior environmental option, i.e. steak (1.5/10); a less inferior option, i.e. chicken (3.5/10); and a superior alternative, i.e. the veggie burger (5/10). Consumers choose less steak and chicken in favour of veggie burgers when the most effective EIC is installed. The combined finding of choosing less steak and less chicken may indicate a trickle-down effect of steak buyers substituting steak for chicken and chicken buyers substituting chicken for veggie burgers. The overall result indicates a switch in buying behaviour of chicken meat to vegetarian alternatives

[17] Buying local and/or organic also originates from other aspects such as quality, healthiness and support of the local economy. We just want to point out that organic and local are the major heuristics (beside seasonality) people use for fresh produce when they want to buy more environmentally friendly.

although product similarity in this stand is low and other important attributes related to quality, taste, freshness and healthiness could well have dominated.

Finally, we recognize the high initial market shares for organic produce (±30%) in the experimental food market compared with the actual market shares for organic produce (±5%) (Samborski and Van Bellegem, 2013). The switch from purchasing in an actual market towards purchasing produce in the experimental food market seems to introduce an upward bias in organic market shares. This is consistent with other studies (e.g. Fox et al., 1998; List and Shogren, 1998; Marette, 2008) showing that field valuations can be greater than laboratory valuations. The upward bias can be a result from a house money effect where the provision of an initial endowment can cause experimental subjects to make unusual choices (Clark, 2002). In addition, the high organic share may indicate that people buy more socially desirable in the experimental market even if nothing has been said about environmental friendliness (Johansson-Stenman and Svedsäter, 2012). As such, the experimental food market might not be an accurate predictor of actual market shares and, as a consequence, neither of the magnitude of the changes in market shares. However, there is no specific reason to believe that the direction of switching behaviour observed in the experimental food market would differ from the switching direction that would be observed in an actual market. In other words, although the reference point, i.e. the control treatment's initial share may be biased upwards; the switch in purchasing behaviour is consistent (Ariely et al., 2003). Therefore switching behaviour in the experimental food market can be a good indicator for switching behaviour in an actual market.

5. CONCLUSION

This paper explores whether the introduction of a more complete, easily-interpretable and standardized environmental information card (EIC) actively decreases the barriers towards environmentally friendly consumption. Using an incentive compatible experimental market in a Belgian supermarket with real products, we show that consumer attitudes translate into more corresponding environmentally friendly behaviour when one of the substantial barriers towards environmental food sustainability, i.e. low effectiveness of information provision, is removed. We find that the environmental information card (EIC) which 230 respondents from a hypothetical choice experiment found most effective in delivering environmental information also has the greatest potential to steer consumers towards more environmentally friendly food purchases. When consumers shop in the experimental market with the most effective EIC installed, we observe switching behaviour towards the most environmentally friendly food products and/or switching behaviour away from the least environmentally friendly food products. Besides, we find evidence that the most effective EIC can overrule often used heuristics such as 'think global, eat local' or the organic label. This happens when the most effective EIC's score indicates another more environmentally friendly option than the local and/or organic variety, which suggests that today consumers are sometimes misled through the use of these heuristics or labels, while they think they are doing the right thing (and are also paying the premium for it in case of organic produce). Furthermore, the most effective EIC has the ability to increase the overall environmental friendliness of consumers' food baskets. Accordingly, we highlight the considerable potential for policy makers to enlarge the environmentally friendly consumer segment through the provision of easy-to-interpret and standardized environmental information limiting the costly search for consumers. We find a positive correlation between the magnitude of switching behaviour and product similarity. An ideal start for the implementation of an environmental information mechanism could thus be to initially target those food products with high similarity and the largest potential to improve the environmental impact. In a subsequent stage, the environmental information mechanism can be enlarged to incorporate all produce since the behavioural change is observed for every food category. Unfortunately, the process of creating and adopting a commonly applied methodology in order to assess and communicate environmental information along the food chain to consumers is slow and costly, although efforts are being made. Therefore the finding that a potential version of a multi-criteria label can alter consumers' food purchases should motivate public authorities (and all relevant players) to enhance efforts of establishing unbiased and objective EICs to encourage consumers into environmentally friendly purchasing behaviour.

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Table 1. The chosen food products and their corresponding prices.

Tomatoes			Apples			Proteins		
BE Conv.	BE Org.	SP Conv.	BE Conv.	BE Org.	NZ Conv.	Steak (ppu)	Chicken (ppu)	Veggie Burger (ppu)
€2.49/kg	€5.53/kg	€2.54/kg	€2.49/kg	€3.32/kg	€2.43/kg	€2.89	€2.71	€2.79

BE: Belgium, SP: Spain, NZ: New Zealand, Conv: Conventional, Org: Organic, PPU: Price Per Unit

Table 2. Conditional logit model estimates and relative ranking for the least and most effective environmental information cards (EICs)

EICs	Clogit (1)		Clogit (2)		Ranking
Raw Info			-1.585***	(0.167)	**6**
Impact at attribute level	0.584***	(0.116)	-0.387***	(0.115)	4
Score at product level	0.480***	(0.113)	-0.456***	(0.117)	2
Raw Info + Impact at attribute level	0.427***	(0.117)	-0.539***	(0.135)	5
Raw Info + Score at product level	0.482***	(0.105)	-0.480***	(0.123)	3
Impact at attribute level + Score at product Level	1.286***	(0.151)			**1**
Log Likelihood	-1048.63		-1021.14		
Observations	3,220		3,220		

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 3. Participants' socio-demographics and food consumption habits within each treatment

Description	Treat Control (%)	Treat Least (%)	Treat Most (%)	χ^2test (p-value)
Gender				
Male	46%	46%	46%	Pr = 1.000
Female	54%	54%	54%	
Age				
≤ 25	8%	6%	10%	Pr = 0.58
26-54	76%	76%	68%	
≥ 55	16%	18%	22%	
Education				
University	40%	33%	56%	Pr = 0.385
Higher education	42%	47%	26%	
Secondary School	18%	20%	18%	
Income class				Pr = 0.297
Higher	38%	23%	48%	
Middle	56%	71%	44%	
Lower	4%	6%	6%	
Member of nature organisation (yes)	26%	18%	26%	Pr = 0.551
Vegetarian (yes)	4%	6%	10%	Pr = 0.472
Fruits per day				Pr = 0.154
≤ 1	24%	40%	22%	
1-2	54%	38%	44%	
≥ 2	22%	22%	34%	
Meat frequency				Pr = 0.206
< once a week	10%	6%	12%	
once a week	10%	4%	4%	
2-4 times a week	40%	60%	32%	
5-6 times a week	24%	20%	32%	
Daily	16%	10%	20%	
Health concern				Pr = 0.711
Not much	22%	20%	20%	
Much	44%	50%	38%	
Very much	34%	30%	42%	

Table 4. Food products' market shares per treatment

Food Products	EF Score	Market shares per Treatment Control	Least	Most	%Change Most/ Control
BE Conv. Tomato	6.5/10	50%	50%	34%	-35%
BE Org. Tomato	6.5/10	32%	38%	16%	-50%
SP Conv. Tomato	7/10	18%	12%	50%	178%
Pearson Chi-square = 22.07 Pr = 0.000					
BE Conv. Apple	8.5/10	46%	34%	46%	4%
BE Org. Apple	9/10	32%	44%	44%	44%
NZ Conv. Apple	7.5/10	22%	22%	10%	-58%
Pearson Chi-square = 5.01 Pr = 0.286					
Steak	1.5/10	24%	30%	18%	-35%
Chicken	3.5/10	62%	44%	50%	-50%
Veggie Burger	5/10	14%	26%	32%	178%
Pearson Chi-square = 6.62 Pr = 0.158					

EF Score: Environmental Friendliness Score, BE: Belgium, SP: Spain, NZ: New Zealand, Conv: Conventional, Org: Organic

Table 5. Multinomial regression estimates for product choice in food market

Food Products	EF Score	Product Choice Treatment Least	Treatment Most	Log Likelihood
BE Conv. Tomato	6.5/10	0.405 (0.598)	-1.407*** (0.500)	-139.31 (χ^2(4) =17.59 ***)
BE Org. Tomato	6.5/10	0.577 (0.627)	-1.715*** (0.582)	
SP Conv. Tomato	7/10	Reference Category		
NZ Conv. Apple	7.5/10	-0.318 (0.538)	-1.107* (0.632)	-153.24 (χ^2 (4) =5.38)
BE Conv. Apple	8.5/10	-0.621 (0.459)	-0.318 (0.441)	
BE Org. Apple	9/10	Reference Category		
Steak	1.5/10	-0.396 (0.608)	-1.114* (0.632)	-150.33 (χ^2 (4) =6.85)
Chicken	3.5/10	-0.962* (0.545)	-1.042** (0.527)	
Veggie Burger	5/10	Reference Category		

Observations: 150; Standard errors in parentheses,*** p<0.01, ** p<0.05, * p<0.1; EF Score: Environmental Friendliness Score, BE: Belgium, SP: Spain, NZ: New Zealand, Conv: Conventional, Org: Organic

Table 6. Summary of treatment effects on product choice

Food Products	EF Score	Product Choice Treatment Least	Treatment Most
BE Conv. Tomato	6.5/10	/	--
BE Org. Tomato	6.5/10	/	--
SP Conv. Tomato	7/10	/	++
BE Conv. Apple	8.5/10	/	/
BE Org. Apple	9/10	/	+
NZ Conv. Apple	7.5/10	/	-
Steak	1.5/10	/	-
Chicken	3.5/10	-	--
Veggie Burger	5/10	+	++

/ no significant effect found, + positive significant effect found (+ : p<0.1; ++: p<0.05; +++: p<0.01), - negative significant effect found (-p<0.1; --p<0.05; ---p<0.01), EF Score: Environmental Friendliness Score, BE: Belgium, SP: Spain, NZ: New Zealand, Conv: Conventional, Org: Organic

Figure 1. **Example of environmental information cards. Card 2 is the least effective EIC used in *Treatment Least*. Card 5 is the most effective EIC used in *Treatment Most.* Card 6 consists of Card1+Card2+Card3.**

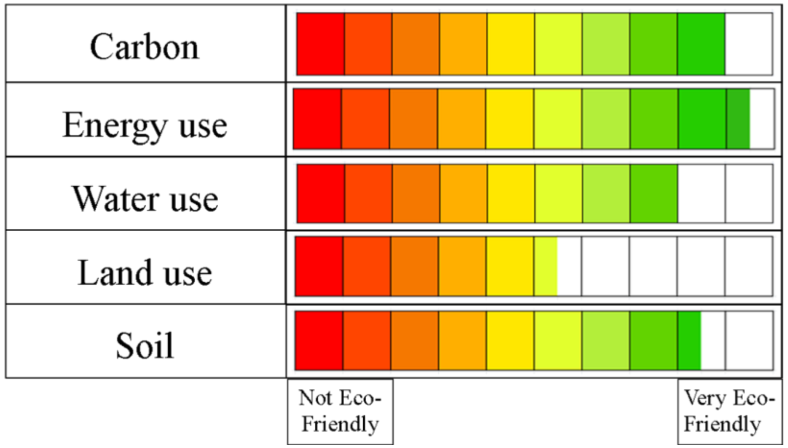
CARD 1

Environmental Friendliness	8.5 / 10

CARD 2

Transport	100km (truck)
Production	Open air
Water use	146 liters/kg
Land use	0.38 m^2/kg
Pesticides	0.6 active substance/kg

CARD 3



CARD 4

Environmental Friendliness	8.5 / 10

Transport	100km (truck)
Production	Open air
Water use	146 litres/kg
Land use	0.38 m^2/kg
Pesticides	0.6 active substance/kg

CARD 5

Environmental Friendliness	8.5 / 10

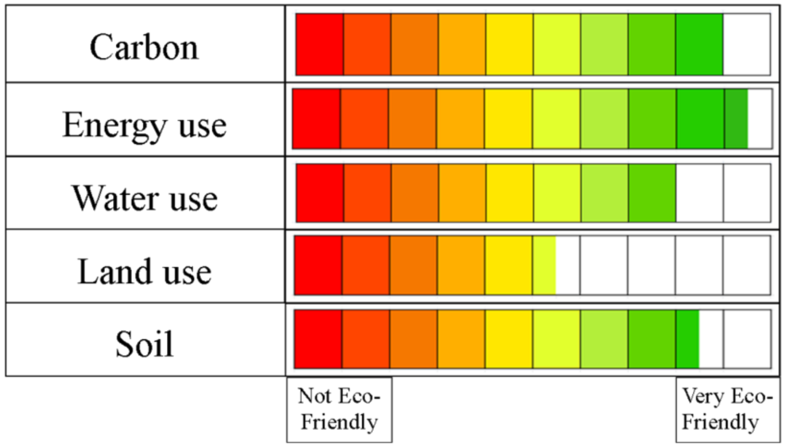
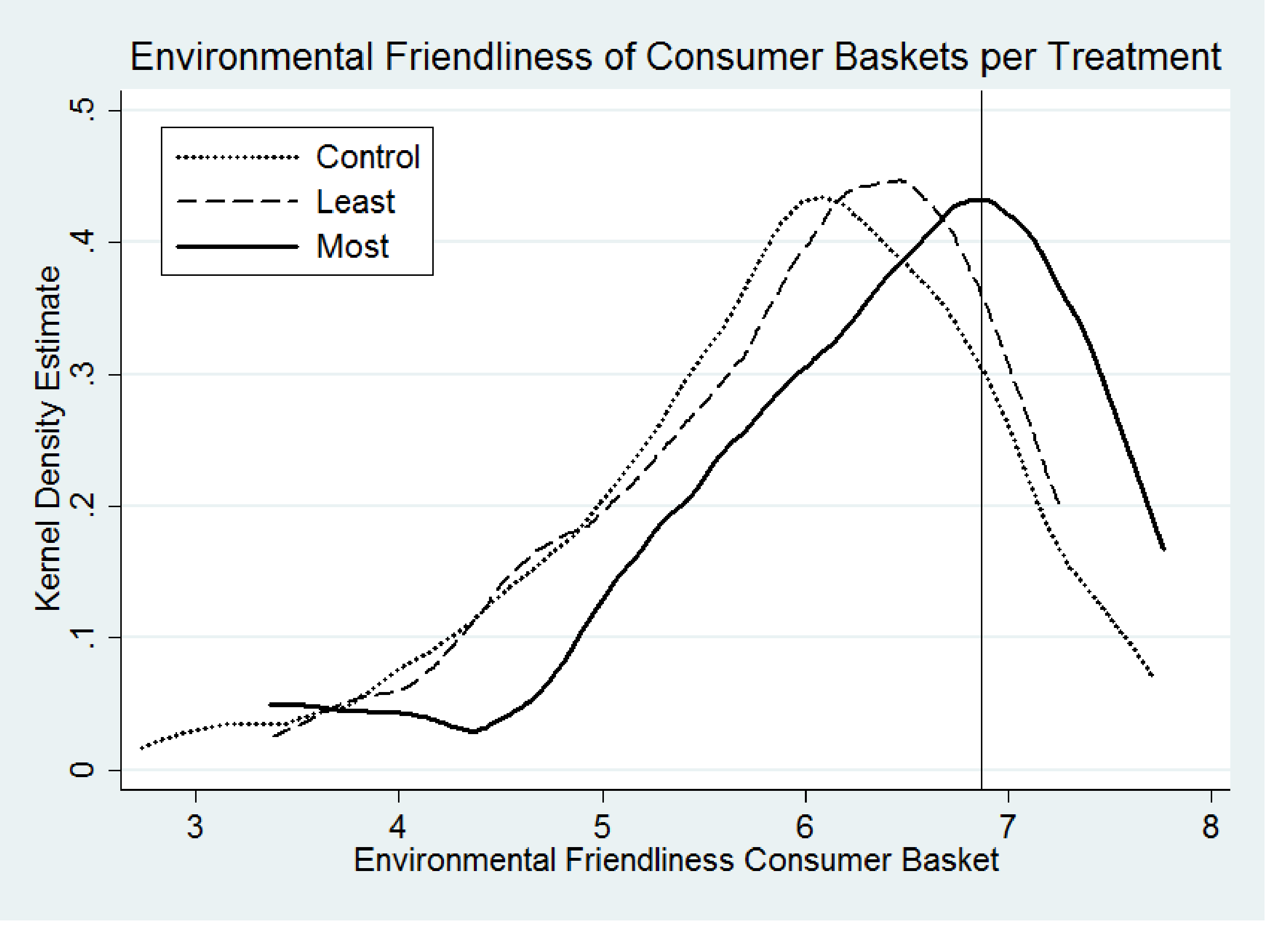


Figure 2. Diagram of the experimental procedure

Figure 3. The environmental friendliness of consumer baskets per treatment



APPENDIX

Table A1. Summary of the LCA data collected for the nine food products

LCA Impact Category	FU	Tomatoes			Apples			Steak	Chicken	Veggie Burger
		BE Conv.	BE Org.	SP Conv.	BE Conv.	BE Org.	NZ Conv.			
Global Warming Potential	kg CO2-eq/t	1700	2100	1020	220	170	450	17000	3200	1700
Primary Energy Use	MJ/kg	36.2	46	9.6	4.2	3.8	5.6	61.8	22.8	13.7
Water Use	l/kg	39	34	53	146	146	220	11000	3000	1106
Land Use	m2/t	19	25	89	380	494	170	17000	5400	2100
Pesticides	kg/ha	0.5	0.2	2.2	0.6	0.1	0.3	7.1	7.7	2.5
Acidification Potential	kg SO2-eq/t	2.4	3.5	4.6	1.8	1.5	24.1	469	173	108
Eutrophication Potential	kg PO3-eq/t	0.21	0.34	0.47	0.4	0.34	3.7	157	49	36

BE: Belgium, SP: Spain, NZ: New Zealand, Conv: Conventional, Org: Organic, FU: Functional Unit

Table A2. LCA data weight conversion table used to calculate the 'impact' and 'score' environmental information cards

Gloria et al. (2007)		Translated to Our Study	
Impact Categories	Weights	Impact Categories	Transformed Weights
Global warming	29.3%	Carbon Emissions	42.1%
Fossil Fuel Depletion	9.7%	Energy use	11.2%
Water Intake	7.8%	Water Use	13.9%
Habitat Alteration	6.1%	Land Use	8.8%
Ecological Toxicity	7.5%		
Eutrophication	6.2%	Soil	24.00%
Acidification	3.0%		
Total	69.6%	Total	100%

Table A3. Calculated input scores to create the 'impact' and 'score' environmental information card for each food product

Impact Category	Tomatoes			Apples					
	BE Conv.	BE Org.	SP Conv.	BE Conv.	BE Org.	NZ Conv.	Steak	Chicken	Veggie Burger
Carbon Emissions	5.0	4.5	6.0	9.0	9.5	7.5	0.5	3.5	5.0
Energy Use	5.0	4.5	8.0	9.5	9.5	9.0	4.0	6.0	7.0
Water Use	9.5	9.5	9.0	8.0	8.0	7.0	1.5	3.5	5.0
Land Use	9.5	9.5	7.5	5.5	5.0	6.5	0.5	2.0	3.0
Soil	8.5	9	7	8.5	9.5	7	2	3	4
Total EF Score	6.5	6.5	7	8.5	9	7.5	1.5	3.5	5

EF Score: Environmental Friendliness Score; BE: Belgium, SP: Spain, NZ: New Zealand, Conv: Conventional, Org: Organic

Photo of the Experimental Food Market in the Supermarket