Making or Buying Environmental Public Goods: Do Consumers Care?

Douadia Bougherara* Sandrine Costa† Mario Teisl ‡

September 5, 2011

Prepared for the 5emes journees de Recherches en Sciences Sociales, INRA SFER CIRAD, 8, 9 et 10 decembre 2011, Dijon, France.

*INRA, UMR1302 SMART, F-35000 Rennes, France
†INRA, UMR1110 MOISA, F-34000 Montpellier, France.
‡School of Economics, University of Maine, USA.

Abstract

Firms may voluntary abate pollution using one of two options. The firm internalizes its own external effects and incurs abatement costs ("making") or the firm delegates environmental protection to other firms ("buying"). We consider greenhouse gases (GHG) emission where a firm can change its production process or purchase carbon offsets. The firms' choice between the two options is not neutral from the consumer's viewpoint. There may be spatial effects; that is offsetting may shift joint local public goods to another region. Besides, offsets induce strong opinions. Notably, some describe offsets as indulgences like in the medieval times. The aim of our paper is threefold. First, we aim at eliciting consumers' WTP for producers' use of the "making" option (producers' own green practices) as compared to the "buying" option (purchase of offsets), controling for spatial effects (joint local public goods). Second, we seek to determine if consumers' attitudes towards offsets translate into their choices. Third, we elicit consumers' WTP for GHG emission reduction and its determinants. We use a stated choice survey with 722 respondents. We find consumers are more willing to pay for a "making" policy (producers' own green practices) than for a "buying" policy (purchase of offsets). Consumers do not significantly care for the producers' use of offsets when the level of local externalities is controlled for. We find positive attitudes on offsets positively influence preferences for offsets whereas negative attitudes do not. Finaly, respondents are willing to pay for lower levels of GHG emissions. The main motivation is gift-giving while those who do not support green products, those who feel their contribution will be wasted and the free riders have lower WTP.

Key words: Offsets; Willingness to pay; Stated choice;
JEL: Q53 (Valuation of Environmental Effects); Q54 (Climate; Natural Disasters; Global Warming); Q58 (Government Policy);

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1 Background and motivation

Firms may use several environmental policy tools such as product eco-labeling (for instance the European Eco-Label), corporate social responsibility, environmental management systems (e.g. ISO14000), cause related marketing (e.g. the campaign of the association "Planète Urgence" supported by private firms: "for each product bought, one tree is planted"[1]). Each of these policies has been the focus of a number of papers. However, few papers deal with the comparison of these different policies. Among the few studies is the work of Langen (2011). The author analyses consumers' coffee choice among several sustainable products: fair trade, organic and cause-related marketing label. By controlling for the amount of money directly going to the producer, she tests for the consumers' preference for each of these sustainable products. The latent class analysis shows that there is a high heterogeneity among consumers preferences about coffee attributes. In particular, she founds that for 51% of the sample, a cause-related marketing label decreases the willingness to pay (WTP) and a fair trade label increases WTP. However, only 3% of the sample is less willing to pay for a fair trade labeled product and more willing to pay for a cause-related marketing labeled product. Since the amount of money going to the producer is controlled within the experiment, other concerns explain such a difference. This result shows that consumers care for the environmental policy tool used by the producer.

The aim of our paper is to compare the consumer WTP for two types of voluntary environmental policies used by the producer. The first policy can be called "making". The firm internalizes its own external effects and incurs abatement costs. The second policy can be called "buying". The firm delegates environmental protection to other firms with a money transfer. There are a lot of policies belonging to the "making" class. For instance, green production practices where firms voluntary reduce their emissions or their resource use. As for the "buying" class, examples are carbon or biodiversity offsets and cause-related marketing. This paper deals with carbon emission reduction and compares green production practices ("making") and carbon offsetting ("buying").

Carbon offsetting enables any party (firms, organizations, individuals) to compensate the carbon emissions of its activities by financing a project that reduces greenhouse gases (GHG) emissions. When the party's GHG emissions are exactly offset, the activity of the party is said to be carbon neutral. Today, carbon offsets are used in different policy contexts. In some cases, offsets are the result of a mandatory policy of pollution reduction, and are a way to allow sharing environmental efforts in a cost-efficient manner. In other cases, offsets result from the voluntary environmental effort of a company or an individual. For instance, the European Climate Policy sets emissions in some sectors, but doesn't impose emission levels to other

[1] http://www.planete-urgence.org/

sectors (e.g. agriculture) or to consumers.

Firms may voluntary comply with GHG emission reduction. The prospect of a higher consumer WTP for GHG emission reduction determines how much effort would be voluntarily provided by companies. Indeed, two papers analyze consumer WTP for carbon offsets that compensate her own pollution (Mc Kerron at al., 2009; Brouwer et al., 2008). These papers show that consumers are willing to pay to offset carbon emissions of their plane travels. Thus, in order to reduce carbon emissions, a firm may change its production process ("making" option) or use carbon offsets ("buying" option). The firms' choice between the two options is not neutral from the consumer's viewpoint. First, there may be spatial effects; that is offsetting may shift joint local public goods to another region. Second, offsetting is criticized on moral grounds. For example, a website[2] offers in a satiric way to compensate infidelity by paying people that engage to be faithful. The point is that offsetting allows getting away from the consequences of harming the environment with a clear conscience. A similar argument is made by G. Monbiot[3]: *"Just as in the 15th and 16th centuries you could sleep with your sister and kill and lie without fear of eternal damnation, today you can live exactly as you please as long as you give your ducats to one of the companies selling indulgences."*.

The aim of our paper is threefold. First, we aim at eliciting consumers' WTP for producers' use of the "making" policy (producers' own green practices) as compared to the "buying" policy (purchase of offsets), controling for spatial effects (joint local public goods). Second, we seek to determine if consumers' opinions in favor or against offsets translate into their choices. Third, we elicit consumers' WTP for GHG emission reduction and its determinants.

We used a stated choice web survey on a sample of consumers from two French regions enabling controlling for spatial effect. We collected responses from 722 individuals. We find consumers are more willing to pay for a "making" policy (producers' own green practices) than for a "buying" policy (purchase of offsets). Consumers do not significantly care for the producers' use of offsets when the level of local externalities is controlled for. We find positive attitudes on offsets positively influence preferences for offsets whereas negative attitudes do not. Finaly, respondents are willing to pay for lower levels of GHG emissions. The main motivation is gift-giving while those who do not support green products, those who feel their contribution will be wasted and the free riders have lower WTP.

The paper is organized as follows. In section 2, we present the stated choice survey design (choice of product and attributes and sample selection). Results are presented in section 3. Section 4 discusses results and concludes.

2 Stated choice survey design

We first present the choice of products, of attributes and the experimental design and then the sample selection process.

[2]http://www.cheatneutral.com

[3]The Guardian, October 18th 2006.

Attribute	Description	#levels	Level description
local	Production is located where the respondent lives	2	Yes; No;
off	Producer uses offsets	2	Yes; No;
cow	Producer reduces number of cows per hectare	2	Yes; No;
h2o	Improvement in water quality	3	+0%; +40%; +60%
ghg	Reduction in GHG emissions	3	-0%; -40%; -60%
price	Price of the good	3	+10%; +20%; +40%

Table 1: Attributes used in stated choice survey

2.1 Choice of product and attributes and experimental design

We consider an application to milk produced in two regions in France: Bretagne (Western France) and Picardie-Champagne-Ardennes (Northern-Eastern France). We chose milk for two reasons. First, milk is a relatively homogenous product. As such, we expect the product to vary only in the attributes of interest (production process and location of production). Second, milk production implies cattle breeding, which is the first contributor to GHG emissions of agriculture in France (the agricultural sector as a whole contributes to 20% of GHG emissions in France[4]). We chose two contrasted areas in France in terms of GHG emissions and water pollution from farming. The first area is composed of an administrative region called "Bretagne" and is intensive cattle breeding farming, whereas the second area is composed of two administrative regions "Picardie" and "Champagne-Ardennes" and is extensive cattle breeding farming and crop production. While Bretagne is a big contributor to GHG emissions (6.9 MtCO2e -mega tons of carbon dioxide equivalent- for CH4 and 5.3 for N2O), Picardie (1.1 for CH4 and 2.5 for N2O) and Champagne-Ardennes (1.2 for CH4 and 3 for N2O) are smaller contributors. It is also worth noticing that Bretagne and Picardie-Champagne-Ardennes belong to two separate hydrological basins. Indeed, efforts to enhance water quality in one region have no effect on water quality in the other region. Water quality is then a local public good in each region.

The aim of the survey is to elicit consumers' preferences for milk produced under differing conditions each representing an attribute in the stated choice survey. In our survey, consumers were asked to make repeated choices between three options: their usual milk and two alternative versions. Each version of the product is described by five attributes: location of milk production (in the respondent's area or not), type of on-farm process (a reduction in production intensity by reducing the number of cows per hectare -"making" option- or no change in production intensity but with a use of offsets -"buying" option), level of a local public good that is water quality (3 levels), level of GHG emissions (3 levels) and price increase (3 levels). The location of milk production enables us to control for a preference for local production. The farm process attributes enables us to measure a preference for offsets as compared to the producer reducing its GHG emissions on the farm. Finally, the local public good

[4]This relatively high figure is due to the fact that France has a relatively low level of GHG emissions for the energetic sector (nuclear energy).

Usual milk	**Milk produced in region A**	**Milk produced in region B**
Produced with the **usual number** of cows per hectare	Produced with a **reduced number** of cows per hectare	Produced with the **usual number** of cows per hectare
The farmer pays **no one** to reduce pollution	The farmer pays **no one** to reduce pollution	The farmer pays **a farmer in region A** to reduce polluton
No improvement in water quality	**40% improvement** in water quality **in region A**	**20% improvement** in water quality **in region A**
No reduction in GHG emissions	**40% reduction** in GHG emissions	**60% reduction** in GHG emissions
Usual price	Usual price +**20%**	Usual price +**40%**
□	□	□

Table 2: Example of a choice set

attribute enables to control for the jointness rationale described above. In short, we want to know if consumers oppose offsets when changes in local water quality are controlled for. The fourth attribute is the global public good resulting from the on-farm pollution reduction or the use of offsets. The last attribute is the payment vehicle. Respondents could also choose no options and select "cannot choose" or "do not want to respond" options. Table 1 gives a description of the attributes used in the stated choice survey.

A full factorial design would imply $3^3 \times 2^2 = 108$ descriptions of milk. We use a fractional factorial design to reduce the number of choices made by the respondents in the survey. The aim is to maximize D-efficiency to achieve balance and orthogonality. Balance requires that each level of each attribute appears the same number of times and orthogonality requires that every pair of levels appears the same number of times across all of the pairs of attributes in each alternative. Furthermore, we restrict the design to situations that are not too obvious (for example, alternative 1 and 2 have the same price and the same process) and not incoherent (for example, no choice set where alternative 2 has a higher price than alternative 1 but with higher air and water pollution and same process). The design we finally used consists of 36 choice sets blocked in twelve groups of three (D-efficiency=98%). Each respondent was presented with 3 choice sets and there were twelve versions of the survey.

Table 2 presents an example of a choice set. In this example, the two alternatives to the usual milk are produced in two different regions (see first row). But because of the use of offsets in the second alternative (see second row), water pollution is improved in region A for both alternatives (see third row).

We anticipated some respondents in the survey would consider that extensifica-

tion has an impact of milk quality. To prevent consumers from associating private benefits to the change of production method, a short paragraph before the presentation of choice sets explained that the only differences between the types of milk are their places of production, how they were produced (and therefore the pollution level) and their price; and that we ask respondents to consider that milk intrinsic quality is identical across the three types of milk.

2.2 Sample selection

We used an Internet survey. A lot of studies do compare web surveys to mail surveys. Response rate is the result which is the most commonly studied for this comparison. Some authors find the response rate to be lower in web surveys (Shih, Fan, 2007; Meckel et al, 2005; Fan, Zheng, 2010) whereas others observe higher response rates with web surveys (Olsen, 2009; Fleming, Bowden, 2009). However, sampling procedures, reminder strategy and survey scope differ a lot between these studies, explaining these contrasted results. As highlighted by Farrell and Petersen (2010), Internet users are not perfectly representative of overall population of a country[5]. For instance, in France, internet users are younger and are characterized by a higher income and a higher education than the average of French population. However, as stated by Farrell and Petersen (2010), it only implies that results have to be analyzed taking care of this potential representativity limit. Two authors do compare web surveys to mail surveys in the field of non-market goods valuation, one studies the WTP for environmental protection (Olsen, 2009), the other estimates recreation value using the transport cost method (Fleming, Bowden, 2009). In these two papers, Internet surveys give the same result as mail surveys, even when the web and mail samples do differ in their socio-economic characteristics.

A number of e-mails were randomly sent in the two regions of interest (Bretagne and Picardie-Champagne-Ardennes) through an e-mailing company. Unfortunately, problems arose with the e-mailing company, which does not enable us to know how many e-mails were send in the first place. We however know that randomness of e-mail selection was preserved in each region of interest.

3 Results

To present the results, we first describe the sample, then the econometrics specification and finally the first econometric results.

3.1 Sample description

As mentioned above, we had problems with the e-mailing company. We are unable to give a figure as to the response rate. There were 722 responses, 464 from Bretagne (64.27%) and 258 from Picardie-Champagne-Ardennes (35.73%). There are clearly

[5]Here we are not attempting to extrapolate our results to a broader population, but are attempting to understand the decision-making process as it relates to offsets. In this case, external validity is less of a concern.

more responses from Bretagne. We do not know if the response rate was higher in Bretagne or if more e-mails were send in Bretagne in the first place. As mentioned in footnote 3, the potential lack of external validity is less of a concern here as we are not attempting to extrapolate the WTP results to a broader population. Our main point of study is the decision-making process focused on the tradeoffs between production changes and use of offsets, environmental attributes and price. Table 3 presents the summary statistics on some socio-demographics variables and describes the interest of respondents as to local or global public goods (frequency and percentage for categorical variables and mean and standard deviation for continuous variables). We also performed t-tests for continuous variables and Chi square tests for categorical variables. The two sub-samples slightly differ (10% significance) in the scope of the environmental organization they belong to. Respondents from Bretagne are more involved in local organizations than respondents of the other region who are more involved in international organizations. That reflects the contrast in the local pollution (water pollution) between the two regions.

We also asked respondents about their concern for several items (air pollution, water pollution, farm production methods, employment, effect of global warming, animal farm well being) at different geographical levels (respondent's area, France, world). The data are not presented here but available upon request. A few results can be noticed. First, the more global the item is, the less concerned respondents appear to be. Second, respondents are concerned (1) by employment, then (2) by water pollution and farm production methods and finally, by (3) farm animal well-being, the effect of global warming and air pollution. Third, respondents from Bretagne are more concerned by water pollution (1% significance) and farm production methods in their area (1%), and less concerned by employment in their area (5%) than respondents from Picardie-Champagne-Ardennes. Table 4 presents some statistics on shopping habits.

Respondents from Bretagne buy less their milk in the supermarket (5% significance), buy more often and spend a higher share of their budget on organic food (1%), and pay more attention to the origin of the milk they consume (5%) than respondents from Picardie-Champagne-Ardennes.

These summary statistics provide interesting insights as to differing behavior between the two areas chosen for the study. Respondents from Bretagne are more concerned by water pollution problems and thus are more engaged in local environmental organizations and organic food consumption, and care more for the origin of milk they consume. This is in line with the characteristics of Bretagne which has more cattle breeding and has more water pollution problems.

3.2 Factor analysis

The survey included one question about the attitude towards offsets, in relation to the second scope of the paper. This question was : "Do you think that polluters should be allowed to buy pollution offsets instead of reducing their own pollution ? Please choose all answers that apply." Ten answers were proposed, five beginning with "Yes, because..." (variables V41 to V45, and five beginning with "No,

Variable	Description	Against	In favor
V41	**Yes, because** the environment can be cleaned up more cheaply	-.18	**.64**
V42	**Yes, because** society can clean up more of the environment for the same amount of money	-.05	**.69**
V43	**Yes, because** it encouages polluters to pay attention to the environment	-.2	**.64**
V44	**Yes, because** it can keep farm costs and thus is less disruptive to employment	-.12	**.68**
V45	**Yes, because** it can keep farm costs and thus milk prices at reasonable levels	-.13	**.66**
V46	**No, because** polluters should pay the full cost of cleaning up their own pollution	**.63**	-.11
V47	**No, because** it is morally wrong to pay someone else to avoid cleaning up your own pollution	**.67**	-.32
V48	**No, because** polluters should be punished as much as possible	**.75**	-.03
V49	**No, because** offsets imply some producers offer to respect the environment in the place of others, in return for money. It is wrong for producers to make money this way.	**.80**	-.09
V50	**No, because** the original victims of the pollution will still be forced to live with the pollution if the polluters use offsets	**.60**	-.37

Table 3: Factor loadings after varimax rotation, opinions towards offsets

because..." (variables V46 to V50). To reduce the number of variables in the set of attitudes towards offsets, we conduct a factor analysis . Factor analysis describes the variability among observed variables in terms of a lower number of unobserved latent variables, the factors. Observed variables, attitudes towards offsets, are then assumed to be a linear combination of the factors, opinions towards offsets.
A principal component analysis has been run with SAS. The first step of the factor analysis determines the number of factors, based on the eigenvalues. Two factors have eigenvalues larger than one and are keeped for the rest of analysis. Factor analysis provides factor loadings, which are the correlation coefficients between the variables and factors. A high loading means that the attitude (the variable) and the opinion (the factor) are highly correlated. To be able to interpret easily the loadings, the factor matrix is rotated. We choose an orthogonal rotation, which results into orthogonal axes and non correlated factors and thus gives more easily interpretable results (varimax rotation procedure).
Loadings show that In favor is positively and highly correlated to all positive attitudes towards offsets. In favor corresponds thus to a positive opinion on offsets. Against is positively and highly correlated to all negative attitudes towards offsets, so Against resumes opposition towards offsets. Table 3 provides the factor loading matrix after orthogonal rotation. Correlations higher than 0.6 are written in bolt.

The third scope of the paper is to elicit WTP for GHG reduction, and its determinants. As attitudes towards pollution reduction and public goods may explain this WTP, twelve questions on the survey measure these attitudes. All of these uestions are framed as affirmative sentences, with a likert scale from 1 (I not at

all agree) to 5 (strongly agree). A factor analysis is conducted in order to resume these attitudes into less variables. The first step of the factor analysis shows that 4 factors have a eigenvalue larger than one. Factor matrix is then rotated with the varimax rotation procedure. Factor loadings are provided in the table 4 (bolt values are correlation higher than .5).
Assur corresponds to the attitude that it is inefficient for the individual to buy environmentally-friendly products, for two reasons : inefficiency of green goods in general, or insuffisance of individual purchase (insurance effect). Gift is altruism. Nogreen seems more contradictory, as the first sentence corresponds to warm-glow (what counts is giving, whatever how useful is the gift) , and the two others says that the individual doesn't buy green goods because it is useless. There are two explanations to this contradiction. Firstly, individuals may have warm-glow preferences in general, but may be careful to consequences of their gifts dedicated to environment. Secondly, individuals have warm-glow preferences in all domains including environment; they don't buy green goods and they choose the useless argument because of response bias (they don't want to say that they don't care about environment, because the survey concerns the environment). FRide is free riding.

3.3 Econometric models

We use a standard specification of random utility. Our presentation of the empirical models follows Revelt and train (1999). In our study, consumer n chooses among 3 alternatives ($j = 1, 2, 3$) the alternative that yields the greatest utility. The probability of selecting an alternative increases as the utility associated with it increases. The individual consumer's utility level associated with the choice of an alternative j in the set of alternatives $t = 1, 2, 3$ writes as in equation (1). It is a linear function of the vector of attributes X_{njt} presented to consumer n in alternative j in set t. The parameters β_n are known to the respondent but not to the researcher.

$$U_{njt} = V_{njt} + \epsilon_{njt} = \acute{\beta_n} X_{njt} + \epsilon_{njt} \tag{1}$$

with $j = 1, 2, 3$, $t = 1, 2, 3$ and $n = 1..N$.

The stochastic term ϵ_{njt} is assumed to be distributed iid extreme value type 1 and independent of β_n. Let $y_n = (y_{nj1}, y_{nj2}, y_{nj3})$ denote the consumers' sequence of chosen alternative in situation $t = 1, 2, 3$. We can write the probablity for consumer n of choosing alternative i in set t as in equation (2).

$$L(y_{nit} = 1) = \frac{\exp(\acute{\beta_n} X_{nit})}{\sum_j \exp(\acute{\beta_n} X_{njt})} \tag{2}$$

Since the ϵ_{njt} are independent over choice situations t, the probability of the consumer's sequence of choices, conditional on β_n is the product of logits (equation (3)).

$$P(y_n|\beta_n) = L(y_{ni1} = 1|\beta_n) L(y_{ni2}|\beta_n) = 1) L(y_{ni3} = 1|\beta_n) \tag{3}$$

Description	assur	gift	nogreen	fride
Even if I buy environmentally-friendly products, not enough people will buy them	**.80**	.01	.04	.06
If I buy environmentally-friendly products, my individual purchase is not enough to protect the environment	**.78**	.09	-.09	-.02
Buying environmentally-friendly products will not help to protect the environment because there are too many other sources of pollution	**.72**	-.14	.2	.15
In reality, buying environmentally friendly products will not help the producer	**.62**	-.21	.21	.04
I like making donations becase it makes me feel good	-.05	**.73**	.31	-.1
I like contributing to charities and other non profit organizations	-.19	**.72**	.12	-.08
I am willing to make sacrifices for the good of those around me	.07	**.58**	-.28	-.07
Paying taxes is good because they fund programs such as schools and roads	-.02	**.56**	-.20	.38
What counts most to me is giving. I am less interested in how useful.	-.07	.2	**.70**	-.02
I do not buy environmentally-friendly products because enough other people buy them	.21	-.06	**.70**	.16
I will not buy environmentally-friendly products because the environment is already preserved	.23	-.15	**.66**	.22
I am comfortable receiving benefits even if I do not contribute	.08	-.04	.14	**.80**
My personal well-being is more important to me than that of the average French person	.07	-.06	.13	**.75**

Table 4: Factor loadings after varimax rotation, opinions towards public goods

As a first approximation, we considered preferences are homogenous so that $\beta_n = \overline{\beta}\ \forall n$. This specification is a conditional Logit model. This exhibits the "independence from irrelevant alternatives" restriction. We tested that hypothesis in our data and it is rejected. We then turn to a mixed Logit model. Indeed, we are interested in examining the heterogeneity in the sample. Thus, we consider as a second step that preferences are heterogenous among consumers so that the conditional probabilities defined in equation (3) are integrated over all possible values of β_n using the population density of β. The probability $P(y_n|\theta)$ of the consumer's sequences of choices conditional on the parameters of the distribution $g(\beta|\theta)$ is displayed in equation (4).

$$P(y_n|\theta) = \int P(y_n|\beta_n)g(\beta|\theta)d\beta \tag{4}$$

This is the specification of a mixed Logit or a random parameter Logit (RPL) model. We use a Monte Carlo simulation method to estimate the probabilities of

choice (100 Halton draws) using the SAS MDC procedure.

In the RPL model, we consider the parameters associated with all the attibutes except price as random. The price coefficient is considered fixed as in many other applications (see Hensher et al., 2005 for a discussion of this assumption) while all other coefficients are assumed normally distributed. So we estimated the mean and standard deviation of the normally distributed coefficients for all attributes except price.

3.4 Econometric results

Table 5 presents the econometric results. We run several random parameter Logits without interactions (model (1)) and with interactions with variables on opinions on offsets (model (2)) and with variables on attitudes towards public goods (model (3)). The RPL model informs about heterogeneity in the sample but does not explain the source of the heterogeneity. We need to include interaction variables to be able to answer some of the objectives of the paper.

The aim of our paper is threefold. We will comment on the results according to each of the objective. First, we were aiming at eliciting consumers' WTP for producers' use of the "making" option (producers' own green practices) as compared to the "buying" option (purchase of offsets), controling for spatial effects (joint local public goods). In all models (1 to 3), the coefficient on the offset attribute is not significant. This shows that consumers do not care for the use of offsets when joint local public goods are controlled for. There is no significant "buying" option effect. The interaction of offset with socio-economic variables (model 2 and model 3) shows that female are more willing to pay for offsets, and that people who belong to an environmental association (asso) are less willing to pay for offsets. Consumers are however significantly willing to pay for the "making" option, that is producers' own cattle reduction.

Second, we seek to determine if consumers' opinions in favor or against offsets translate into their choices. Consider the opinion variables (against and in favor) that are interacted with the offset attribute. We find that consumers who oppose offsets are indifferent to the use of offsets whereas consumers who are in favor of offsets are willing to pay for the use of offsets. This result shows that the use of offsets could be better financed through the market provided more information about the benefits of offsets.

Third, we elicit consumers' WTP for GHG emission reduction and its determinants. Consumers are willing to pay around 0.25 €cents per liter of milk. Model (3) shows that consumers who are reluctant to buy environmentally-friendly products because of fear of inefficiency (assur) are less willing to pay for a GHG emission reduction, as those who don't buy green products (nogreen), or those who tend to adopt free-riding behaviors (fride). On the other side, those who adopt altruist attitudes (gift) are more willing to pay for a reduction of GHG emissions.

Attribute	(1)		(2)		(3)	
	Coefficient (SE)	Coeff. std (SE)	Coefficient (SE)	Coeff. std (SE)	Coefficient (SE)	Coeff. std (SE)
local	0.2110**	0.0208	0.4231***	0.0012	0.2462***	0.0221
	(0.0837)	(2.8911)	(0.1289)	(2.3123)	(0.0956)	(3.0096)
off ("buying")	-0.0549	0.0013	-0.3123	0.2449	-0.0345	0.0398
	(0.1477)	(2.6229)	(0.4556)	(1.3597)	(0.4320	(2.6290)
cow ("making")	0.5985***	0.0119	0.7247***	2.0765***	0.5935***	0.0130
	(0.1627)	(2.6332)	(0.2492)	(0.6223)	(0.1793)	(2.6790)
h2o	0.0215***	0.0249***	0.0267***	0.0281***	0.0234***	0.0275***
	(0.0025)	(0.0069)	(0.0047)	(0.0098)	(0.0029)	(0.0074)
ghg	0.0066***	0.0256***	0.0094***	0.0348***	0.0084***	0.0254***
	(0.0018)	(0.0064)	(0.0025)	(0.0109)	(0.0020)	(0.0072)
price	-0.0318***		-0.0394***		-0.0336***	
	(0.0044)		(0.0076)		(0.0049)	
gender X off			0.3534*		0.0653	
			(0.1868)		(0.1651)	
age X off			0.0048		0.0042	
			(0.0074)		(0.0070)	
educ X off			-0.0849		-0.3212*	
			(0.1908)		(0.1777)	
asso X off			-0.7296**		-0.8657***	
			(0.3049)		(0.2655)	
against X off			-0.0159		-0.0985	
			(0.0913)		(0.0856)	
in favor X off			0.1668*		0.1831**	
			(0.0871)		(0.0801)	
assur X h2o					-0.0049**	
					(0.0019)	
gift X h2o					0.0067***	
					(0.0020)	
nogreen X h2o					-0.0076***	
					(0.0020)	
free riding X h2o					-0.0020	
					(0.0018)	
assur X ghg					-0.0055***	
					(0.0018)	
gift X ghg					0.0047***	
					(0.0018)	
nogreen X ghg					-0.0060***	
					(0.0017)	
fride X ghg					-0.0054***	
					(0.0019)	
					(0.0018)	

Note: *, ** and *** respectively mean 10%, 5% and 1% significant.

Table 5: Econometric results: random parameter Logit

Attribute	Model (1)		Model (2)		Model (3)	
	WTP (cents/Liter)	%>0	WTP (cents/Liter)	%>0	WTP (cents/Liter)	%>0
same	6.64	100	10.74	100	7.33	100
off	-1.73	0	-7.93	11	-1.03	19
cow	18.82	100	18.39	64	17.66	100
h2o	0.68	81	0.68	83	0.70	80
ghg	0.21	61	0.24	61	0.25	63

Table 6: Willingness to pay and share of consumers with positive willingness to pay

Our econometric analysis does provide other results. Consumers are willing to pay for a production located in the same place they live (local). Two explanations might be proposed. People do care about local employment and local economy, or people do care about local agriculture. As it might be expected, interactions between opinions towards public goods (assu, gift, nogreen, fride) and reduction of water pollution (H2O) are very similar to interactions between opinions towards public goods and reduction of GHG pollution. The only difference comes from the interaction with free-riding behavior, which is not significant in case of water pollution reduction whereas it is in case of GHG pollution reduction. However, free-riding is reduced for local public goods (as water quality) by comparison to global public goods (as GHG pollution).

4 Discussion and conclusion

The first objective of our paper was to elicit consumers' preferences for two kinds of voluntary environmental policies: one that belong to the "making" class (reduction of carbon pollution within the production process), and one that belong to the "buying" class (the producer pays someone else: carbon offsetting). By controlling for GHG emission reduction and joint local pollution effects, it is shown that consumers in average are willing to pay for the "making" policy and not for the "buying" policy. However, it is also shown that females and consumers who agree with offsetting for efficiency motives are more willing to pay for offsets, whereas consumers who belong to an environmental association are less willing to pay for offsets. This result highlights the heterogeneity among consumers in terms of preferences over the environmental policy chosen (own effort versus offsetting). It means that the coexistence of the two different policies might be the most efficient choice for a company to raise consumers'funding : the company proposes products with own green technology as well products with offsets. To go further in the question of complementarity, a latent class model might allow to characterize some classes that are more willing to pay for one policy, or the other, to determine how important they are into the population and how much they are willing to pay, as done by Langen (2011) in case of ethical efforts.

5 References

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