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Consumers' Willingness to Pay for Climate-Friendly Food in European Countries

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ABSTRACT

Since food consumption contributes significantly to greenhouse gas emissions it is important field of action for consumer engagement. In this context, the present article looks into the question if carbon footprint labels are a suitable mean to foster climate-friendly food purchase behavior. By means of a mixed methods approach comprising choice experiments and qualitative face-to-face interviews European consumers' preferences and willingness to pay for carbon footprint labels compared to other sustainability labels as well as socio-psychological barriers for climate-friendly consumption are explored. The results reveal that consumers are prepared to pay a price premium for carbon footprint labels but that label skepticism and fatigue as well as a lack in awareness about the impact of food production and consumption on climate change are major barriers for climate-friendly purchase behavior. Information provision in form of carbon footprint labels can only be one part of the solution. Political engagement and engagement by the retail are incremental for success.

Keywords*: carbon footprint label; consumer perception; climate-friendly behavior; choice experiments; mixed methods; climate-friendly food; willingness to pay*

Introduction

On the United Nations Climate Change Conference in Paris in December 2015 a global agreement on the reduction of climate change was negotiated, the so called Paris Agreement. In the agreement the signing parties committed to limit global warming to less than 2 degrees Celsius compared to pre-industrial levels (UNFCCC, 2016). In order to meet this target the agreement calls for collective efforts to combat climate change. This includes a widespread public engagement embracing the industry as well as individual citizens.

One way of combatting climate change as an individual citizen is to engage in a climate-friendly lifestyle (O'Neill and Nicholson-Cole, 2009). In this respect, food consumption constitutes an important field of action since it contributes significantly to all greenhouse gas emissions (Vanclay et al., 2011; Vanhonacker et al., 2013). In the EU-27 about 17% of the greenhouse gas emissions from private households originate from food, beverages and tobacco goods (Haubach and Held, 2015). A prerequisite for consumers to engage in climate-friendly food consumption is that they know and care about the social and environmental effects of their consumption behavior, and have the motivation as well as the opportunity to act as ecological citizens or ethical consumers (Seyfang, 2005). One option to enable consumers to act 'green' is the implementation of eco-labelling schemes (Onozaka et al., 2015). Various retailers through Europe display labels on their products which indicate the climate impact of the respective product by using different carbon footprint labelling schemes. But those CO2-labels have thus far only minor relevance on the market in most European countries (Onozaka et al., 2015).

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Many barriers – cognitive, psychological, social and material – prevent individuals from acting climate-friendly (O'Neil and Nicholson-Cole, 2009). One reason for the absent success is consumers' limited knowledge about the carbon footprint and about climate-friendly food (Hartikainen et al., 2014; Upham et al., 2011). Consumers lack an understanding of the potential to make environmentally and climate-friendly choices by adjusting their food consumption habits and have thus only a limited ability to act according to their interest in climate-friendly behavior (Beattie and Sale, 2009; Gadema and Oglethorpe, 2011; Hartikainen et al., 2014). People struggle to conceptualize climate change and to relate it to their everyday life due to its' abstract and complex nature (Lorenzoni and Pidgeon 2006). In addition, consumers frequently have difficulties to understand the existing CO2-labels (Guenther et al., 2012; Gadema and Oglethorpe, 2011; Schaefer and Blanke, 2014). The underlying concepts and their implications are complicated and sometimes scientifically controversial such as the calculation of the carbon footprint itself (Baldo et al., 2009; Boardman, 2008; Burger et al., 2010; Onozaka et al., 2015).

Climate-friendly consumption is often associated with renunciation and reduced product quality (Lüth et al., 2009). People frequently refuse to pay a price-premium for climate-friendly products and state that they would only consider buying climate-friendly products if the climate-friendliness would be a cost-neutral side-effect of the respective product with all other product attributes staying the same (Grunert et al., 2014; Hartikainen et al., 2014; Lüth et al., 2009). Several studies indicate that climate-friendliness is of less importance to European consumers than other ethical product attributes (e.g., eco-friendly packaging, animal welfare, organic) (Eurobarometer, 2009; Hartikainen et al., 2014; Guenther et al., 2012; Gadema and Oglethorpe, 2011). Climate change is mainly perceived as a risk which is far away in space and time (Lorenzoni et al., 2007; Hagen and Pijawka, 2015; Whitmarsh et al., 2011). Personal risks are frequently underestimated while the risk for the society as a whole and for future generations is acknowledged. Therefore, altruistic motives such as a moral obligation towards future generations motivate people to act against climate change (e.g., Lorenzoni and Pidgeon, 2006). Previous studies also underline that the perceived consumer effectiveness of one's efforts to mitigate climate change is a strong predictor of intention to perform climate-friendly actions (Lorenzoni et al., 2007; Truelove and Parks, 2012; Semenza et al., 2008).

Even though several studies on preferences for label designs (e.g., Berry et al., 2008; Hartikainen et al., 2014; Vanclay et al., 2011) and on willingness to pay (WTP) for food CO2-labels (e.g., Caputo et al., 2013; Onozaka and McFadden, 2011; Van Loo et al., 2014) exist, we want to go one step further: we analyzed consumer preferences and WTP for CO2 labels designed based on the outcome of earlier research in different European countries. Our aim is to better understand consumers' perceptions of climate change and of climate-friendly food and information needs. We follow this objective by using a mixed method approach combining qualitative and quantitative research steps. Our research expands recent research by discussing if CO2-labels are an appropriate and effective tool to increase climate-friendly consumption in Europe.

The present paper is structured as follows: First the methodological approach is depicted. In a next step the results of the survey including the estimates resulting from the choice experiments followed by the results from the interviews are displayed. Afterwards the results are discussed in the light of recent research and in the conclusion recommendations for the communication of climate-friendly food are presented.

Method

Since European consumers' interest in CO2-labels is a quiet controversial topic we decided to address it in an all-embracing manner and thus with a mixed methods approach. In mixed methods research quantitative and qualitative viewpoints are integrated in order to gain a more elaborated understanding of the issue at hand (Johnson et al., 2007). The use of mixed method research allows the consideration of different perspectives and takes into account convergent and/or complementary effects of different approaches. Hence the use of mixed method research enhances the validity and richness of the results (Denscombe, 2008).

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In the present study, two different research steps were combined in order to gain a more complete understanding of European consumers' preferences for CO2-labels. First a quantitative online survey consisting of choice experiments (CE) and a questionnaire was conducted with 6007 consumers in six European countries (France-FR, Germany-DE, Italy-IT, Norway-NO, Spain-ES and United Kingdom-UK) to elicit consumers' preferences for two different CO2-labels in comparison to local and organic production and a claim on climate-friendliness. This quantitative step was followed by a qualitative step. Based on the outcomes of the survey an interview guideline was developed and face-to-face interviews with 32 consumers were conducted in France, Germany and United Kingdom. The interviews aimed at gaining insights into the underlying reasoning for the preferences revealed in the survey.

Online survey design

The online survey was carried out in June 2015. Participants were recruited by means of a representative online access panel run by a commercial market research agency. All surveys were self-administered by the participants. A quota was set for age and gender. Country-specific quotas for the three age groups ('18-29', '30-49', '50-70') were set according to their shares in the total population. Female and male participants took as far as possible equally part in the study. People working in marketing/market research and/or in the food retailing industry were excluded in order to avoid distorted results due to expert knowledge. Participants had to be at least partially responsible for the food purchase in their household.

Table 1 shows the socio-demographic characteristics of the sample. The participants in the UK were slightly younger than in the other countries while the German sample showed the highest share of the oldest age group. In comparison to census data in the six countries, people with higher education (12 or 13 years of school visit, college or university degree) were overrepresented in our data. This must be taken into account when evaluating the results.

Table 1 Socio-demographic characteristics of the survey sample (per country)

	DE	ES	FR	IT	NO	UK
Gender						
Female	49.7%	50.1%	50.8%	50.6%	51.4%	50.1%
Male	50.3%	49.9%	49.2%	49.4%	48.6%	49.9%
Age						
18-29	23.1%	20.9%	25.0%	21.0%	22.9%	26.9%
30-49	40.6%	43.7%	39.5%	44.1%	41.0%	39.3%
50-70	36.4%	35.4%	35.5%	34.9%	36.2%	33.8%
Education						
No formal qualification	0.2%	0.8%	2.6%	0.5%	0.5%	4.2%
About 10 years of school visit	48.9%	14.7%	15.6%	15.1%	5.7%	24.1%
12 or 13 years of school visit	27.3%	40.3%	34.9%	50.1%	35.8%	19.5%
College or university degree	23.7%	44.2%	46.9%	34.3%	58.0%	52.2%
N	1001	1002	1000	1003	1001	1000

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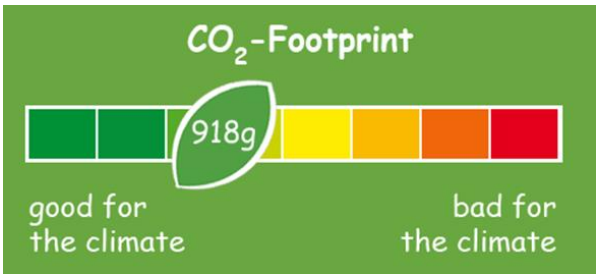
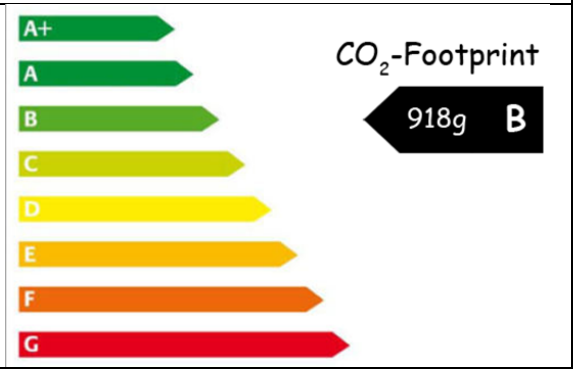
The CE and the questionnaire were developed in German and English and then translated into the other languages by professional translation services by means of the back-translation method. The questionnaires were pre-tested in the respective national languages and checked by native speakers.

Choice Experiments

Choice experiments (CE) are a stated preference method. CEs can be used to simultaneously assess consumers' preferences and their willingness-to-pay (WTP) (Mauracher et al., 2013; Wägeli et al., 2015). The method is based on the theory of choice behavior according to which consumers always try to maximize their benefit by choosing the product alternative that they perceive as best for them (McFadden, 1974; Tait et al., 2016). In CEs, participants have to make a choice out of a set of product alternatives. The set of alternatives is called a choice set (Hensher et al., 2015). The alternatives differ with respect to their product attributes (e.g. CO2-label, local production). The preferences for each attribute are derived from the choices made with respect to the different product alternatives (Hensher et al., 2015; Louviere et al., 2007; McFadden, 1974). The estimation of the WTP can help to identify the market perspectives for new products or product attributes since it indicates the money equivalent to consumers' benefit from a product or a product attribute (Wägeli et al., 2015). In addition, the WTP estimates allow for a comparison of the results between different models and thus in our case between study countries.

In the present study CEs were used to assess consumers' preferences and WTP for climate-friendly labelled food and for two different CO2-labels in particular. In order to test potential designs for a CO2-label, we created two hypothetical labels for the carbon footprint measures (Figure 1). The design of both labels was based on findings by previous studies (e.g., Berry et al., 2008; Gadema and Oglethorp, 2011; Hartikainen et al., 2014). The two labels use a scale to detail the carbon footprint as this form was appreciated and preferred by the participants in earlier research (Hartikainen et al., 2014; Berry et al., 2008; White et al., 2009). Scales allow for comparison due to the relative rankings making the labels more meaningful to consumers (Berry et al., 2008; Boardman, 2008; Upham et al., 2011). The colors of 'our' scales corresponded to traffic lights as these are intuitively understandable and thus easily handled (Berry et al., 2008; Gössling and Buckley, 2016; Röös and Tjärnemo, 2011). Both labels combine scales with an absolute number for the CO2-equivalent per unit. The combination between a scale and a number allows for direct comparison between product categories and to other actions (Berry et al., 2008; Hartikainen et al., 2008; Leire and Thidell, 2005). The carbon footprint level for the two labels was based on CO2-equivalents of milk found by Fritsche et al. (2007).

Figure 1 CO2-labels tested in the online survey

CO2sc	CO2en
	

In the present study milk was selected as the target product since it is a widely available product and many consumers regularly buy milk. The alternatives in the CEs varied by five attributes: claim on organic production with EU organic label, claim on local production, claim on climate-friendliness, CO2-label and price (Table 2).

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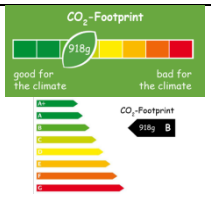
Local production was indicated by a claim, as a widely adopted label for this claim did not exist in the EU market at that time.

Tabel 2 Attributes and their levels in the choice experiments

Product attributes	Attribute levels
CO2-label	 No CO2-label
Claim on climate-friendliness	Yes/No
Claim on local production	Yes/No
Claim on organic production with EU organic label	Yes/No
Price (in relative price levels)	0.6/1.0/1.4

We tested three different price levels. In all study countries the relative price levels were the same: 0.6, 1.0 and 1.4. The absolute prices used in the experiments were inferred from the average market price for 1 l of UHT milk in the study countries one month before the experiments were conducted. The average market price equals price level 1.0 (Table 3).

Table 3 Prices in the CE for all study countries*

Price levels	ES	FR	DE	IT	NO	UK
0.6	0.59EUR	0.66EUR	0.50EUR	0.73EUR	10.80NOK (1.12EUR)	0.43GBP (0.59EUR)
1.0	0.99EUR	1.10EUR	0.85EUR	1.21EUR	18.00NOK (1.87EUR)	0.71GBP (0.97EUR)
1.4	1.39EUR	1.54EUR	1.19EUR	1.69EUR	25.00NOK (2.60 EUR)	1.00GBP (1.36EUR)

* Prices in Euro for Norway and UK are based on the exchange rates by the European Central Bank on the 6th of January 2016.

SPSS software was used to create an orthogonal fractional factorial design for the CEs. The design resulted in 64 choice sets and a total sample of 5944 individuals. We divided the sample into eight blocks. Eight choice sets within each block were shown to each participant in random order to reduce any effects of learning or exhaustion because these issues are more prevalent in online surveys (Onozaka and McFadden, 2011). Before the choice tasks, a short instruction was given to the participants: "Please imagine that you wish to purchase UHT-milk. In what follows, we will present you with 8 choice situations. Each choice situation corresponds to an individual shopping transaction. In each, please choose one milk product out of the three on offer by clicking “buy”". In each choice set participants had to choose between three alternatives. Figure 2 displays an example for a choice set shown in the experiments. We decided to use forced choice sets since we found it less viable that consumers who intent to buy milk refer from the purchase because of the combination of attributes presented to them in a choice set due to the fact that milk is an everyday product. In this situation including a no-choice alternative might have falsely increased the weight of attributes that are harder to compare directly and which are easier to assess alone like credence attributes (e.g., organic production) (Parker et al., 2011).

Figure 2 Example of a choice set

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The CEs were analyzed with mixed logit models (also called random parameter logit) using the software NLogit 5.0. Mixed logit models as other discrete choice models are based on the assumption that the utility of choosing alternative *i* out of a choice set of *J* alternatives consists of two components: the observed utility V_i and the random error term e_i. The random term e_i catches the unobserved utility. In our study, all variables besides 'Price' were categorical variables and as such transformed into effect-coded variables. The variable 'CO2-label' was split into two dummy variables, one for each tested CO2-label ('CO2sc' and 'CO2en') and the two dummy variables were effect-coded. We included 'Price' as a metric variable. The model for calculating the preferences in (the so called preference space) is:

$$U_i = ß_{Price}\text{Price} + ß_{Local}\text{Local} + ß_{Organic}\text{Organic} + ß_{Claim}\text{Claim} + ß_{CO2a}\text{CO2sc} + ß_{CO2b}\text{CO2en} + e_i$$

The probability (*Prob*) that alternative *i* is chosen out of a choice set of *J* alternatives is expressed by:

$$Prob_i = \frac{\exp Vi}{\sum_J^J \exp Vj}$$

All product attributes were modelled as random parameters and were assumed to be normally distributed with the exception of 'Price'. A lognormal distribution was imposed on the price variable because this distribution leads to more reasonable price estimates than a fixed price coefficient or a normal distribution (Hensher and Greene, 2002; Meas et al., 2014; Revelt and Train, 1998; Train and Weeks, 2005). Since the lognormal distribution results in strictly positive values we multiplied the 'Price' variable by -1 and then used the negative price variable in the model. After thoroughly testing over a range of draws and with different draw methods (standard Halton sequences and shuffled uniform vectors) we decided to use Halton draws with 100 to 1000 replications for the estimations. We took into account repeated choice situations and allowed for correlation between the error components of different choice situations from a given individual. Coefficients in a country model were compared with the Friedman test followed by the Dunn-Bonferroni post-hoc test.

The WTP was calculated in WTP space since it was found that this modelling approach results in more reasonable estimates of WTP than when the WTP is computed using ratios of parameters (Hensher et al., 2015). The approach assumes that utility can be separated in price and non-price attributes. For the direct

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estimation of the distribution of the WTP the model is re-formulated in a way that the coefficients represent the WTP measures. The model in WTP space thus is:

$$U_i = \beta_{Price}[\text{Price} + \vartheta_1\text{Local} + \vartheta_2\text{Organic} + \vartheta_3\text{Claim} + \Theta_4\text{CO2sc} + \vartheta_5\text{CO2en}] + e_i$$

where the price parameter has been normalized to 1.0 and ϑ_1, ϑ_2, ϑ_3 ,ϑ_4, ϑ_5 represent the WTP estimates for the non-price attributes (Hensher et al., 2015). Differences between country models were compared by using the Kruskal-Wallis-test. All tests were based on conditional estimates.

In order to explain the preference heterogeneity related to the tested product attributes we estimated interaction terms between the random parameters of the attributes which explicitly indicate climate-friendliness (CO2sc, CO2en, Claim) and five different covariates originating from the questionnaire:

- skepticism towards labels,
- perceived consumer effectiveness,
- subjective knowledge,
- concern about climate change.
- perceived responsibility for future generations as a motive for buying climate-friendly products.

The skepticism towards labels covariate consisted of the mean scores over four items measuring the general skepticism towards labels. The covariates 'perceived consumer effectiveness' and 'subjective knowledge' were each assessed on a 7-point Likert scale with five respectively three items (see Table 4).

Table 4 Items used for measuring perceived consumer effectiveness and subjective knowledge

Perceived consumer effectiveness
• My consumption patterns have no influence on climate change. • Each person's behavior can contribute to the mitigation of climate change. • There is not much that I can do about global warming. • I can reduce the effects of climate change by purchasing climate-friendly products. • I think it is a good idea to introduce labels indicating the climate-friendliness of food products.
Subjective knowledge
• Compared to an average person I know a lot about the climate effects of products and services. • I know a lot about how to evaluate the climate-friendliness of products and services. • People who know me consider me as an expert in the field of climate effects of products and services.

The 'concern about climate change' covariate was based on items measuring the attitudes towards climate change. The 'perceived responsibility for future generations' covariate was binary since participants either stated the responsibility for future generations as a reason for buying climate-friendly products or not.

Questionnaire

To collect additional information on consumers' attitudes and behavior the CE were accompanied by a questionnaire. At the beginning the participants were asked to rank the importance of 10 different product attributes in their purchase decision and were afterwards introduced to the CE. The questions following the CE centered on the attitudes towards the two tested CO2-labels and on climate-friendly behavior. Attitudes towards the CO2-labels were assessed by the degree of comprehensibility of the presented labels and the indicated trust in the shown labels. The comprehensibility of the two labels was assessed by showing the labels to the participants and asking them to indicate on the basis of four statements which information they can derive from these labels. Additionally, the questionnaire measured subjective knowledge about climate change, perceived consumer effectiveness, skepticism towards labels, attitudes towards climate change and

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motives for acting climate-friendly. Differences between variables were calculated with the Wilcoxon signed-rank test.

Face-to-face interviews

In order to gain a deeper understanding of consumers' interest in carbon labels and underlying motives revealed in the survey we conducted face-to-face interviews. These interviews followed a semi-structured guideline and were conducted in May 2016 in France, Germany and UK. In total 32 interviews took place, 11 in Germany (Brunswick) and UK (Edinburgh) respectively and 10 in France (Paris). All interviews were directed by the same interviewer and took place in the respective national language. Each interview lasted for half an hour to an hour and was audio recorded.

We used convenience sampling to recruit the participants. Participants in Paris were randomly recruited from the street by students trained for the recruitment. In Brunswick and Edinburgh participants were recruited by the researchers themselves by means of a snowball scheme. Participants had to be at least partially responsible for doing the grocery shopping in their household.

In total 23 women and 9 men participated in the interviews of which 50% had a university degree. Persons between the age of 18 and 30 and between 41 and 50 were the most prevalent in the sample. A summary of the sample characteristics is shown in table 5.

Tabel 5 Sociodemographic characteristics of the interview sample (per country)

	Germany	**UK**	**France**
Female	64%	82%	70%
Male	36%	18%	30%
18-30	36%	9%	50%
31-40	9%	9%	20%
41-50	27%	55%	20%
>50	27%	27%	10%
About 10 years of school visit	18%	0%	0%
12/13 years of school visit	36%	0%	30%
College or university degree	45%	100%	70%
N	11	11	10

At the beginning of the qualitative interviews, consumers were probed for knowledge about the impact of food production and consumption on climate change. Following this, participants were called for their perception of climate-friendly food in particular with respect to organic and local production. Afterwards participants talked about barriers as well as incentives for climate-friendly food purchase behavior. In a next step, we explored participants' information needs with respect to climate-friendly food consumption. Finally, participants argued on the advantages and disadvantages of CO2-labels.

The interviews were transcribed by native speakers. For the analysis of the transcripts we used content analysis according to Mayring (2010) and the software MAXQDA version 11. The basic unit of analysis was a word. The category system was developed beforehand in line with the findings of the survey. The system was pretested with 6 interviews, two for each country, and adjusted were necessary. Each text segment could be assigned to more than one category.

Results

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Questionnaire

Prior to the CEs we elicited in the questionnaire which importance consumers attached to different product attributes in the purchase decision. The consumers in our study rated quality as the most important attribute of food in the purchase situation followed by price (Figure 3). Healthiness and price were of similar importance to consumers. Animal welfare standards were the most important attribute of all ethical attributes. Local sourcing was more important to consumers than climate-friendly and organic production as well as country of origin. Local sourcing and eco-friendly production were equally important to consumers.

Figure 3 Average importance attached to different product attributes*

Question: How important is each of the product attributes in your purchase decision.
*The importance was measured on a 5-point Likert scale ranging from 1-'not important' to 5-'important'.

After the CEs we asked participants a series of questions related to their willingness to tackle climate change and their perception of the two designed CO2-labels. Participants were most willing to tackle climate change by purchasing seasonal vegetables and fruits (75%) followed by buying climate-friendly products in general (59%). Simultaneously, the participants in our study were the least willing to pay a price premium of up to 20% for climate-friendly food (42%). Of the two tested CO2-labels the CO2sc was the more trusted and more comprehensible one. As could be expected, the CO2en-label was more often wrongly interpreted as indicating the power consumption of a product and thus was confused with the European energy label.

Choice experiments

In the CEs we analyzed consumers' preferences and WTP for the designed CO2-labels compared to a claim stating climate-friendliness and to organic as well as local production. Additionally, we explored the influence of different psychological variables on the purchase probability of climate-friendly labelled food by calculating mixed logit models with interaction terms. The results for the estimation of the mixed logit models in preference space without interactions are depicted in table 6 for all 6 study countries. In all countries, consumers preferred the CO2sc-label over the CO2en-label, that is the mean coefficients for CO2sc were significantly higher than those for CO2en ($p<0.001$). All mean coefficients of the tested product attributes besides price and CO2en in France and Norway had a positive sign. This suggests that climate-friendly labelled milk is more likely to be chosen than milk not indicated as climate-friendly. Consumers' preferences for organic as well as for locally produced milk were higher than their preferences for milk conventionally as well as not locally produced. The significant standard deviations for all attributes indicate that the preference for these attributes were heterogeneous among the participants.

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Table 6 Estimates for consumers' marginal utilities in the 6 European study countries

	France		Germany		Italy		Norway		Spain		UK	
Random parameters												
CO2sc	0.409	***	0.628	***	0.689	***	0.588	***	0.491	***	0.372	***
CO2en	-0.014		0.096	*	0.206	***	-0.019		0.368	***	0.145	***
Claim	0.291	***	0.340	***	0.503	***	0.437	***	0.703	***	0.118	***
Organic	0.360	***	0.479	***	0.654	***	0.413	***	0.524	***	0.155	***
Local	0.656	***	0.936	***	0.773	***	0.840	***	0.461	***	0.706	***
Price	-1.906	***	-1.806	***	-0.766	***	-1.460	***	-1.939	***	-1.597	***
Standard deviations												
CO2sc	0.497	***	0.738	***	0.676	***	0.481	***	0.658	***	0.753	***
CO2en	0.297	***	0.725	***	0.701	***	0.481	***	0.423	***	0.440	***
Claim	0.224	***	0.380	***	0.512	***	0.604	***	0.432	***	0.457	***
Organic	0.787	***	0.878	***	0.767	***	0.979	***	0.448	***	0.836	***
Local	0.235	***	0.667	***	0.600	***	0.636	***	0.198	***	0.528	***
Price	1.092	***	1.324	***	1.505	***	1.107	***	1.257	***	1.318	***
Model specifications												
N	7680		7808		7616.000		7680		7808		7744.000	
Log likelihood	-5337.813		-5488.771		-5767.541		-4613.074		-5793.489		-5909.165	
McFadden Pseudo R^2	0.367		0.360		0.311		0.453		0.325		0.305	

Note: Significance on a 99%***, 95%** and 90%* level

The estimation of interaction terms helps to explain why preferences for the product attributes differ between consumers. Table 7 shows the interaction terms between the random parameters of the attributes which explicitly indicate climate-friendliness (CO2sc, CO2en, Claim) and five different covariates originating from the questionnaire. All insignificant interaction terms were excluded from the model estimations as recommended by Hensher et al. (2015). The estimated interactions with the covariate label skepticism (Labsc) revealed that skepticism towards label influenced the probability of purchasing climate-friendly products negatively in all study countries. Label skepticism had the least negative influence on the purchase preference for climate-friendly products in the UK where label skepticism had only a negative effect on the preference for the CO2en-label while it had no significant effect on CO2sc and the claim stating climate-friendliness. In contrast, skepticism towards labels had no impact on the purchase probability of products with the CO2en-label in Italy.

Table 7 Interaction terms for explicit indications of climate-friendliness

	France		Germany		Italy		Norway		Spain		UK	
CO2sc*Labsc	-0.270	***	-0.347	***	-0.195	***	-0.244	***	-0.270	***	-	
CO2en*Labsc	-0.216	***	-0.307	***	-		-0.202	***	-0.203	***	-0.087	*
Claim*Labsc	-0.217	***	-0.240	***	-0.200	***	-0.246	***	-0.182	***	-	
CO2sc*PCE	0.353	***	0.492	***	0.335	***	0.480	***	0.340	***	0.311	***
CO2en*PCE	0.296	***	0.358	***	0.189	***	0.318	***	0.255	***	0.323	***
Claim*PCE	0.278	***	0.262	***	0.390	***	0.368	***	0.251	***	0.209	***
CO2sc*Sukno	0.122	**	0.232	***	0.117	**	-		0.142	***	0.080	*
CO2en*Subkno	0.088	**	0.260	***	0.150	***	0.095	**	0.104	**	0.105	***
Claim*Subkno	0.159	***	0.106	***	0.078	**	-		-		0.072	**
CO2sc*CCcon	0.220	***	0.415	***	0.171	***	0.301	***	0.227	***	0.227	***
CO2en*CCcon	0.124	***	0.256	***	0.131	**	0.266	***	0.158	***	0.235	***
Claim*CCcon	0.190	***	0.158	***	0.335	***	0.302	***	0.178	***	0.236	***
CO2sc*FutGen	0.264	**	0.318	**	-		0.338	**	-		0.216	*

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CO2en*FutGen	-		-		-		0.326	**	-		0.403	***
Claim*FutGen	0.222	*	0.267	**	0.435	***	0.708	***	0.276	**	0.326	***

Note: Significance on a 99%***, 95%** and 90%* level

All coefficients of the three calculated interaction terms with the covariate perceived consumer effectiveness (PCE) had a positive value and were significant. Subjective knowledge (Subkno) also had a positive influence on purchase probability in most countries. Only in Spain and Norway subjective knowledge had no significant effect on the preference for products with a claim and on products labelled with the CO2sc-label in the case of Norway. Additionally, concern about climate change (CCcon) enhanced the probability of buying climate-friendly products in all study countries as did concern for future generations (FutGen).

The analysis of consumers' WTP show that consumers were willing to pay a price premium for climate-friendly labelled food in all study countries stressing consumers' interest in CO2-labels (Table 8). Of all three explicit indications of climate-friendliness consumers were willing to pay the highest price premium for the CO2sc-label followed by the claim and the CO2en-label ($p<0.001$). When comparing the WTP for the CO2sc-label between all study countries it became obvious that Italians were prepared to pay the highest price premium for the CO2sc-label with 0.24 € (+33% of the lowest price level)($p<0.001$). The claim indicating climate-friendliness reached higher price premiums compared to the CO2en-label ($p<0.001$) except in the UK where consumers were prepared to pay 2 cents more for the CO2en-label than for the claim ($p<0.1$). When comparing all tested product attributes, consumers were willing to pay the highest price premium for locally produced products with the exception of Spain. In Spain WTP for local and organic production as well as for the indication of a claim signaling climate-friendliness did not differ significantly. Thus, Spanish participants were prepared to pay similar prices for these three attributes and comparatively less for the two CO2-labels. In France, Italy, Norway and UK participants revealed a similar WTP for the CO2sc-label and organic production.

Table 8 Estimates for consumers' willingness to pay in Euro per 1 l UHT-Milk

	France	**Germany**	**Italy**	**Norway**	**Spain**	**Uk**
Random parameters						
CO2sc	0.11 ***	0.13 ***	0.24 ***	0.14 ***	0.14 ***	0.10 ***
CO2en	0.03 ***	0.03 ***	0.09 ***	0.00	0.11 ***	0.06 ***
Claim	0.06 ***	0.05 ***	0.14 ***	0.09 ***	0.15 ***	0.04 ***
Organic	0.12 ***	0.10 ***	0.23 ***	0.14 ***	0.16 ***	0.09 ***
Local	0.19 ***	0.20 ***	0.27 ***	0.27 ***	0.15 ***	0.15 ***

Note: Significance on a 99% level ***

Face–to-face interviews

The quantitative research step revealed that consumers' were interested in CO2-labels and that label skepticism, perceived consumer effectiveness, subjective knowledge, concern about climate change as well as the concern for future generations all had an impact on the purchase probability of climate- friendly food. But the results of the questionnaire and the CEs came to different conclusions with respect to the WTP for climate-friendly food. While less than half of the participants in the survey stated in the questionnaire to be prepared to pay a price premium from up to 20% for climate-friendly food the results of the CEs indicated otherwise. Against this background, the interviews aimed at analyzing this contradiction between consumer statements in the questionnaire and the CEs. Additionally, the interviews aimed to gain a deeper understanding of consumers' knowledge about climate change and climate-friendly food and resulting information needs in order to develop recommendations for the support of climate-friendly food consumption.

Our interview results show that participants had only a vague idea of how food production and consumption impact climate change. Asked about how food production and consumption affect climate change participants

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frequently stated that the emissions resulting from global food trade and from the production process itself enhanced climate change. The climate impact of food production was sometimes deduced from the degree to which a product was processed. In this logic a highly processed product had a bigger impact on climate change than a less processed product due to the supposedly higher use of energy and other resources during the production process. For the same reasons some participants believed that the agricultural production intensity and the application of drugs and pesticides had an impact on climate change. Deforestation caused by agriculture was another aspect mentioned. A few participants pointed out that the rearing of animals impacted climate change because of the climate-damaging gases emitted by for example cows and that the reduction of meat consumption would be beneficial for the climate. Other food specific measures mentioned were the avoidance and reduction of food waste and in this context the reduction of overproduction. In particular German and Scottish participants highlighted food waste.

Participants had difficulties separating climate change from other environmental and ethical topics. They tended to subsume climate change and related issues under an umbrella of environmental and ethical issues. Some participants talked about measures they undertook for the environment and to foster animal welfare as well as about fair trade and not only about directly climate related topics when they were asked which measures could be undertaken to combat climate change and about the impact of food production on climate change. One common topic in this respect was the engagement in activities for an efficient use of resources (e.g., wearing second hand clothes, preferring electrical devices with a low energy demand, saving water). Especially, in France and UK recycling emerged as a solution for climate change while it was not brought up in Germany. But the convergence of climate-friendliness and eco-friendliness did not persist for a part of the participants when talking about concrete production schemes not necessarily directly related to personal behavior.

In line with the vague knowledge about the impact of food production and consumption on climate change, people often lacked a concrete idea what climate-friendly food means. Frequently, participants started to develop an idea about the term when asked if they bought climate-friendly food:

"Probably if the product is grown naturally – meaning not in a greenhouse. Is this correct?" (DE, Participant 2, female).

Climate-friendly food was associated with local production and sometimes also with seasonal produce. Local production was mostly associated with a more climate-friendly production due to shorter transport distances. Although some participants argued that local products would not be particularly climate-friendly as long as they are produced conventionally. Other associations with climate-friendly food were self-grown and naturally produced food. Naturally produced referred to the less processed as possible and the farming of animals and growing of plants in their natural environment.

Some participants also related organic to climate-friendly. It was reasoned that the ban of artificial pesticides and fertilizers made organic products more climate-friendly. Others stated that they had no clear idea if organic would be more climate-friendly than conventional products. A part of the participants doubted the climate-friendliness of organic food due to potentially long transport distances and production in big scales. Other reasons were that organic products still can be processed and thus used more energy and other resources than unprocessed foods. Interestingly, some participants argued that organic production was eco-friendly but not necessarily climate-friendly.

Labels for climate-friendly products were mostly unknown even though the UK retailer 'Tesco' had a CO2-label before it started to phase it out in 2012 and the French retailer 'Casino' still displays a carbon footprint on their own products. Many participants said that information about climate-friendly food was scarce or even not present at all and that they would need more information in order to consider buying climate-friendly food. Thus far, climate-friendliness was often not the main reason preferring certain products over others but rather

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a positive side-effect. In line with this, some participants stated that they would not be willing to pay a price premium for climate-friendly food.

As a result, lack of knowledge about climate-friendly food was identified as an important barrier for purchasing (more) climate-friendly food. Additionally, some participants were skeptical about the information offered. Some perceived it as greenwashing. A part of the participants felt overwhelmed by the information already offered and thus were not inclined to consider for example another label in their purchase decision. Others were generally in favor of more information. Thus, the interviewees were undecided if too much or too few information about climate-friendly behavior and climate-friendly food consumption in particular was available:

"I think it's there, I think it's there. I think if you looked through it you would find it but I think if you're lazier, you're not that way inclined, you're not going to go and look for it until it really starts to affect you" (UK, Participant 31, female).

Given this contradictory views participants in tendency preferred to have more information about climate-friendly food but just to have the information around in case they wanted to take a look and not always in order to consider this information in their everyday choices. The information should be practical and enabling like tips about how to integrate climate-friendly behavior in everyday life. Additionally, the information should be concise, comprehensible, reliable and readily available. Relevant information sources were campaigns and publicities, on- and offline media (TV, radio, newspapers, social media), the internet in general, stores and product packages. A CO2-label was also welcomed but not perceived as absolutely needed and some participants even doubted that they would use such a label. The introduction of just one CO2-label or the inclusion of climate considerations into one overarching eco-label together with other environmental issues were perceived as the most promising approaches in this respect. Participants highlighted the importance of having just one CO2-label in order to reduce confusion and adding to the information overload.

Discussion

The results of the survey and the interviews confirm European consumers' general interest in CO2-labels. In both research steps participants welcomed CO2-labels on foods. In the CEs consumers were willing to pay a price premium for products showing an explicit indication of climate-friendliness. Of the two tested carbon labels the one showing a horizontal scale (CO2sc) was clearly preferred over the one inspired by the EU energy label (CO2en). The CO2sc was more comprehensible and more frequently trusted. Consumers in all study countries were prepared to pay the highest price premium for the CO2sc-label compared to the CO2en-label and the claim.

But our study also stresses that climate change is less important to consumers than other environmental, personal and social issues (see also Hartikainen *et al,.* 2014; Lorenzoni and Pidgeon, 2006). Consumers attached higher importance and were willing to pay higher price premiums for local production than for climate indications and organic production in most of the study countries. This findings underline the growing popularity of locally sourced food (Darby et al., 2008; Feldmann and Hamm, 2015; Meas et al., 2014; Zepeda et al., 2006).In four of the six study countries WTP for the CO2sc-label and organic production was similar. This suggests potential substitution effects between the shown CO2-labels and the attributes local and organic production. Lombardi et al. (2016) found that an increase in utility of carbon free milk decreases the utility of organic milk. Apart from that, Onozaka and Mc Fadden (2011) showed that carbon labelling is complementary to the indication of local sourcing. Participants in their study were more reluctant to purchase local products if they displayed a high carbon footprint which was mostly in the off-season the case. The indication of origin together with a carbon label reduced carbon emissions due to the fact that consumers were able to take seasonal aspects of production into account with respect to greenhouse gas emissions (Onozaka et al., 2015).

The interviews show that consumers had problems to define and to identify climate-friendly food. This might be another reason for consumers to prefer local and organic production over any explicit climate indications.

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Consumers are more familiar to the term 'local' and to the organic logo as both are actually present in the market. Also consumers associate more ethical and personal benefits with organic and local than with indications of climate-friendliness (Röös and Tjärnemo, 2009; White et al., 2009). Consumers associate local production with the benefits of sustaining local farmland and contributing to the local economy as well as healthiness (Onozaka and McFadden, 2011; Darby et al., 2008; Feldmann and Hamm, 2015).

Combining the results of the preferences for carbon labels, local and organic production with the findings of the interviews shows that participants tended to subsume climate indications together with the attributes local and organic production under the umbrella term eco-friendly behavior. Consumers paid more attention to more 'general' green and ethical goals than to climate change in particular (see also De Boer et al., 2016; Hartikainen et al., 2014). The carbon footprint is one aspect of many environmental and ethical criteria which participants are likely not to differentiate in detail.

Consumers' problems in defining climate-friendly food are also an indication for the lack of knowledge about climate-friendly engagement (see also Berry et al., 2009; Upham and Bleda, 2009). Consumers felt that they were not aware enough about options to act climate-friendly (see also Beattie and Sale 2009; Gadema and Oglethorpe, 2011; Hartikainen et al., 2014). Thus, they demanded more practical and concise information. In this context, they also welcomed the introduction of a CO2-label. However, participants stressed simultaneously the already present information overflow as well as label fatigue and skepticism. Information should be available but will not necessarily be considered in everyday choices. In our study some of the interviewees doubted that they would pay attention to CO2-labels even though they generally appreciated the presence of such information. Thus, a substantial use of CO2-labels by consumers is questionable (see also Grunert et al., 2014; Hartikainen et al., 2014; Upham et al., 2011). All these reasons might explain why consumers in a part of the quantitative step and in the qualitative research step as well as in other studies stated to be mainly unwilling to pay a price premium for climate-friendly food (e.g., Gadema and Oglethorpe, 2011; Hartikainen et al., 2014; Vanclay et al., 2011). The contrasting results of our CE (and also in a study by De Marchi et al., 2016) might rather be an expression of general interest and importance attached to the issue of climate change instead of revealing a potential for a price premium for climate-friendly labelled food in the market.

With respect to the impact of different socio-psychological constructs on climate-friendly purchase behavior we found that the stronger consumers believed that their efforts made a difference in the mitigation of climate change and thus, the higher the perceived consumer effectiveness (PCE), the more they were willing to buy climate-friendly products. This confirms previous non-food related studies (Lorenzoni et al., 2007; Truelove and Parks, 2012; Semenza et al., 2008) which point out that the PCE of one's efforts to mitigate climate change is a strong predictor of intention to perform climate-friendly actions. Also our results show that subjective knowledge enhanced the probability of purchasing climate-friendly products labelled as such in most cases. This underlines that consumers have to have some knowledge about the climate-friendliness of products in order to act climate-friendly in a conscious way (Kollmuss and Aygeman, 2002). Additionally, attitudes towards an issue are another important factor influencing environmental behavior (Kollmuss and Aygeman, 2002). It is thus not surprising that people who were more concerned about climate change were also more inclined to purchase products with climate indications. In the same direction, our study shows that the perceived responsibility for future generations had a significant positive effect on the preference for climate-friendly products in all study countries (see also Berné-Manero et al., 2014; Brécard et al., 2012; De Marchi et al., 2016; O'Neill and Nicholson-Cole, 2009; Salladarré et al., 2010; Whitmarsh, 2009). Skepticism towards carbon labels influenced the probability of purchasing climate-friendly products negatively which was to be expected since consumers' trust is a central prerequisite for product indications in order to be successful in the market (see e.g., Golan et al., 2001; Zander et al., 2015a).

Conclusion

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Our study shows that consumers are interested and concerned about climate change and are also willing to engage in actions against climate change. The results suggest that the CO2sc-label might be an appropriate design. In order to foster climate-friendly consumption with the introduction of a CO2-label various aspects have to be taken into account. The introduction of just one reliable CO2-label is advisable and this one needs to be easily comprehensible for consumers and well communicated to them.

But, the likely contribution of a CO2-label to a more climate-friendly consumption will be limited for several reasons. Due to a lack of knowledge and problem awareness consumers might be challenged and overburdened at the point of sale when making climate friendly decisions. In this regard, the limits of ethical consumer behavior become obvious. Information provision can be just one piece of a broader concept to promote lifestyle changes and public acceptance (Berry et al., 2008; Gadema and Oglethorpe, 2011; Prieß, 2011; Whitmarsh, 2009, 2011). Particularly, policy makers are challenged to set proper structures to foster citizens' climate-friendly behavior. These structures should consider the broader context of environmental and general ethical issues in order to facilitate uptake.

Nevertheless, there are also indirect effects of consumer labels which can be quite effective: Retailers might adjust their sourcing policies by requiring carbon footprint labelling and removing products with particularly high carbon values within a product category (e.g., Berry et al., 2008; WB, 2011). One excellent example is the sustainability label of the MSC (Marine Stewardship Council) for wild fish. In Germany the largest share of frozen fish is labelled with the MSC logo and many retailers committed themselves to phase out wild fish products without a sustainability label, although consumer knowledge is limited (Zander et al., 2015b).

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