Effects of green nudges on consumer valuation of sustainable food: A discrete choice experiment

Sustainable nutrition is becoming increasingly relevant in society. This empirical study suggests that green nudges can encourage consumers to buy food that has an ecology or animal welfare label.

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GAIA 32/2 (2023): 233 – 240

Abstract

This paper analyzes whether green nudges – displaying nature pictures or providing information on other people's behavior before the consumer makes a choice – can promote more environmentally friendly food choices. Based on data from an online, discrete choice experiment conducted in Germany, in which randomly selected groups of participants were shown either one of the nudges (treatment groups) or no nudge (control group), the study finds that green nudges increase individuals' willingness to pay more for products that have ecology and animal welfare labels. However, consumers in one of the treatment groups were willing to pay more for meat rather than the meat alternative, indicating that nudges can have an effect opposite from that intended. Future research should investigate the impact of these relatively cheap interventions with a representative sample and in a field setting.

Keywords

choice experiment, environmental behavior, nudge, sustainable consumption, willingness to pay

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https://doi.org/10.14512/gaia.32.2.6
Received August 5, 2022; revised version accepted May 17, 2023 (double-blind peer review).

In recent years, several environmental disasters due to extreme weather events (Barlow et al. 2020, Green 2020), have highlighted the importance of reducing human environmental impacts. On the level of the individual, shifting food choices towards more sustainable consumption (e.g., less meat) is one way to increase environmental protection. Because food choice is a personal matter, using methods to support rational and value-congruent, individual decision-making is critical to moving collective behavior in a more sustainable direction (IPCC 2018).

As consumers' decisions may deviate from their original values or be biased in other ways, there is an opportunity to use behavioral techniques to promote more sustainable consumption (Wensing et al. 2020). This article summarizes the results of an online experiment that we conducted in Germany to investigate whether *green nudges*[1] (showing consumers images of nature or informing them about other people's behavior before they make a decision) have an impact on consumers' evaluation of and willingness to pay (WTP) for more or less sustainable food products.

Scholarly evidence on the effect of nudges in the food environment is still rare (Kwasny et al. 2022, p. 12). In a systematic review, Blackford (2021) identified 14 studies on the effect of nudges on sustainable food choices in real-life settings. The nudges studied included changing the display of the choice options, changing the portion sizes, providing different sustainability labels or information on different sustainability options, as well as changes to the default product. The studies found mixed results. Kwasny et al. (2022) focused on interventions to reduce meat consumption, including real and intended choices. They report on three studies that investigated the effect of so-called social norm nudges, which provide information on other individuals' behavior. These nudges were able to reduce (intended) meat consumption. More recently, Bauer et al. (2022) provided evidence for a small effect of a social norms nudge combined with an information nudge in a supermarket setting.

In the present study, we investigate the effect of two nudges that have not or only rarely been studied in the context of sus- >

1 Following Sunstein (2014), nudges can take various forms – from default settings on a printer to reduce paper consumption to text messages reminding people of scheduled doctor's appointments – and they serve the purpose of making one's life "simpler, safer or easier" (Sunstein 2014, p. 584).

TABLE 1: Levels of the attributes in the discrete choice experiment (DCE).

ATTRIBUTE	LEVELS	DESCRIPTION
product type	meat product/meat alternative	Is the product made of meat or a meat substitute?
animal welfare label	present/absent	Is there an animal welfare label on the product?
ecology label	present/absent	Is there an ecology label on the product?
price (Euro)	1.23 / 1.99 / 2.49 / 2.99 / 3.49	What is the price of the product?

tainable food choices but have been found to be effective in the choice of packaging alternatives (Wensing et al. 2020): showing nature pictures and a social norm nudge. Wensing et al. (2020) found that different nudges can have different effects on label perceptions, and thus, purchase decisions. As a first, inexpensive approach to explore possible effects of these nudges in the context of food choice, we conducted a randomized online experiment. Following Wensing et al. (2020), we focused on two questions: we investigated 1. whether the nudges pushed individuals' hypothetical choices towards the more sustainable option (meat alternative instead of meat), and 2. whether the nudges increased individuals' valuation of labels, and thus (to the extent that products with labels are considered more sustainable than products without labels) may have an indirect effect on the choice of sustainable options.

Experimental setup

Experimental design

We performed a discrete choice experiment (DCE), an approach widely used in economics, to study whether green nudges influence individuals' meat-consumption choices. The DCE was implemented through an online survey and is described in detail below.

In the survey (in German), we first collected socio-demographic data (such as gender, income, occupation, etc.), and, amongst other things, information about participants' dietary habits (mixed, vegetarian, pescetarian, and vegan diets). We then randomly assigned respondents into one of three groups: two different treatment groups and one control group. Respondents in the treatment groups were exposed to different nudges before the DCE, the control group was not subject to any intervention.

The first treatment exposed the respondents to pictures that were randomly drawn from a set of nature pictures of the *Nencki Affective Picture System* database (Marchewka et al. 2014). Since a stimulus should not be overtly obvious, the nature images were presented as an evaluation task and respondents were asked to rate the pictures' perceived attractiveness.[2]

The second treatment was a norm nudge[3], which provided information taken from a study by the European Consumer Organization (BEUC 2020):

> *"A survey by the European Consumers' Association, which examined attitudes toward more sustainable food consumption, found the following: Two-thirds of consumers are willing to change their eating habits to benefit the environment. Wasting less food at home and buying seasonal fruits and vegetables is also widely supported. Just over 40% of consumers say they have either stopped eating red meat or reduced it for environmental reasons. More than 1 in 3 consumers are currently unwilling to eat less red meat. As for the consumption of dairy products, only 1 in 5 are willing to reduce consumption."*

Since both nudges – seeing a nature picture or learning about other people's behavior – may activate pro-environmental values, we expected an effect on food choices.

All respondents then entered the DCE. In a DCE, respondents are generally asked to choose from a set of alternatives (e. g., products or situations) that vary in different attributes. Following McFadden (1974), answers to a series of hypothetical questions can be used to estimate consumer preferences, for example, how much they are willing to pay for different product attributes.

However, before participants got to see the DCE, they were asked whether they follow a mixed, vegetarian, pescetarian, or vegan diet. Depending on the answer, the participants were presented with a DCE that matched their diet. We tested the DCEs beforehand in a pretest as is recommended by Kløjgaard et al. (2012) and were able to keep our design without any further adjustments. In this study, we present the results for "meat eaters" only, as this is likely the subsample with the greatest potential impact on the environment given the green-house gas (GHG) emissions related to meat consumption (Hallström et al. 2014). Participants who reported following a mixed diet were asked to choose between three unlabeled options, two food products (e. g., meat or an unspecified meat alternative) and the option not to buy any product. The food products varied in four different attributes that are described in detail in table 1: the product type (meat, meat alternative), whether the product had an animal welfare label (yes or no), whether it had an ecology label (yes or no), and the product's price. The attributes and their levels were selected with the help of a literature review.[4] In order to exclude the possibility that the participants would include other factors in their decision, the given decision situation was described to them

2 The pictures used, and an explanation of the rating task, can be found in the online supplementary material [SM], here SM C, available at *https://doi.org/10.14512/gaia.32.2.6.suppl*. Furthermore, several studies find that nature pictures influence or activate environmentally friendly values (e. g., Wensing et al. 2020).

3 A norm nudge relies on "eliciting social expectations with the intent of inducing desirable behavior" (Bicchieri and Dimant 2022).

TABLE 2: Example of a choice set (DCE in the online survey).

	OPTION 1	OPTION 2
product	meat	meat alternative
label 1	with animal welfare label	without animal welfare label
label 2	with ecology label	without ecology label
price	2,49 Euro	2,99 Euro

○ I choose option 1.
○ I choose option 2.
○ If these options are the only two present, I choose neither one.

again in detail and it was explained that the products are identical except for the four attributes. After that, ten choice sets were presented to each participant (table 2 for an example of a choice set and SM B2 for the introduction text and all choice sets).[5]

The specific design of the choice sets was created using the R-package *support.CEs* and a rotation design method (Aizaki 2012).

Animal welfare and ecology labels were incorporated as attributes in the choice sets because a vast majority of food products carry a label in the real world (Grunert et al. 2014). The variety of existing labels made it necessary to provide examples of the labels (box 1), which was done on a separate page in the questionnaire, before the choice sets were presented. Instead of assigning specific positive or negative labels to a certain product, we varied only the presence or absence of the label between the alternatives.

Providing a specific ecology label for a meat product, for example, would have revealed this product as being either beef, pork, poultry, or another type of meat as the ecological impact varies between types of meat. For informed consumers, the hypothetical choice would then have been between a specific type of meat, the meat alternative, and opting out, which would have biased the results as label preferences would have been mixed with taste preferences.

Data collection and description

We collected the data via a non-representative online survey from February 28 to March 31, 2021, in Germany.[6] The survey was distributed among students at the University of Halle, as well as through mailing lists of individuals who used to hold a *German National Merit Foundation* scholarship. A total of 831 participants started and 660 completed the survey (completion rate ≈ 79.4%). All further results presented in the study are based on the 411 participants who reported that they eat meat.

Table 3 (p. 236) illustrates the distribution of socio-demographic variables for the sample of meat eaters. Compared to the German population (last column), our sample is, on average, young, female, (well-)educated, and in the lower range of the income distribution. Differences to the average German population likely stem from the way the survey respondents were invited to partake in the study. Furthermore, there may be a self-selection bias surrounding online surveys (Bethlehem 2010), and the topic of the survey may have attracted a specific group of individuals.

BOX 1: Animal welfare and ecology label in the questionnaire

This is an example of the labels used in the questionnaire. The description should help the participants to better imagine the labels. A combination of traffic light scores and informational text was chosen, emphasizing that a label can indicate both a good and a bad score in the DCE. A detailed description can be found in SM D[2].

It is important to interpret the results with respect to these limitations.

Though the sample may not be representative of the German population generally, importantly, covariates are balanced across the three treatment groups. Chi square tests confirmed that the randomization worked well and differences in choices between the groups can thus be interpreted as effects of the nudges.

Methods

The DCE approach refers to the approach described in McFadden (1974) and is based on random utility theory. This technique relies on the assumption that individuals make choices to maximize their own wellbeing. When presented with different options, individuals will choose the option that generates the highest utility for them. Observing individuals' (hypothetical) choices in different situations will – when the situations are designed usefully – allow inference into what matters to individuals.

In our specific example, we presented individuals with ten different choice sets, each with three options (two different products, and no consumption as the third option) where the products further varied in the four attributes described above: product type (MP=1 meat product, 0 meat alternative), whether an animal welfare label was present (AL=1, 0 no animal label), whether an ecology label was present (EL=1, 0 no label), and price (PRICE). For each of the choice sets, we recorded the option that individuals chose (the stated choices). >

4 Care was taken not to present too many attributes, as this would lead to a higher error term variance and a decrease in the completion rate (Caussade et al. 2005). Furthermore, the levels were chosen to be comprehensible and relevant (Kløjgaard et al. 2012).

5 The number of choice sets per participant depends primarily on the impact on completion rate and cognitive burden, with Caussade et al. (2005) recommending an optimal number of choice sets per individual of 9 to 16. Similarly, for the number of alternatives, the decision was made to use the opt-out alternative because leaving it out would lead to WTP inflation (Veldwijk et al. 2014).

6 The survey was thus fielded during the COVID 19 pandemic. Given that we only have data for that time period, we are unable to assess whether the pandemic influenced the results.

TABLE 3: Descriptive statistics across treatment groups and averages for the German population. CTRL, PIC and NORM depict the control, the picture nudge, and the norm nudge groups, respectively. All numbers are in percentage share of the respective group, except for age and environmental awareness, where the numbers represent group means.

		CTRL	PIC	NORM	GERMAN POPULATION[b]
environmental awareness[a]		3.33	3.32	3.28	—
gender	female	62.9 %	61.3 %	64.2 %	50.8 %
	male[c]	37.1 %	38.7 %	35.8 %	49.2 %
age		30.7	32.5	30.7	44.7
monthly income	< 2,000 €	67.4 %	71.1 %	72.3 %	64.6 %
	≥ 2,000 €	32.6 %	28.9 %	27.7 %	35.4 %
occupation	part- or full-time	41.7 %	38.0 %	38.7 %	91.5 %
	student	59.3 %	55.6 %	61.3 %	5.8 %
	seeking work	3.0 %	1.41 %	2.19 %	5.3 %
education	finished high school	43.2 %	47.2 %	40.9 %	26.6 %
	Bachelor's or Master's degree	31.8 %	19.7 %	31.4 %	1.3 %
	state examination	5.3 %	7.8 %	5.8 %	—
	(state) doctorate	8.3 %	5.6 %	8.0 %	1.1 %
	vocational degree	8.3 %	12.0 %	11.7 %	56.9 %
no. of observations		132	142	137	

a Environmental awareness is measured on a scale from 1 ("I do not know anything about the impact of agricultural practices on the environment") to 5 ("I am very well informed about the impact of agricultural practices on the environment"). | b The measure of environmental awareness in the survey cannot be compared to measures used on a representative German sample, and there is no uniform source stating numbers of Germans with state examination as their highest educational degree. The numbers in the column refer to statistics from the German Federal Statistical Office from the years 2019 to 2022 for different characteristics (Statistisches Bundesamt 2023 a – e). | c Includes four individuals who reported non-binary as a category.

More specifically, random utility theory assumes that the utility can be represented as the sum of the utilities that individuals receive from the different attributes of the option (plus a random unobserved individual-specific component). How much utility individuals derive from different attributes is captured by weights (also called parameters or coefficients) that individuals attach to these attributes (McFadden 1974). An individual, for example, who is concerned about animal welfare may derive high utility from consuming products with animal welfare labels, and thus attaches a high weight to the presence of such a label. Similarly, an individual who is price sensitive will attach a high (negative) weight to the price.

We use the data from our online survey to estimate the weights that individuals attach to the different features (MP, AL, EL, PRICE, No-buy) using a mixed logit model (see SM A for a detailed mathematical description, equation A4[2]). The exact model results from an assumption on the statistical distribution of the random component of individual utility. We further allow for heterogeneity in the weights that individuals attach to the different attributes (MP, AL, EL) and assume that the weights, or "random parameters", are distributed normally. We then estimate the average and the standard deviation of the distributions of the weights for the different attributes. We further allow for correlation between the random parameters by assuming a multivariate normal distribution.

As utility functions are not unique representations of individuals' preferences, their values can only be interpreted ordinally, not cardinally. The magnitudes of the estimated weights are thus only meaningful relative to each other. As the model includes price as an attribute, we can translate the estimated weights into monetary units. By dividing the estimated weights of the other attributes by the weight attached to the price, we get a measure of how much each specific attribute is worth to the individual, relative to the price. Or stated differently, how many Euros an individual would be willing to pay for a product because of the specific attribute. Following the literature, we call this the WTP (Aravena et al. 2014).

As a means of investigating our research questions 1. whether the nudges affect consumers' valuation of meat compared to the (unspecified) meat alternative, and 2. whether they affect consumers' valuation of the presence of labels, we included interaction terms of the indicator variables that capture the two treatments (picture and norm nudge) with the indicator variable for the attributes in our estimation (see SM A, equation A4[2]). The coefficients on the interaction terms capture to what extent the weights of the attributes vary with the treatment compared to the control group. We assess the significance of our results against a 5 % significance level.

Results

The mixed logit model was estimated to determine the general preferences and the effects of nudges. We specified the model so that the reference product, against which all parameters have to be compared, was a meat alternative without animal and ecol-

TABLE 4: Mixed logit regression results (dependent variable: choice). Positive values mean a higher valuation than "meat alternative, no label".

MEAN COEFFICIENTS	COEFFICIENT	STANDARD ERROR	95 % CONFIDENCE INTERVAL
no-buy	**−3.27*****	0.14	−3.54−−3.00
price	**−0.34*****	0.05	−0.43−−0.25
meat	**0.85*****	0.10	0.65−−1.05
animal label	**1.93*****	0.12	1.70−2.16
ecology label	**1.37*****	0.11	1.16−1.58
interaction effects			
meat x picture	0.13	0.14	–0.14−0.39
animal label x picture	**0.39*****	0.15	0.10−0.67
ecology label x picture	0.25*	0.14	−0.03−0.52
meat x norm	**0.29****	0.14	0.01−0.56
animal label x norm	**0.42*****	0.15	0.13−0.71
ecology label x norm	**0.41*****	0.14	0.14−0.69
STANDARD DEVIATION (SD) COEFFICIENTS			
sd meat	**2.31*****	0.11	2.10−2.52
sd animal label	**1.57*****	0.10	1.39−1.76
sd ecology label	**1.54*****	0.10	1.35−1.71
AIC (Akaike Information Criterion)	6,084.70		
log likelihood	−3,000		
no. of observations	3,960		

***p < 0.01; **p < 0.05; *p < 0.1. **Bold parameters** are significant at the 5 % level. The model allows for correlation between the random parameters (meat, animal label, ecology label) in a multivariate normal distribution. Correlation coefficients are available upon request.

ogy labels. We used a model selection process to identify the model that best fits our data. More specifically, we employed likelihood ratio tests to compare different models with each other. The model that fits the data best was a mixed logit model that accounts for the repeated decisions per person and allows for correlation between the random parameters in a multivariate normal distribution.[7] Table 4 presents the estimation results of this model. The upper panel of the table gives the estimates of the mean weight (as well as their standard errors and the 95 %-confidence intervals in columns two and three) that participants attach to the opt-out alternative (no-buy), the meat product, and the included attributes (i. e., price, animal label, ecology label) relative to the reference product. For example, the positive coefficients on meat and on the two labels indicate that individuals value meat products more highly than the meat alternative, and value products with labels more than those without. The interaction terms in the upper panel indicate differences between the two treatment groups and the control group, respectively. The lower panel presents the estimated standard deviations of the random parameters.

As expected, we observed a negative price coefficient. Generally, this means that individuals prefer cheaper products, as their utility falls with higher prices. The no-buy variable describes the opt-out alternative. The negative coefficient indicates that the respondents receive a lower utility from not choosing any product.[8]

The mean coefficients of the random parameters and their standard deviations are also significant at the 5 % level. The significant standard deviations show that there is heterogeneity with- >

7 Since repeated decisions per individual are observed, it is important to include this information in the model, which can be done using a panel specification of the mixed logit model. Furthermore, we included so-called random parameters. These coefficients (i. e., meat, animal label, ecology label) are modeled using a distribution assumption (i. e., a normal distribution). This means that we estimate not only a mean coefficient for these variables but also the variation of these coefficients and consider heterogeneity within the sample (Train 2009). In contrast, the coefficients of the no-buy and price attributes were fixed. This can be explained by the fact that this ensures that a negative sign is estimated for the price coefficient and that WTP is normally distributed (Revelt and Train 1998). Thus, the price coefficient is fixed across individuals, but the WTP varies across individuals. Since the no-buy alternative was not the subject of this study and was not relevant for the calculation of WTPs, the corresponding coefficient was also fixed.

8 During the model selection process, we checked whether the inclusion of a second alternative specific constant (alternative 1 vs. 2) has an effect on the results. This was not the case, which was in line with our prior expectation as the alternatives were unspecified.

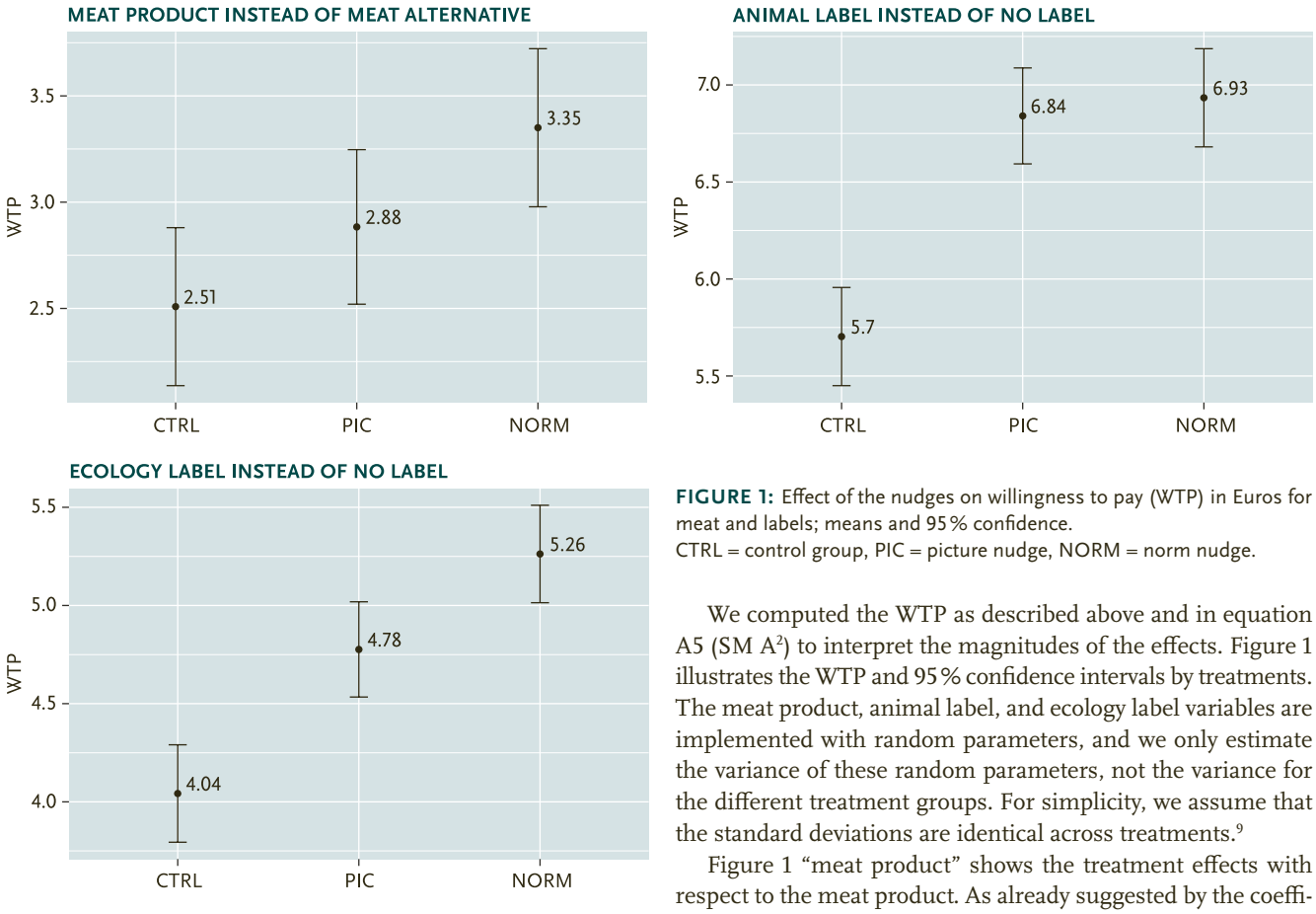

FIGURE 1: Effect of the nudges on willingness to pay (WTP) in Euros for meat and labels; means and 95 % confidence.
CTRL = control group, PIC = picture nudge, NORM = norm nudge.

in the sample with respect to the utility attached to meat consumption, the animal and the ecology labels. Additionally, on average, participants prefer meat products to meat alternatives and derive positive utility from the presence of an animal and ecology label (indicated by a positive coefficient of the meat and each of the label variables).

The interaction terms indicate the treatment effects of the nudges. For research question 1, the interaction effects between the nudges (picture or norm) and the meat attribute are relevant. These interaction terms are positive, albeit only statistically significant for the norm nudge at the 5 % level. Although we expected that both nudges would push consumers towards more environmentally friendly choices, and thus towards the meat alternative, the results in table 4 indicate the opposite. On average, the norm nudge pushes individuals to prefer the meat product relative to the meat alternative, whereas the picture nudge has no significant effect on the valuation of the meat product.

The interaction terms of the nudges with the labels were used to answer research question 2. The results indicate that both nudges increase the weight that consumers attach to the presence of labels. Although the estimate is only significant at the 10 % level (p-value = 0.075) for the combination of the picture nudge and the ecology label, the estimates are positive and significant at the 5 % level for all other combinations.

We computed the WTP as described above and in equation A5 (SM A[2]) to interpret the magnitudes of the effects. Figure 1 illustrates the WTP and 95 % confidence intervals by treatments. The meat product, animal label, and ecology label variables are implemented with random parameters, and we only estimate the variance of these random parameters, not the variance for the different treatment groups. For simplicity, we assume that the standard deviations are identical across treatments.[9]

Figure 1 "meat product" shows the treatment effects with respect to the meat product. As already suggested by the coefficient estimates, the means of WTPs differ between the control and the two treatment groups. Although individuals in the control group were willing to pay more for the meat product than for the meat alternative, individuals in the norm nudge are willing to pay even more.[10]

In figure 1 "animal label", we displayed the treatment effects on the WTP for the animal label. Both types of nudges induce a positive effect on the WTPs for the animal label. This means

9 We tested this assumption by estimating one model for each treatment and then calculating WTP. The results showed that the standard deviations of the WTPs are similar, which supports our assumption. Results available from the authors upon request.

10 Given that the most expensive product in our design costs only 3.49 Euros, it may seem strange that, for example, individuals with the norm nudge are willing to pay 6.93 Euros more for a product with an animal label than a product without this label. This is possible as the WTP is constructed by dividing the coefficient of the alternative (e. g., label) by the price coefficient. Therefore, the results are not limited to the original price range of the products in the choice set. Moreover, in a DCE, there is the possibility of the so-called hypothetical bias because respondents are placed in a hypothetical setting where their choices have no consequences. Thus, their reaction in a real-world situation may differ from that within the experiment (e. g., Murphy et al. 2005, Vossler and Watson 2013, find an overestimation of WTP). For this reason, the results should be interpreted with caution regarding the absolute size of WTP. On the other hand, a comparison of the WTPs among themselves is less problematic since the overestimation of WTP applies equally to all treatments and attributes.

that participants are willing to pay more because of the mere fact that an animal label is on the product. This is a very interesting finding and may reflect the fact that the nudges make individuals more likely to notice the label. This result is also supported by figure 1 "ecology label", as we find a similar effect of nudges on the ecology label, even if the picture nudge seems to have a smaller influence here.

Overall, the results suggest that the green nudges studied were not successful in pushing individuals towards the more sustainable option (i. e., the meat alternative). However, exposing individuals to green nudges increased their WTP for different labels. Green nudges thus enhance sustainable food choices to the extent that products with labels can be expected to actually be more environmentally friendly than products without a label.

Discussion and conclusion

In our study, we address two research questions: 1. Whether specific green nudges can push individuals towards more sustainable food choices (i. e., a meat alternative instead of meat), and 2. whether the nudges change individuals' valuation of labels, and may thus have an indirect effect on sustainable food choices.

The results show significant treatment effects of the nudges on the valuation of meat products, animal and ecology labels. However, although the nudges increased participants' utility and, consequently, their WTP for the two labels, the effect on the meat product was not in line with our expectations. The social norm nudge induced a higher WTP for meat. This outcome conflicts with the results of Kurz (2018) and the scarce literature on social norm nudges (Kwasny et al. 2022), who find norm nudges to be effective. However, an explanation for our findings (the undesirable effect of the norm nudge on meat consumption) could be that the information text in the norm nudge treatment described one out of three consumers as reluctant to give up (red) meat, which may have justified meat consumption (see the experimental design section for an explanation of the norm nudge). This reinforces a point made by Biccheri and Dimant (2022), who emphasize that the design of a norm nudge is more complex than other nudges, and that it can cause the opposite effect when there are no majorities among the population in favor of a particular social norm.

However, both nudges (norm and picture) increased the WTP for labels, which may be due to the fact that the norm nudge conveyed a positive norm of switching to environmentally friendly eating habits in general. These results are in line with Wensing et al. (2020) who found similar effects for ecology labels in the context of packaging. The increased sensitivity to labels provides evidence that the relatively inexpensive interventions of using pictures or norm nudges in a real-life setting could change consumption behavior, and thus help to mitigate climate change in the middle or long run.

Although these results give first insights into possible effects of the nudges on sustainable food choice, they are subject to several limitations that should be addressed in future research. Importantly, our results rely on hypothetical choices taken in an online survey by a non-representative sample. As the responses are stated preferences, they can only serve as proxies for actual behavior and the effects may not directly translate to real-life (Brownstone et al. 2000). The generalizability of the results is further limited by the fact that the sample is, on average, younger, mostly women with a higher level of education, but a lower income (e. g., students) than the general population. However, through the design of the experiment, we have results that are internally valid and thus show the effect of the nudges on the valuation of meat products and labels for this specific part of the population. As other studies find that females are more susceptible to nudges in the food context (Blackford 2021), these effects may be larger than that found in the general population. As no studies, thus far, have investigated possible moderating effects of age, education, or income with respect to nudges in the context of meat consumption (Kwasny et al. 2022), it is hard to predict how the effects may deviate from the effects in the general population. Other issues include upscaling of nudges, as many studies have shown that nudges are not easily scaled up (Zhou et al. 2019, Dos Santos et al. 2020), and ethical concerns when it comes to nudging (Schubert 2017).

With these limitations in mind, our results still indicate that 1. green nudges may have the opposite result from the intended effects. This is particularly evident with the norm nudge as emphasized by Biccheri and Dimant (2022), and highlights the importance of the wording when using this type of nudge. Additionally, 2. green nudges may have indirect effects through changing the valuation of product attributes, leading to more sustainable product choices. Future work should build on these results with a representative sample in a real-life setting, and test different wordings of the social norm nudge (i. e., by presenting the intended behavior as a social norm).

Acknowledgement: We would like to thank three anonymous reviewers for their helpful comments.
Funding: This work received no external funding.
Competing interests: The authors declare no competing interests.
Author contribution: *VG:* research design; *VG, AW:* data collection; *VG, CH:* data analysis; *VG, AW, CH:* manuscript drafting and writing the final manuscript.

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