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How Information on Emissions per Euro Spent can Influence Leisure Travel Decisions

By Thomas Hagedorn* and Jan Wessel*

Based on a discrete choice experiment with 306 individuals from Germany, we examine the impact of the emissions-per-Euro-spent indicator (g/€ indicator) on people's travel behavior. This indicator, which was motivated by Hagedorn and Sieg (2019), makes cheap, but emission-intensive travel alternatives appear particularly harmful for the environment. We find that the g/€ indicator induces people to be more likely to choose the travel alternative with the lower indicator value. This effect persists even if participants are informed about general carbon dioxide (CO_2) emissions. We also find that the steering effect of the g/€ indicator is stronger than for other emission indicators, especially for the costs of offsetting emissions. Our results thereby indicate that the g/€ indicator could be used as an effective steering instrument for people to rethink traveling with cheap, but emission-intensive means of transport, especially with ultra-low cost carriers.

JEL: C35, Q50, R40.

Keywords: Environmental metrics, g/€ indicator, discrete choice experiment, travel decisions, carbon dioxide emissions.

I. Introduction

The transportation sector contributes almost a quarter of global CO_2 emissions (International Energy Agency, 2020). Thus, lowering emissions from transportation is necessary in order to effectively combat climate change and global warming. To reduce emissions from transport, there are two main pillars: technological progress and inducing behavioral changes (Santos, 2017). Within this study, we focus on the second pillar, more specifically on behavioral changes that could be induced through the provision of information on CO_2 emissions. In general, behavioral changes are feasible in situations where behavior can be adapted easily and without high costs. One example of such easy and low-cost behavioral adjustments could be the transport-mode choice when traveling. Whether one travels from Berlin to Munich (linear distance: 465 km) by train instead of plane has a significant environmental effect, but might be associated with rather low adaptive costs for certain people.

Henceforth, we look at behavioral changes in the tourism sector, which accounts for about 8 % of global greenhouse gas emissions (Lenzen et al., 2018). When traveling, however, people often do not know how much CO_2 their trip will produce.[1] Although the CO_2 emissions associated with a travel alternative could

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[1] Brazil and Caulfield (2014) show that people often either do not know the climate impact of different

be a relevant decision determinant, such information is often not displayed in travel advertisements. Therefore, the aim of this study is to investigate whether people can be steered to travel in a more environmentally friendly manner by providing information on CO_2 emissions through various indicators, especially through the new emissions-per-Euro-spent indicator, referred to hereafter as the g/€ indicator, described below.

Usually, emission indicators present emissions in absolute values (e.g., *grams of CO_2 per trip*) or relative to the distance traveled (e.g., *grams of CO_2 per km*). Hagedorn and Sieg (2019), however, have shown that the latter may not be an appropriate indicator for leisure travel, because the travel distance is often an endogenous decision variable for leisure travel.[2] For such travel purposes, consumers often decide between various travel alternatives, for example a trip to Prag by train or to Budapest by plane. Accordingly, relating emissions to the endogenous distance would not appropriately reflect the increase in emissions associated with longer trips, since the g/km indicator only reflects differences in average emissions between transport modes, but not the additional effects of increases in distance. Given that individuals often decide between different leisure travel alternatives based on an ex ante exogenously determined travel budget (see, for example, Eugenio-Martin, 2003; Lim, 1999), it is more appropriate to relate the emissions of leisure travels to the exogenously determined travel budget, rather than to the endogenously determined travel distance. Relating emissions to the exogenous travel budget thus has the advantage that longer distances are also reflected in a higher indicator value. More specifically, such a travel budget would not only comprise the monetary costs, but also the time costs of the travel alternative, as this travel time has to be deducted from the time spent at the travel destination. This composite budget can then be referred to as the "full-price budget" of a trip. Hence, the metric "full-price emissions" forms the ratio of emissions and full-price budget, and is denoted in *grams of CO_2 per Euro (g/€)*. For a more detailed discussion of the full-price emission indicator, however, we refer to Hagedorn and Sieg (2019).[3]

To obtain an initial understanding of the real-world impact of the full-price emission indicator, we reduce the complexity of this indicator in our study and relate emissions only to the monetary costs of the trip, such that the indicator is also denoted in g/€. A more thorough analysis of the original full-price emission

transport modes or are likely to overestimate or underestimate them. Also in other contexts, consumers are often found to have a poor understanding of the emissions caused by certain products (e.g., Camilleri et al., 2019). The data from our study also support that people have limited knowledge about CO_2 emissions and have difficulty estimating the emissions from a trip. For further information, we refer to Section II.A.

[2] On the other hand, for business travel purposes, distance is often an exogenous decision variable, as the destination is predetermined. Consequently, distances do not differ much between transport modes and therefore, the g/km indicator can represent emissions of business travels appropriately. According to the database of the Federal Statistical Office of Germany (2021), for Germany, around 84 % of the trips in 2019 were made for private reasons and only 16 % for business.

[3] To understand the impact and advantage of the g/€ indicator, consider the following example: Traveling from Cologne to Prag by train costs about €130, and traveling to Budapest with a low-cost flight costs about €70. While these destinations may be equally desirable to visit for certain consumers, the environmental impacts differ substantially. Also, different emission indicators can suggest substantially different levels of environmental friendliness. The absolute emissions for the Prag trip amount to 39 kg of CO_2 and for the Budapest trip to 460 kg of CO_2, resulting in a ratio of emission indicator values of approximately 11.7. When using the g/km indicator, the ratio declines to about 7 (32 vs. 230 g/km). The g/€ indicator, however, clearly results in the highest ratio of about 24 (289 vs. 7078 g/€), thus making the flight to Budapest appear significantly more environmentally damaging, compared to the other indicators. For a detailed discussion of the advantages and disadvantages of the g/€ indicator, we refer to Section IV.

indicator is accordingly left as an area for future research.

We then investigate the impact of the g/€ indicator on people's travel decisions through a discrete choice experiment with 306 individuals from Germany, split across all social groups. The participants are confronted with different travel advertisements and have to choose their preferred alternative, or the outside option of not traveling at all. The travel advertisements show general trip characteristics such as destination, price, and transport mode, as well as information about the CO_2 emissions of the travel alternatives. The latter vary in the form of emission presentation, i.e., we use different emission indicators to evaluate which indicator is especially effective in influencing travel behavior.

Scientific research on the impact of emission indicators on travel decisions is rather scarce. There are, however, two papers studying this relationship in more detail. Sanguinetti and Amenta (2021) investigate whether people can be nudged towards greener business air travel by providing them with information about the absolute CO_2 emissions. 450 employees of the University of Davis were asked to choose among hypothetical flight options for business trips, in which emission information was displayed for each alternative, and the most environmentally friendly alternative was labeled the "Greenest Flight". Sanguinetti and Amenta find that highlighting emissions during flight search can indeed nudge people to choose lower-emissions flights. Moreover, they estimate a willingness to pay (WTP) for saving a ton of CO_2 equivalents to lie around $ 200. Conducting a survey, Brazil et al. (2013) examine the impact of different framings of CO_2 emissions in online journey planning and smartphone applications on the ease of understanding such emission information. The authors find a strong correlation between understanding the different framing methods and the likelihood of altering mode choice. Actual changes in transport modes, however, are not explicitly estimated.

In addition to these two papers that focus explicitly on travel decisions, there are other studies that more generally analyze framing effects of CO_2 emission information on the perception of emission differences. Avineri and Waygood (2013); Waygood and Avineri (2018), for example, show for hypothetical mode choice scenarios, that negative framing has the highest effect on the perceived difference. Cadario et al. (2016) find that larger numbers of quantitative emission information lead to greater perceived emission differences, which is known as the "unit effect" demonstrated by Pandelaere et al. (2011). Larrick and Soll (2008) have shown that individuals behave differently when information on the environmental friendliness of a car is given in *gallons per mile* instead of *miles per gallon*. With respect to travel decisions, Schwirplies et al. (2019) analyzed the effects of framing a polluting activity in different contexts, such as different transport modes or travel occasions, on the individual WTP for offsetting CO_2 emissions. Their results show that there are significant framing effects from variations of the transport mode, meaning that the individual WTP for carbon offsetting is affected by the transport mode.

In contrast to the aforementioned papers, we analyze the impact of emission information on realistic leisure travel decisions – especially with respect to the new g/€ indicator. As outlined above, the impact of CO_2 emission information on leisure travel decisions is severely understudied in the literature, but often discussed in the public context of climate protection (e.g., traveling via plane), and therefore constitutes an important and topical research area. By analyzing how information on CO_2 emissions can affect consumers' travel decisions, we can

contribute to the literature in various ways.

First, we investigate whether the new indicator g/€, which was theoretically derived and motivated by Hagedorn and Sieg (2019), also works in reality. We find that the g/€ indicator has a significant impact on people's leisure travel decisions, resulting in more people choosing the supposedly more environmentally friendly travel alternative, i.e., that with the lower indicator value.[4] Consequently, the results indicate that the g/€ indicator could be used as a behavioral steering instrument towards promoting more environmentally friendly travel.

Second, we compare the new g/€ indicator to the more commonly known absolute emission indicators (kg, g) and relative emission indicators (g/km). In our experiment, these two indicators only show a significant influence on people's travel decisions when one travel alternative is substantially less emission-intensive than the other. In contrast, the g/€ indicator impacts on travel decisions regardless of the size of the emission differences between travel alternatives.

Third, we investigate whether and how informing participants about climate change and CO_2 emissions in the transport sector can impact on the degree to which emission indicators can influence consumers' leisure travel decisions. One could assume that a better understanding of emissions and emission indicators could reduce the degree to which consumers can be steered by emission indicators, because they can more easily appraise how much emission a particular travel alternative would produce. Our findings, however, show that informed consumers are still at least as likely to choose the supposedly more environmentally friendly alternatives.

Fourth, we investigate whether the g/€ indicator has a stronger steering effect than providing individuals with information on the costs of offsetting their CO_2 emissions. If travel advertisements feature information on emissions, they usually report the costs of offsetting the caused emissions. Against this backdrop, our results show that the g/€ indicator has a stronger effect on travel decisions than providing information on offsetting costs. Thus, the g/€ emission indicator could be more effective in encouraging people to choose more environmentally friendly travel than the offsetting costs.

Finally, our experiment includes participants from all social groups and only real-world choice scenarios are considered, whereas much of the aforementioned research is conducted with students only and often considers hypothetical scenarios. Using realistic choice scenarios has the advantage that participants are likely to make more realistic decisions as consequences become more perceptible, thus increasing the external validity of our experimental setup.

The remainder of the paper is structured as follows. Section II describes the experiment as well as some environmental and demographic statistics of the participants, and the methodology. In Section III, hypotheses are derived and the results presented. Section IV discusses the results, and Section V concludes.

II. Description of Experiment and Methodology

A. General Information

To analyze the effects of different environmental metrics on consumers' travel decisions and to find answers to the aforementioned open questions, we conducted

[4] The phrase "supposedly more environmentally friendly" means that individuals *perceive* one alternative as more environmentally friendly than another. This perception is then based on the value of the relative emission indicator and not on the value of the absolute emission indicator.

a discrete choice experiment. The experiment was set up as an online survey of a panel of 306 individuals from the city of Münster (Germany) between 24 February 2021 and 7 March 2021.

The survey participants were recruited from a database of around 400 randomly contacted households in the city of Münster. These households are regularly invited by e-mail to participate in surveys conducted by the University of Münster. Due to the voluntary participation of the individual database members, we can only claim that the database is an approximation of the population living in the city of Münster. Accordingly, it should be noted that our sample consists of individuals from different social groups in the city of Münster and not only of students. The proportion of female and male participants is relatively balanced, the age structure is relatively young with more than 70 % between 18 and 39 years old, and participants are quite well educated. This implies that the younger generation is slightly overrepresented in our sample and that participants are also better educated than the average population. The general socio-demographic characteristics of the respondents are displayed in Table 5 in the Appendix.

The participants were asked about their environmental attitudes, which are shown in Table 6 in the Appendix. In general, they consider climate change to be a serious problem, and transportation to be a major driver of climate change. In terms of travel decisions, however, environment is not a key determinant in their decisions, but ranks last. Factors like safety, price, and comfort are more important to them. Participants were also asked to assess their knowledge about CO_2 emissions. On average, they assess their knowledge on a 5-point Likert-Scale as "low". We were also able to confirm this by asking participants to estimate the emissions per person for a trip of 1,000 kilometers for different transport modes. We find that they significantly overestimate the emissions caused by such a trip. These findings are thus in line with previous research on people's environmental knowledge and their ability to estimate emissions (Brazil and Caulfield, 2014; Camilleri et al., 2019).

Throughout our experiment, we always use values, i.e., travel prices and CO_2 emissions, that can be observed in the real world, thereby underlining the realism of the setting and alternatives.

B. Experimental Design

The discrete choice experiment was conducted using a web-based survey in which participants were randomly assigned to one of three groups. The 306 participants in our experiment are evenly divided among the groups, so that each group consists of 102 individuals. Using several statistical tests (χ^2, t-test, ANOVA, Mann-Whitney-Wilcoxon test), we find that the three groups in our experiment show no statistically significant differences with respect to socio-demographic characteristics. We also find no substantial differences with respect to their environmental attitudes. Consequently, this indicates that the randomization was successful, such that the groups can be considered comparable.

Our experiment is generally built on two types of realistic choice sets, Amsterdam/Brussels and Paris/Barcelona. In both types of choice sets, subjects could indicate which of two travel destinations they would prefer. The choice sets also feature an outside option of not traveling at all. The travel alternatives differed in terms of the means of transport, destination, travel price, and CO_2 emission indicators. The attribute levels of these factors always reflect values that can be

observed in the real world. Moreover, the choice sets were designed to achieve a high degree of comparability between the alternatives, e.g., in terms of overall attractiveness of the destinations and accessibility in similar time. Accordingly, the transport modes were selected. While the destinations could be reached by several transport modes, we chose to focus on one transport mode for each destination in order to keep the choice scenarios rather lean and concise. We also decided to use average emission factors for a given transport mode to calculate the respective emission indicator values, rather than taking into account that emissions may vary for a given transport mode on the same route.

Moreover, our experiment is basically divided into two parts. In the first, each participant had to answer four choice sets, meaning that they are confronted twice with the choice set Amsterdam/Brussels, and twice with the choice set Paris/Barcelona. This allows us to study the effect of various treatments (i.e., indicators) on travel decisions. In this part, participants are not explicitly informed about CO_2 emissions and their environmental impacts, both in general as well as with respect to transportation. After the first part of the experiment, we provided general emission statistics such as average per capita CO_2 emissions, transport-mode-specific CO_2 emissions for the example of a travel from Münster to Munich, and information on the relationship between CO_2 emissions and climate change. This is done in order to increase the salience of the topic and inform the participants. The second part of the experiment then consists of the same choice sets as the first part, with the difference that participants are now informed about CO_2 emissions and their environmental impacts. On the one hand, the provision of such information could potentially lead to some bias in favor of the more environmentally friendly trips. On the other hand, it helps us to understand in what way participants' attention to and understanding of the emission indicator can lead to changes in travel decisions – and whether this impacts on the effectiveness of the new g/€ indicator. We think that the benefit of additional analyses outweighs the potentially higher risk of a bias.

Choice sets of the same type (e.g., Amsterdam/Brussels) differ between the groups only with respect to the form of emission information they receive, but are identical with respect to price, destination, and transport mode. Consequently, price, destination, and transport modes are constants in the experiment. The treatment variation is the type of CO_2 emission indicator. Using otherwise identical choice sets allows us to test whether the type or form of presentation of CO_2 emissions has an impact on travel decisions. We are especially interested in the effect of the new g/€ indicator, in order to test whether this indicator could encourage people to changing their travel decision.

At the end of the survey, participants are asked to state their general preferences for traveling, environmental attitudes, as well as some socio-demographic characteristics. An overview of the experimental setup and an example of an original decision screen can be found in Table 8 and Figure 3 in Appendix A.C, respectively.

C. Incentivization Scheme

To maximize the likelihood of participants answering truthfully, they are financially incentivized. For participation in the experiment they receive a participation fee. Additionally, there is a variable payment that participants receive if they read the informatory texts on CO_2 emissions carefully and answer the re-

lated questions correctly. This variable payment is useful in order to ensure that people really read the information and, consequently, get informed about CO_2 emissions. The last component of the incentivization scheme is a raffle of three travel vouchers, which ensures that the experiment is probabilistically consequential. Therefore, the participants were informed before the experiment that among all answered choice scenarios, three choice scenarios would be randomly selected as winners of the raffle and the respective participants then receive an additional payout. Moreover, if the participants of these choice scenarios had chosen one of the two travel alternatives, they would receive a travel voucher when conducting their chosen trip within the next two years. If they had chosen to forego traveling, they would receive a tenth of the travel voucher value.[5] Thus, a realistic choice would maximize the expected payout of the participants.

D. Methodology

To analyze participant choices and the effects of the emission indicators, we apply a standard multinomial logit (MNL) model with three discrete outcomes: travel alternative 1 (Amsterdam/Paris), travel alternative 2 (Brussels/Barcelona), and an opt-out option (no trip). For each part of the analysis, only the respective choice sets of interest are considered, i.e., those choice sets that include the emission indicators we want to investigate. Since this leads to within-group and between-group comparisons, the sample sizes may vary between respective analyses. Our independent variables are then dummy variables for the emission indicators that were used in the respective choice set, i.e., they equal 1 if the participant receives a given form of emission information (e.g., g/€) in a specific choice set, and 0 otherwise. We can thereby estimate the impact of the emission indicators on travel decisions.

We additionally control for individual characteristics and environmental attitudes of the participants by including the following control variables: desire to use each transport mode, desire to visit each destination, environmental awareness when traveling recreationally, fear of climate change, and the importance of transport mode characteristics such as speed, comfort, price, and environmental impacts. It can reasonably be assumed that all these characteristics impact on travel decisions and therefore need to be accounted for. The variables are used as controls and are not variables of interest in the regression. By including these as control variables in the regression, we want to make sure that the coefficients of the emission indicator dummy variables are not driven by omitted variables. All control variables are measured on a 5-point Likert scale ranging from very low to very high (see Table 6 in Appendix A.A).

III. Analysis

A. Hypotheses

As outlined in the introduction, the new g/€ indicator makes cheap but emission-intensive trips appear more environmentally damaging, and could thus be used as a behavioral steering tool for promoting more environmentally friendly travel.

[5] A pre-test has shown that the average probability of conducting the potential travel alternatives is roughly 10 %. Thus, the expected payouts of choosing a travel alternative, versus choosing to forego travel should be approximately equal. The travel voucher is paid in cash, and thus not conditional on any travel company.

This could be especially relevant against the backdrop of low-budget flights, as these emit a lot of CO_2 at a low price. Our study now investigates whether the g/€ indicator is not only an interesting construct in theory, but also has implications in reality. If this were the case, the g/€ indicator would lead to more people choosing the travel alternative that appears to be more environmentally friendly, i.e., the alternative with the lower indicator value.

Based on the notion that many people are relatively familiar with the ranking of transport modes in terms of their CO_2 emissions per kilometer per person (e.g., plane emits more CO_2/km than car, car emits more CO_2/km than train or coach), we assume that the g/€ indicator would provide a new dimension of information and thereby influence people's travel decisions. For testing the effectiveness of the g/€ indicator, we propose the following hypothesis:

Hypothesis 1 *The g/€ indicator has a significant impact on people's travel decisions. It shifts their decision towards the alternative with the lower emission indicator value, i.e., the alternative that is apparently more environmentally friendly.*

To test this hypothesis, we proceed in two steps: First, we analyze the choice set Amsterdam/Brussels in which both alternatives emit the same absolute amount of CO_2 (18,560 g), but the relative emission indicators favor different alternatives. With the g/km indicator, the trip to Brussels by coach appears to be more environmentally friendly (29.0 g/km for Brussels vs. 32.0 g/km for Amsterdam).[6] With the g/€ indicator, however, the trip to Amsterdam becomes the supposedly more environmentally friendly alternative (285.6 g/€ for Amsterdam vs. 412.5 g/€ for Brussels). The g/€ indicator thus leads to a clear and visible change in the alternative that appears more environmentally friendly.[7] This realistic scenario yields conclusions about the impact of different emission indicators on travel decisions, when the choice of emission indicator can change which alternative appears more environmentally friendly.

Second, we analyze the choice set Paris/Barcelona in which one alternative is always less emission-intensive regardless of which indicator is used, but its relative environmental advantage changes with different indicators. The trip to Paris causes an absolute amount of 40.3 kg of CO_2 and the journey to Barcelona an absolute amount of 568.1 kg of CO_2, thus 14 times as much. If we use the g/km indicator, the ratio reduces to approximately 7 (32.0 g/km vs. 230.0 g/km), while it is still 14 if we use the g/€ indicator (67.2 g/€ vs. 946.9 g/€). This realistic scenario yields conclusions about the impact of different emission indicators on travel decisions, when the choice of the emission indicator does not change which alternative appears to be more environmentally friendly, but only the relative environmental friendliness of the alternatives.

In these two analyses, participants are not explicitly informed about CO_2 emissions. Some people have only limited knowledge of travel-related CO_2 emissions, which would make them more prone to manipulation by relative emission indicators. In the Amsterdam/Brussels scenario, for example, the g/€ indicator makes

[6] Note that emission values may differ between countries, depending, for example, on the load factors and technical characteristics of the vehicles. Since the experiment is conducted in Germany, we use the values reported by the German Environment Agency (2020). According to this study, coaches emit the least CO_2 per passenger kilometer, followed by train, car, and planes (see Table 7).

[7] The fact that trips are equally environmentally friendly in absolute terms, but the g/€ indicator simultaneously favors one alternative over the other, is of course due to the construction of the choice set. This, however, was intended in order to more explicitly analyze the steering effect of the g/€ indicator.

Amsterdam appear more environmentally friendly, even though both alternatives emit the same absolute amount of CO_2. One could assume that being attentive to and knowing transport-mode-specific CO_2 emissions would reduce the ability of the emission indicators to influence people's travel decisions. We therefore propose the following hypothesis:

Hypothesis 2 *If individuals are generally informed about CO_2 emissions and emission indicators, they are less likely to be influenced by relative emission indicators. This implies that they would be more likely to base their decision on their perceived level of absolute emissions rather than on relative emission information.*

To test this hypothesis, we inform people about CO_2 emissions and their quantification through emission indicators before the second part of the discrete choice experiment.[8] The participants then receive the exact same choice sets as in the first part, and are asked whether they would like to change their decision based on the information they have now received. This procedure allows us to test whether people acquire a better understanding of relative emission indicators, and are therefore less likely to be influenced by them.

Having tested whether the g/€ indicator is effective in influencing people's travel behavior, it is subsequently worth analyzing whether this indicator is more or less effective than providing information on the monetary amount needed to offset the emissions, i.e., information on the costs of CO_2 offsetting. If travel advertisements feature information on emissions, they usually report the costs of offsetting the emissions caused. Against this backdrop, we can thus test if the g/€ indicator could be used as an even more effective steering instrument in such advertisements. One reason why this steering instrument might be stronger is the fact that people may see the offsetting of emissions as a mere "letter of indulgence" and thus perceive the emission of CO_2 as less damaging in the first place. Thus, we propose the following hypothesis:

Hypothesis 3 *Providing individuals with the g/€ emission indicator is more effective in discouraging people from traveling less environmentally friendly than providing information on the amount of money needed to offset emissions.*

To test this hypothesis, we provide participants in the Paris/Barcelona scenario not only with the g/€ indicator, but also with information on the monetary amount needed to offset the emissions. Thus, one of the three groups is presented with the g/€ indicator in the Paris/Barcelona scenario, and a second group is presented with the offsetting indicator in this scenario. We can thus test whether the effect of the g/€ indicator is stronger than that of the offsetting indicator.

B. Results

Hypothesis 1

Scenario Amsterdam/Brussels

The choice scenario Amsterdam/Brussels entails the choice between a 3-day-trip either to Brussels by coach, to Amsterdam by high speed train, or an opt-out option of not traveling at all. As noted above, in this choice scenario, the

[8] Participants receive information about the average emissions of different transport modes, about the average per capita emissions and about examples of absolute emissions of different transport activities (trips by plane, train, coach or car, and commuting).

Table 1—: Choice Scenarios

	Scenario Amsterdam/Brussels		
	Alternative 1	Alternative 2	Alternative 3
Destination	Amsterdam	Brussels	No trip
Travel price	€399.99	€379.99	
Ticket price	€64.99	€44.99	
Mode	Train	Bus	
CO_2 indicators[1]	18,560.0 g	18,560.0 g	
	32.0 g/km	29.0 g/km	
	285.6 g/€	412.5 g/€	
	Scenario Paris/Barcelona		
	Alternative 1	Alternative 2	Alternative 3
Destination	Paris	Barcelona	No trip
Travel price	€599.99	€599.99	
Mode	Train	Plane	
CO_2 indicators[2,3]	40.3 kg	568.1 kg	
	32.0 g/km	230.0 g/km	
	67.2 g/€	946.9 g/€	
	0.93 €	13.07 €	

CO_2 emissions were calculated using average emission factors as reported by the German Environment Agency (German Environment Agency (2020); see Table 7 in the Appendix).

[1] In the third scenario, individuals are confronted with the g/€ indicator related to the ticket price and not to the total trip costs. Therefore, we also provide separate information on ticket costs.

[2] In the third scenario, individuals are confronted with the g/€ indicator related to the total trip costs.

[3] The values on CO_2 offsetting costs are from `www.atmosfair.de`, which is the most popular provider of carbon offsets.

choice of the emission indicator can change which alternative appears to be more environmentally friendly. All relevant information for this choice set can be found in the upper part of Table 1.

Figure 1 shows the share of individuals choosing the respective travel alternative, dependent on the emission indicator. We observe quite similar shares when participants receive no information on emissions, and when they receive the information that both alternatives emit the same absolute emissions in grams. The g/km indicator, however, increases the share of the alternative that is supposedly more environmentally friendly under this indicator (Brussels). In line with this, the g/€ indicator increases the share of the alternative that is supposedly more environmentally friendly under this indicator (Amsterdam). Thus, it appears that the type of indicator indeed impacts on travel decisions.

To analytically test this observation, we perform a regression with an MNL model with dummy variables for the different indicator types, as well as various control variables.[9] If not noted otherwise, the reference category for all regres-

[9] To test whether the results are driven by the attitudinal control variables, we also perform the regression analyses without these control variables. We find that results do not change significantly. If

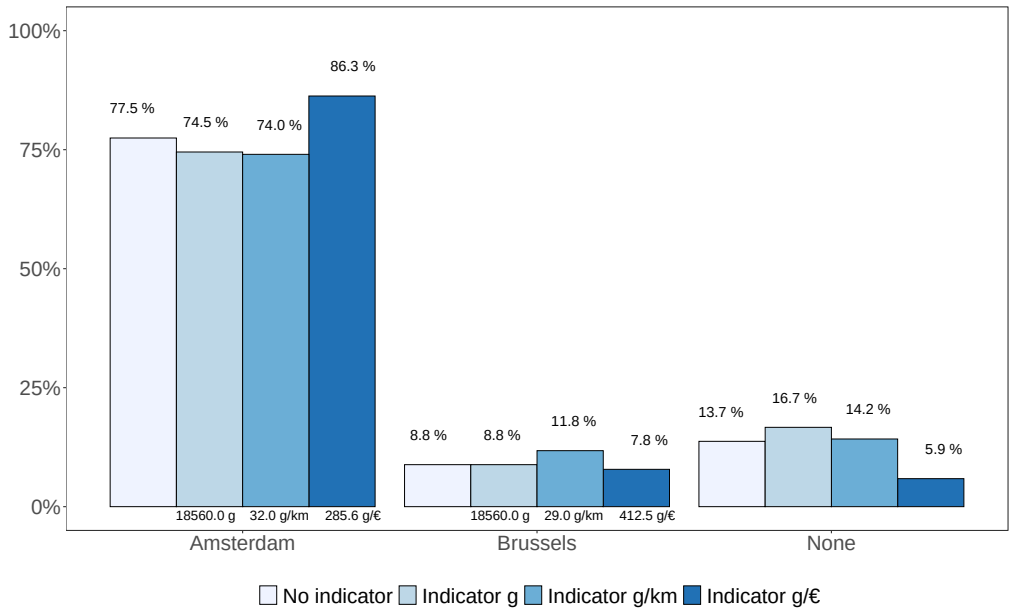

Figure 1. : Choice Scenario Amsterdam/Brussels (Only First Part)

sion models is that individuals receive no information on CO_2 emissions. The marginal effects of the MNL models for the choice scenario Amsterdam/Brussels are presented in Table 2. Column (1) then shows the results of the first experimental part in which individuals are not informed about CO_2 emissions in general. We find that presenting information on absolute emissions and on emissions in g/km, does not significantly impact on travel decisions, compared to when no emission information is given. The g/€ indicator, however, increases the likelihood of choosing the apparently more environmentally friendly travel alternative Amsterdam (i.e., the alternative with the lower indicator value) by 9.9 percentage points. The likelihood of choosing to forego the travel declines accordingly. Therefore, we find evidence that individuals respond to the g/€ indicator by shifting their choice towards the supposedly more environmentally friendly travel alternative in a situation where indicators change which alternative is supposedly more environmentally friendly. The other emission indicators, that is, the absolute emissions and the g/km indicator, however, show no statistically significant effect on the choice behavior compared to the reference group that receives no emission information.

Scenario Paris/Barcelona

Again, individuals can choose between a 3-day trip to Paris by high speed train, a 3-day trip to Barcelona by plane, or an opt-out option of not traveling. In this choice scenario, the alternative of Paris has the lower value for all three emission indicators, and the choice of indicator only changes the relative environmental friendliness of the alternatives. All relevant information for this choice set can be found in the lower part of Table 1.

anything, the effect sizes of the emission indicator variables are slightly higher when not controlling for the attitudinal factors.

Table 2—: Marginal Effects of the MNL Model for the Scenario Amsterdam/Brussels

Dependent Variable:	Travel Alternative		
	First Part	Second Part	Both Parts
	(1)	(2)	(3)
Indicator g/€			
Amsterdam	0.099*	0.170***	0.109***
	(0.058)	(0.060)	(0.056)
Brussels	-0.007	-0.097*	-0.023
	(0.041)	(0.050)	(0.044)
None	-0.092*	-0.073	-0.086***
	(0.053)	(0.051)	(0.048)
Indicator g/km			
Amsterdam	-0.046	-0.064	-0.055*
	(0.043)	(0.044)	(0.031)
Brussels	0.033	0.034	0.033
	(0.032)	(0.036)	(0.024)
None	0.013	0.030	0.022
	(0.036)	(0.036)	(0.025)
Indicator g			
Amsterdam	-0.040	0.029	-0.005
	(0.051)	(0.054)	(0.037)
Brussels	0.004	-0.069	-0.033
	(0.039)	(0.047)	(0.031)
None	0.036	0.040	0.038
	(0.041)	(0.041)	(0.029)
Informed			
Amsterdam			-0.060**
			(0.025)
Brussels			0.066***
			(0.020)
None			-0.006
			(0.020)
Informed × Indicator g/€			
Amsterdam			0.046
			(0.071)
Brussels			-0.052
			(0.054)
None			0.006
			(0.062)
Control Variables:	Yes	Yes	Yes
Pseudo R^2	0.2158	0.2397	0.2270
Number of Decisions	510	510	1020

*p<0.1; **p<0.05; ***p<0.01. Standard errors in parentheses.
Shown here are the marginal effects of the respective MNL model. The original regression coefficients are available upon request. The used control variables are described in Section II.D.
The reference category is that of no information provision.

Figure 2 shows that if no information on the CO_2 emissions of the trips is provided, the share of people choosing the Paris trip is about the same as the share choosing the Barcelona trip. If individuals receive information on the CO_2 emissions of the travel alternatives and thus learn that the Paris trip is more

environmentally friendly than the Barcelona trip, visibly more people choose Paris over Barcelona. Moreover, more people appear to choose not traveling at all.

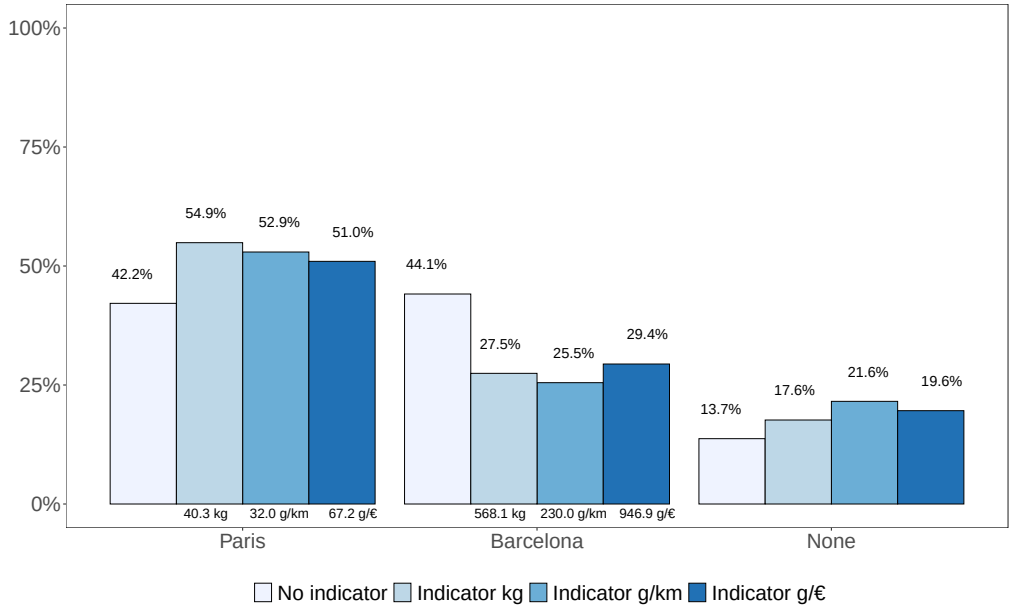

Figure 2. : Choice Scenario Paris/Barcelona (Only First Part)

Again, we use the MNL model to verify our observations. The results can be found in Table 3. Column (4) then shows the results for the first part of the experiment, in which individuals have not been informed about CO_2 emissions in general. Now, we see that the g/km indicator significantly reduces the likelihood of choosing the less environmentally friendly trip to Barcelona. Subsequently, there are increases in the likelihood of choosing Paris or to forego the travel, but neither increase is statistically significant. For both the absolute emission indicator in kg and the g/€ indicator, the likelihood of choosing Barcelona decreases, and the likelihood of choosing the more environmentally friendly alternative Paris increases. The g/€ indicator, however, leads to a slightly higher increase.[10]

Summary

We find significant evidence that the new g/€ emission indicator impacts on travel decisions. The g/€ indicator is thus effective in steering people to choose the travel alternative with the lower indicator value, i.e., the alternative that is (supposedly) more environmentally friendly. Interestingly, and in contrast to other emission indicators, the g/€ indicator affects travel behavior even when the trips emit the same absolute amount of CO_2 and are thus equally environmentally friendly.[11] Therefore, we can confirm Hypothesis 1.

[10] It should be noted that this result differs from what is depicted in Figure 2, where it appears that the absolute emission indicator in kg and the g/km indicator have a stronger influence on travel decisions. The MNL model, however, also accounts for personal characteristics and environmental attitudes of the individuals, thereby isolating the effect of the emission indicators.

[11] This is further discussed in Section IV.

Table 3—: Marginal Effects of the MNL Model for the Scenario Paris/Barcelona

Dependent Variable:	Travel Alternative		
	First Part	Second Part	Both Parts
	(4)	(5)	(6)
Indicator g/€			
Paris	0.128**	0.129**	0.121**
	(0.062)	(0.061)	(0.056)
Barcelona	-0.186***	-0.146***	-0.168***
	(0.049)	(0.043)	(0.041)
None	0.057	0.016	0.047
	(0.053)	(0.054)	(0.048)
Indicator g/km			
Paris	0.066	0.079	0.073*
	(0.060)	(0.059)	(0.042)
Barcelona	-0.129***	-0.111***	-0.120***
	(0.048)	(0.042)	(0.032)
None	0.063	0.032	0.048
	(0.052)	(0.052)	(0.037)
Indicator kg			
Paris	0.124**	0.072	0.098**
	(0.061)	(0.059)	(0.043)
Barcelona	-0.165***	-0.111***	-0.138***
	(0.049)	(0.042)	(0.032)
None	0.042	0.038	0.040
	(0.053)	(0.053)	(0.037)
Informed			
Paris			0.077**
			(0.034)
Barcelona			-0.097***
			(0.027)
None			0.020
			(0.029)
Informed × Indicator g/€			
Paris			0.013
			(0.069)
Barcelona			0.007
			(0.055)
None			-0.020
			(0.058)
Control Variables:	Yes	Yes	Yes
Pseudo R^2	0.2721	0.2904	0.2818
Number of Decisions	408	408	816

*p<0.1; **p<0.05; ***p<0.01. Standard errors in parentheses.
Shown here are the marginal effects of the respective MNL model. The original regression coefficients are available upon request. The used control variables are described in Section II.D.
The reference category is that of no information provision.

Hypothesis 2

Analysis for Only the Second Part of the Experiment

Both previous analyses rely on the first part of our experiment in which participants were not informed about CO_2 emissions. After providing general information on CO_2 emissions and climate change, the participants receive the exact same choice sets as in the first part, and are asked whether they would like to change their decision based on the information they have now received. Thereby, we can test whether people gain a better understanding and sense of relative emission indicators and are therefore less likely to be influenced by them.

Columns (2) and (5) in Tables 2 and 3 show the results of the MNL regressions for only the second part of our experiment, i.e., after participants were informed. We find that the g/€ indicator still impacts on people's travel decisions by increasing the likelihood of choosing the supposedly more environmentally friendly travel alternatives. It is noteworthy that in the Amsterdam/Brussels scenario, people are now even more likely to choose Amsterdam over Brussels than before. One might have thought that through the provision of general emission information, people would have been able to guess that both alternatives were (relatively) equally environmentally friendly in absolute terms, and thus would have reacted less strongly to the steering by the g/€ indicator. For the Paris/Barcelona scenario, the marginal effects are slightly weaker than before, but still statistically significant.

Analysis for Both Parts of the Experiment

To test for potential interaction effects between the g/€ indicator and being informed, we conduct an analysis with choice sets from both parts of the experiment, i.e., before and after people were generally informed about CO_2 emissions and their environmental impacts. The results of the corresponding MNL models are shown in Columns (3) and (6). Here, we add the dummy variable *Informed* that is equal to 1 when people have read the informatory texts about CO_2 emissions and emission indicators, and 0 otherwise. This variable thus captures whether being generally informed about CO_2 emissions has an impact on people's decisions. Moreover, we use the interaction term *Informed* × *Indicator g/€* to capture whether being informed influences the impact of the g/€ indicator on people's travel decisions.

We find that the g/€ indicator still has a statistically significant impact on decisions in both scenarios in that it reduces the likelihood of choosing the (supposedly) less environmentally friendly alternative. We also find that informing people has a statistically significant impact on travel decisions in both scenarios. However, being informed has no statistically significant impact on the effect magnitude of the g/€ indicator.

Summary

Taken together, these results suggest that while information has a significant impact on people's travel decisions, this does not necessarily mean that being informed about CO_2 emissions in general changes the influence of the g/€ indicator on people's travel decisions. Therefore, we have to reject Hypothesis 2. Hence, the

results suggest that the g/€ indicator could indeed be a useful and robust instrument for encouraging people to switch to the supposedly more environmentally friendly travel alternatives.

Hypothesis 3

Next, we conduct a direct comparison between choice sets with the g/€ emission indicator and the offsetting indicator, in order to test whether providing individuals with the g/€ indicator is more effective in encouraging people to travel more environmentally friendly than providing them with information on the monetary amount needed to offset the emissions. If travel advertisements feature information on emissions, they usually report the costs of offsetting the emissions caused.

Results for the MNL models with the CO_2 offsetting indicator as the reference category are shown in Table 4. Irrespective of whether people are informed, we find that the g/€ indicator is significantly more likely to discourage people from choosing the less environmentally friendly alternative, i.e., flying to Barcelona on an ultra-low-cost airline. In all model specifications, the likelihood of choosing the Barcelona alternative decreases by about 10 to 12 percentage points. Therefore, we can confirm Hypothesis 3.

IV. Discussion

Unlike many other studies, the participants of our study are not just students, but individuals from all social groups. In relation to that, a study of the Federal Environment Agency has shown that the environmental awareness of different social milieus sometimes differs significantly, with the younger generation being more environmentally aware on average (Federal Environment Agency, 2018). Therefore, a different choice behavior could have been expected if we had surveyed only students. Consequently, our approach of surveying a broader panel of people is likely to provide a more representative picture on how people respond to the new g/€ emission information.

To further support the external validity of our results, the choice scenarios are constructed in a realistic manner. This means that all information that participants receive with respect to the travel alternatives, i.e., the price and the emission indicator values, as well as the general environmental information provided between the first and the second part of the experiment, could be observed in the real world. This underlines the potential of the g/€ indicator as a behavioral steering instrument in real-world settings.

Although we find that the g/€ indicator has a strong impact on people's travel decisions, this does not always imply that traveling becomes more environmentally friendly. More specifically, we find that people in the Amsterdam/Brussels scenario in the first part of the experiment are more likely to choose the supposedly more environmentally friendly of the two travel alternatives, but are at the same time less likely to forego traveling, thereby increasing overall emissions. A possible explanation of this result is that the new g/€ indicator could have been misinterpreted by the participants due to a lack of knowledge. Given that knowledge and awareness of the g/€ indicator is increased for the second part of the experiment, we no longer observe such choice behavior. We now find that the g/€ indicator statistically significantly increases the likelihood of choosing the (supposedly) more environmentally friendly trips and decreases the likelihood of

Table 4—: Marginal Effects of the MNL Model for the Comparison of the g/€ Indicator and the CO_2 Offsetting Indicator

Dependent Variable:	Travel Alternative		
	First Part	Second Part	Both Parts
	7	8	9
Indicator g/€			
Paris	0.067	0.097	0.065
	(0.058)	(0.059)	(0.058)
Barcelona	-0.099*	-0.122***	-0.099**
	(0.051)	(0.046)	(0.045)
None	0.032	0.025	0.034
	(0.053)	(0.054)	(0.053)
Informed			
Paris			0.063
			(0.055)
Barcelona			-0.075*
			(0.045)
None			0.011
			(0.052)
Informed × Indicator g/€			
Paris			0.031
			(0.080)
Barcelona			-0.019
			(0.065)
None			-0.013
			(0.073)
Control Variables:	Yes	Yes	Yes
Pseudo R^2	0.2990	0.2894	0.2906
Number of Decisions	204	204	408

*p<0.1; **p<0.05; ***p<0.01. Standard errors in parentheses.
Shown here are the marginal effects of the respective MNL model. The original regression coefficients are available upon request. The control variables are described in Section II.D.
The reference category is the costs of CO_2 offsetting in €.

choosing the less environmentally friendly trips – thus contributing to more environmentally friendly travel. For the Paris/Barcelona scenario, however, the g/€ indicator never leads to such statistically significant decreases in the likelihood of foregoing traveling.

One reason that could explain the effectiveness of the g/€ indicator is that it provides a new dimension of information to potential travelers. Many individuals have an explicitly or implicitly determined travel cost budget, and a low-cost flight to a far-away destination might then be just as feasible as a much shorter train ride to a closer destination. Often, these individuals already have a rough idea of which travel alternative would emit less CO_2 in absolute terms or per kilometer, but not per Euro. Especially for travelers who think about flying low-cost, the confrontation with a very high g/€ indicator value for such alternatives could lead them to reconsider their pending decision.

The g/€ indicator appears to be effective with respect to making the travel alternative with the lower indicator value more attractive by suggesting greater environmental friendliness. Next, it is important to analyze in which situations the g/€ indicator could have a clear advantage over other, more commonly used emission indicators when it comes to changing people's behavior towards more environmentally friendly travel alternatives. With the g/€ indicator, travel alternatives with higher emissions and lower costs would appear to be especially unattractive. This is specifically the case for low-budget flights, as these emit a lot of CO_2 at a low price, resulting in a very high indicator value. In such cases, the g/€ indicator could have a stronger steering effect than other emission indicators. Nevertheless, there may also be situations where the indicator leads to less environmentally friendly travel behavior. Such behavior could occur, for example, when comparing a business class flight from Cologne to Paris with a train ride to Paris. Although the flight to Paris would produce much higher absolute emissions, it would most likely generate fewer relative emissions in g/€ and thus appear more environmentally friendly. However, such setting would imply significantly different travel budgets and would thus not be consistent with the original idea of the *full-price emissions* approach, which assumes a fixed budget of money and time. Therefore, this setting was not considered in the analyses.[12]

In recent years, the usage of offsetting indicators, i.e., costs that would be incurred when offsetting emissions for a given trip, has increased in real-world travel offers, for example when booking tickets for trains, coaches, or flights. The process of offsetting emissions is usually criticized for not tackling emissions in the first place. In fact, a journey that is completely offset does not foster climate change, because emissions are produced, enter the atmosphere, and are not avoided. Rather, offsetting emissions thereby offers a kind of indulgence for environmentally harmful behavior. However, such indulgences are not associated with the g/€ indicator, as it merely refers to the emissions and does not imply any offsetting of emissions. Additionally, we show that the g/€ indicator has a more pronounced impact on travel decisions than such offsetting indicators.

At present, information on CO_2 emissions is not necessarily provided when booking tickets or holiday packages. Our results suggest that if the display of

[12] Another example would be to compare a flight to the Canary Islands with a flight to Thailand. Again, the g/€ indicator would most likely show a lower value for the trip to Thailand, even though the absolute emissions for that trip would be much higher. Here, one would be comparing trips that differ significantly with respect to their full-price budget, which comprises both money and time costs. This would also not be consistent with the idea of the original full-price emission indicator assuming a fixed budget.

such information were mandatory, the g/€ indicator could have a stronger steering effect than other emission or offsetting indicators. Thus, the g/€ emission indicator could be useful as a policy tool for encouraging potential travelers to choose more environmentally friendly travel alternatives. Providing this information would not be associated with high costs, but could – without restricting the choices of potential travelers – lead to more sustainable (leisure) travel. Nevertheless, the shortcomings of such a mandatory information provision should also be mentioned. Firstly, Sunstein (2021) describes that consumers might not have a sufficient understanding of such emission information and may not be able to assess the differences in indicator values and translate them into economic and environmental consequences. Moreover, he points out that such mandatory instruments might be less cost effective with regard to reducing emissions than, for example, price instruments (such as a carbon tax) because emission reductions do not occur where they are cheapest.

At this point it should be mentioned that the g/€ indicator faces a trade-off between consumption distortion and welfare. More specifically, the information provided by g/€ indicator, like all other relative emission indicators (e.g., g/km), distorts the true environmental ranking of the trips prior to decision making (which is given by the absolute emission indicator), but may increase overall welfare by reducing emissions due to people choosing more environmentally friendly trips. The appropriateness of using the g/€ indicator thus depends on what goal is being pursued. If one aims at inducing consumers to take well-informed and sophisticated decisions, the use of such relative emission indicators is problematic. However, if the aim is to change behavior towards emission reductions, then our results indicate that this indicator works quite well, as we have shown above.

In this paper, we mainly test whether people would react to the g/€ indicator – which apparently they do. When this indicator was introduced by Hagedorn and Sieg (2019), it was defined slightly differently than in our experiment. Instead of relating CO_2 emissions to the ticket price or the price of the travel package, the emissions were related to the full price of the travel alternative. This full price included the costs of travel tickets, hotels, and also time costs. For the sake of simplicity, we omitted the travel time cost dimension in this experiment and focused instead on the ticket price and the price of the travel package. A logical next step would therefore be to incorporate the travel time dimension in an experimental setup and analyze whether this addition of indicator complexity would come at the price of the effectiveness of the indicator as a steering instrument for potential travelers. At this point, it should also be mentioned that the g/€ emission information depends on the exact definition of the indicator, which may vary, e.g., full-price emissions, full-trip-price emissions, transport-price emissions. Therefore, before making such information mandatory, careful consideration should be given to how the indicator is defined.

V. Conclusion

In this paper, we have investigated whether and how the provision of information on CO_2 emissions, specifically in the form of the g/€ indicator, can impact on people's travel decisions. The g/€ indicator makes travel alternatives with higher emissions and lower costs appear to be especially unattractive. This is specifically the case for low-budget flights, as these emit a lot of CO_2 at a low price, resulting in a very high indicator value. To estimate the effects of this

indicator, we conducted a discrete choice experiment with 306 individuals from all social groups.

First, we show that the g/€ indicator indeed impacts significantly on travel decisions. People are more likely to choose the travel alternative that is supposedly more environmentally friendly, i.e., that has the lower indicator value. Interestingly, this is even the case if both travel alternatives actually emit the same amount of CO_2 in absolute terms, hence underlining the strong steering effect of the g/€ indicator.

Second, we find that people still react to the g/€ indicator even after being explicitly informed about CO_2 emissions in general terms, as well as about CO_2 emissions in the transport sector. Apparently, more knowledge of emissions and their environmental ramifications does not seem to reduce the steering effect of the g/€ indicator.

Third, we also find that the g/€ indicator has a stronger steering effect than showing individuals the necessary costs for offsetting their emissions. Moreover, the g/€ indicator appears to impact more strongly on people's travel decisions than the g/km indicator or an absolute emission indicator.

Our results then allow to derive relevant policy implications. First of all, it would be useful if information on CO_2 emissions were provided more regularly in travel advertisements. The provision of such information does not restrict travel alternatives of consumers and is associated with low cost. Hence, emission information could efficiently nudge consumers to travel more environmentally friendly. Since the results indicate a strong steering effect of the g/€ indicator in our experimental setting, the indicator could thus serve as a behavioral steering instrument, specifically aimed at making cheap, but high-emitting travel alternatives such as low-cost flights appear more environmentally damaging. Accordingly, this indicator could contribute to more sustainable leisure travel behavior. We also find that the g/€ indicator has a stronger steering effect than offsetting indicators, which are used quite regularly in travel advertisements.

Future research should further elaborate on the real-world impact of emission indicators in a travel context. Although our experiment was designed in a realistic and probabilistically consequential way, it would be interesting to apply our setting to a real-world context, e.g., through a natural field experiment with an online travel planner. Additionally, we reduced the complexity of the original full-price emission indicator for our experiment and focused on the less complex g/€ indicator instead. Thus, a natural extension of our research would be to conduct an experiment with the original, more complex full-price emission indicator in order to evaluate the effectiveness of this indicator as a steering instrument.

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Appendices

A. Appendix

A. Characteristics and Attitudes of the Participants

Table 5—: Socio-demographic Characteristics of the Participants

Variable	Overall	Group 1 (n=102)	Group 2 (n=102)	Group 3 (n=102)
Sex				
Female	55.56%	58.82%	51.96%	55.88%
Male	44.12%	40.20%	48.04%	44.12%
Divers/No answer	0.03%	0.98%	0.00%	0.00%
Age				
$\leq$ 17	0.00%			
18-24	24.18%	25.49%	24.51%	22.55%
25-39	48.04%	43.14%	46.08%	54.90%
40-59	16.34%	15.69%	15.69%	17.65%
$\geq$ 60	11.11%	14.71%	13.73%	4.90%
No answer	0.03%	0.98%	0.00%	0.00%
Education				
Hauptschulabschluss[1]	1.31%	0.98%	1.96%	0.98%
Realschulabschluss[2]	7.19%	9.80%	3.92%	7.84%
Abitur[3]	32.03%	34.31%	27.45%	34.31%
Bachelor's degree	24.84%	27.45%	26.47%	20.59%
Master's degree	17.32%	14.71%	15.69%	21.57%
Master craftman's certificate	0.65%	0.98%	0.00%	0.98%
Diplom[4]	9.80%	7.84%	16.67%	4.90%
PhD	4.90%	0.98%	4.90%	8.82%
Monthly net household income[5]				
< €1,000	18.30%	24.51%	12.75%	17.65%
€1,000 - €1,999	20.59%	17.65%	22.55%	21.57%
€2,000 - €2,999	24.84%	22.55%	25.49%	26.47%
€3,000 - €3,999	11.11%	7.84%	12.75%	12.75%
€4,000 - €4,999	10.13%	9.80%	9.80%	10.78%
$\geq$ €5,000	9.80%	9.80%	11.76%	7.84%
No answer	5.23%	7.84%	4.90%	2.94%
Average amount of money per year spent on vacation	€1509.75	€1402.16	€1630.71	€1496.38

[1] "Hauptschulabschluss" is the lowest school completion level in Germany.
[2] "Realschulabschluss" is the intermediate school completion level in Germany.
[3] "Abitur" is the highest school completion level in Germany. It qualifies for university entrance.
[4] Before universities switched to Bachelor and Master programmes, the "Diplom" was the most common university degree in Germany, corresponding (roughly) to the current Master's.
[5] The average monthly net household income in Germany was €3661 in 2018 (Behrends et al., 2021). For North Rhine-Westphalia, the state in which Münster is located, the data from 2019 show a monthly net household income of €3401 (IT.NRW, 2020).

Table 6—: Environmental Attitudes of the Participants

Variable	Overall	Group 1 (n=102)	Group 2 (n=102)	Group 3 (n=102)
Scared of climate change	3.5458	3.5882	3.5784	3.4706
Desire to visit Brussel	3.0620	3.1275	3.0392	3.0196
Desire to visit Amsterdam	3.8399	3.7353	3.8137	3.9706
Desire to visit Paris	3.6307	3.7647	3.5000	3.6275
Desire to visit Barcelona	3.8105	3.8137	3.7745	3.8431
Importance of transport speed	3.6307	3.4804	3.5980	3.8137
Importance of transport comfort	3.8889	3.8137	3.9314	3.9216
Importance of transport price	3.9248	3.9510	3.8824	3.9412
Importance of transport environment	3.3987	3.5196	3.4804	3.1961
Environmental awareness of recreational mobility	3.0488	3.2251	3.0686	2.8528
Desire to use plane	3.1567	3.0392	3.1176	3.3137
Desire to use train	4.0719	4.1078	4.1471	3.9608
Desire to use bus	2.5098	2.5686	2.5098	2.4510

All valuations are given on a Likert-Scale ranging from 1 (=very low/strongly disagree) to 5 (=very high/strongly agree). Shown here are the average values of the respective group.

B. Input Factors for the Choice Scenarios

Table 7—: Yield and Emission Factor Per Vehicle Type

Vehicle type	Yield (€/pkm)	CO_2 Emission factor (g/pkm)
Coach	0.0740	29
High Speed Train	0.1094	32
Aviation, ultra-low cost carrier	0.0334	230

Sources: German Environment Agency (2020); Gipp et al. (2019); Ryanair (2018); Deutsche Bahn AG (2017).

C. Outline of the Experimental Setup

Our experiment is generally built on two types of realistic choice sets, Amsterdam/Brussels and Paris/Barcelona. In both these choice sets, the subjects could indicate which of two travel destinations they would prefer. The choice sets also feature an outside option of not traveling at all. The travel alternatives differed in terms of the means of transport, destination, travel price, and CO_2 emission indicators. Choice sets of the same type (e.g., Amsterdam/Brussels) differ between the groups only with respect to the form of emission information they receive, but are identical with respect to price, destination, and transport mode. Consequently, our treatment variation is the CO_2 emission indicator. An overview of the experimental setup is shown in Table 8. Figure 3 then shows an example of a choice screen.

Table 8—: Experimental Setup

	Choice Set	CO_2 Emission Indicator		
		Group 1	Group 2	Group 3
1	Amsterdam/Brussels	no information	g/€[1]	g/€[2]
2	Paris/Barcelona	g/km	no information	g/€[2]
3	Paris/Barcelona	offsetting costs in €	kg	trees[3]
4	Amsterdam/Brussels	g/km	g	g/km
	Informing about CO_2 emissions			
5	Amsterdam/Brussels	no information	g/€[1]	g/€[2]
6	Paris/Barcelona	g/km	no information	g/€[2]
7	Paris/Barcelona	offsetting costs in €	kg	trees[3]
8	Amsterdam/Brussels	g/km	g	g/km
	Travel preferences			
	Demographic characteristics			

[1] In this scenario, individuals are confronted with the g/€ indicator related to the ticket price and not to the total trip costs.

[2] In this scenario, individuals are confronted with the g/€ indicator related to the total trip costs.

[3] In this scenario, we use a tree-indicator for CO_2 offsetting as used by Waygood and Avineri (2016). It shows the number of trees needed to offset the CO_2 emissions produced on the trip.

Check out the following travel advertisements:

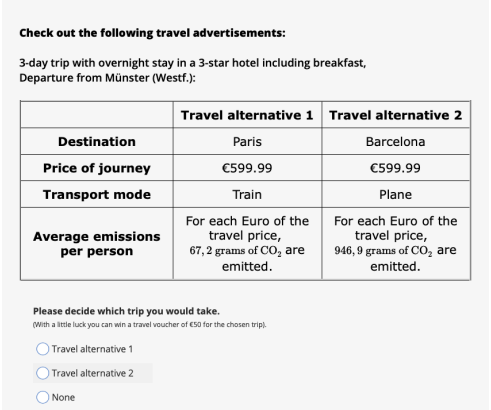
3-day trip with overnight stay in a 3-star hotel including breakfast,
Departure from Münster (Westf.):

	Travel alternative 1	Travel alternative 2
Destination	Paris	Barcelona
Price of journey	€599.99	€599.99
Transport mode	Train	Plane

Please decide which trip you would take.
(With a little luck you can win a travel voucher of €50 for the chosen trip).

- ◯ Travel alternative 1
- ◯ Travel alternative 2
- ◯ None

(a) Choice Set Without Emission Information



Check out the following travel advertisements:

3-day trip with overnight stay in a 3-star hotel including breakfast,
Departure from Münster (Westf.):

	Travel alternative 1	Travel alternative 2
Destination	Paris	Barcelona
Price of journey	€599.99	€599.99
Transport mode	Train	Plane
Average emissions per person	For each Euro of the travel price, $67,2$ grams of CO_2 are emitted.	For each Euro of the travel price, $946,9$ grams of CO_2 are emitted.

Please decide which trip you would take.
(With a little luck you can win a travel voucher of €50 for the chosen trip).

- ◯ Travel alternative 1
- ◯ Travel alternative 2
- ◯ None

(b) Choice Set With Emission Information

Figure 3. : Example of a Choice Set

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