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**Flying rebound:
consequences of the imposed flying sufficiency during the COVID-19 pandemic**

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Flying Rebound: Consequences of the Imposed Flying Sufficiency During the COVID-19 Pandemic

Abstract

Political measures during the COVID-19 pandemic forced consumers to cancel flights, resulting in significant decreases of their individual greenhouse gas emissions. This paper introduces the concept of imposed flying sufficiency and asks whether this could lead to a flying rebound. Imposed flying sufficiency describes that external factors, such as political measures during the pandemic, force consumers to reduce their flights. The term flying rebound refers to the gap between the emissions that could be potentially saved due to flying sufficiency and the actualized emissions savings due to adjusted flying behavior. A major contribution of this paper is combining the economic mechanisms with moral-psychological aspects of rebound effects in an experimental study. In a 2 (with/without economic hint) \times 2 (with/without ecological hint) between-subjects experimental study, this paper analyzes how the awareness of monetary savings and the awareness of ecological consequences affect consumers' flying intentions. The study reveals an interaction effect of these two aspects: While awareness of the monetary savings will increase flying intentions, awareness of the ecological consequences will buffer this effect. Furthermore, the degree to which consumers feel flight shame, strongly moderates the economic and ecological hints' impact. Finally, the paper provides implications for managers and policymakers.

Keywords

Rebound effects, sufficiency, COVID-19, consumer behavior, flight shame, voluntary simplicity

1 Introduction

The World Economic Forum's (2020) Global Risk Report 2020 stresses that human-made greenhouse gas emissions (GHG) are the main cause of global warming. Emissions from vacation travel accounted for approximately 22% of all transport-related emissions and 5% of the total human-caused emissions in 2016 (UNWTO and ITF, 2019). Tourism-related air travel alone accounts for 50% of these transport-related emissions (UNWTO and ITF, 2019). In light of these numbers, calls get louder that consumers should travel more sustainably to produce fewer GHG. This development is embedded in a general call for more sufficient consumption. The concept of sufficiency suggests that individuals should consume the right amount or a sufficient amount of things (Princen, 2005). Following this principle, some consumers consider sufficiency as free choice that enables more independence, self-determination, and wellbeing (Hüttel et al., 2020; Rebouças & Soares, 2020). Several scholars promote the concept of sufficiency, as they doubt that resource efficiency-increasing, technological innovations alone will assure that humankind achieves climate goals (e.g. Vita et al., 2019).

Despite growing awareness of the carbon footprint of vacation flights and even growing feelings of flight shame (Gössling et al., 2020a; Cocolas et al., 2020; Hasberg, 2019), passenger traffic has continuously increased in the last years (ICAO, 2018). Notably, things changed unexpectedly in 2020. Governments in many countries decided on lockdowns and largely restricted traveling abroad, which caused a dramatic reduction in flights (Gössling et al., 2020b). These developments led to a 73% slump in the number of arrivals by international tourists in 2020 (UNWTO, 2021). As a side effect, worldwide emissions have declined (Zambrano-Monserrate et al., 2020).

However, the question arises whether these developments will have a steady impact on tourists' traveling behavior and GHG. The traveling restrictions were not based on the deliberate decisions of consumers who answered the call for more sustainable traveling behavior. Instead, consumers were forced not to fly. We introduce this new concept and label it imposed flying sufficiency. Will consumers learn from this experience that less air traveling is possible? Or will they compensate for the foregone vacations with even more intensive flying plans for the future? Put differently, will the forced flying restrictions during the COVID-19 pandemic lead to rebound effects? Rebound effects refer to the failed realization of potential emission savings. They are recognized as a severe problem, which hinders slowing down climate change (Chitnis et al., 2013; Gillingham et al., 2016; Santarius et al., 2018; Sorrell, 2007). This paper therefore asks whether imposed flying sufficiency can stimulate more flying behavior in the future. We label this phenomenon the flying rebound. The term describes that consumers' potential emissions savings via less air traveling are not fully realized due to the consumers' behavioral adjustments.

The flying rebound is conceptually close to the recently identified revenge travel phenomenon. Revenge travel refers to a revival of the tourism industry in the post-pandemic phase, which is characterized by a strong increase in flight frequency without a change toward more sustainability (Wassler and Fan, 2021). On the individual level, the psychological pressure and pandemic fatigue caused by forced lockdowns, quarantines, and social distancing (Zaman et al., 2021) stimulate this type of increased traveling. Individuals travel more to compensate for their lost travel time and they consider these holidays as a form of vengeance on the pandemic (Kim et al., 2022; Wassler and Fan, 2021). This might evoke flying rebounds regardless of whether tourists simply resume their pre-COVID-19 flying behavior or whether they, stimulated by revenge trav-

eling motivations, even increase their trips,. However, to date, studies lack that focus on the environmental issues associated with consumers' flying decisions in response to the imposed flying sufficiency.

This paper makes the following contributions to the literature. First, using the COVID-19 pandemic as a case study we explore consumer reactions to imposed flying sufficiency behavior involving pro-environmental impacts. Second, we disentangle the economic mechanisms (monetary savings) and moral-psychological mechanisms (GHG savings) involved in consumers' decision to reduce or intensify overseas traveling plans after imposed flying sufficiency. The literature on individual rebound effects consists of two largely unrelated streams. While economists study the economic mechanisms based on observed expenditures (Azevedo, 2014; Font Vivanco et al., 2018; Sorrell et al., 2020), social scientists mainly emphasize the relevance of moral-psychological effects (Dütschke et al., 2018; Reimers et al., 2021; Santarius et al., 2018; Sorrell et al., 2020). We examine the joint impact of both perspectives in an experimental study. In a 2 (with/without economic hint) \times 2 (with/without ecological hint) between-subjects experimental study, this paper analyzes how the canceled flights' impact on monetary savings and individual carbon footprint jointly affect traveling intentions. Third, the paper considers the upcoming concept of flight shame (Andersen, 2022; Gössling et al., 2020a) by analyzing how consumers' level of flight shame moderates the interaction effect of the monetary and moral-psychological mechanisms. For practitioners, this study provides initial insights into how economic and ecological aspects affect intentions to fly and travel long distances and which combinations of economic and ecological cues in campaigns will lead to more environmentally friendly traveling intentions.

2 Conceptual Background

2.1 *Imposed flying sufficiency*

Sufficiency, efficiency, and consistency are three strategies to increase sustainability and reduce emissions (Brinken et al., 2022). Resource efficiency aims to improve the output-input ratio (e.g., via technological developments). Consistency aims at creating material and energy flows that match natural processes (e.g., circular economy). Sufficiency implies the reduction of consumption or the complete abandonment of resource-intensive or otherwise critical aspects of consumption (Sorrell et al., 2020). The literature on sustainable consumption has considered sufficient consumption behavior under different labels, such as consumption reduction (Peattie and Peattie, 2009), environmentally motivated consumption reduction (EMCR, Lasarov et al., 2019), and voluntary simplicity (Hüttel et al., 2020).

The term voluntary simplicity refers to a lifestyle motivated by the goal to overcome materialism and overconsumption (Craig-Lees and Hill, 2002; Etzioni, 1998). Notably, voluntary simplicity is stimulated not only by environmental reasons but also by reasons of self-determination, personal growth, and wellbeing (Alexander and Ussher, 2012; Etzioni, 1998). Remarkably, the concept of voluntary simplicity is based on consumers' voluntary decisions to avoid unnecessary products and services. However, empirical studies confirm that most consumers experience consumption reduction as an unpleasant burden (Connolly and Prothero, 2003; Hutter and Hoffmann, 2013).

In contrast to the lifestyles of voluntary simplicity, changes in the economic or political situation can force consumers to reduce their consumption. Especially during the COVID-19 pandemic, policy measures imposed people around the globe to reduce their consumption in specific

areas to hamper the spread of the coronavirus. Many people had to cancel or modify their vacation plans for summer 2020 since their home country's or their destination country's government restricted vacationing abroad. According to UNWTO, all countries worldwide imposed travel restrictions in May 2020 due to COVID-19 (UNWTO, 2020). Yet, mobility and traveling restrictions are not only beneficial in preventing the spread of COVID-19 (e.g., Wang and Zheng, 2021; Zhu et al., 2022) but also clearly reduced the carbon footprint of many consumers (Mukanjari and Sterner, 2020). Abandoning vacation flights often also implies that consumers save financial resources. They could use these savings for consumption spending in other product categories or they could spend more at a later stage, for example, in the next traveling season.

In sum, traveling reduction during the COVID-19 pandemic is a form of sufficiency, but not a voluntary simplicity lifestyle. Hence, we label this concept as imposed flying sufficiency. Thus far, the literature is silent about the effects of imposed flying sufficiency. On the one hand, imposed sufficiency may trigger behavioral changes and consumers learn that they need less without compromising, which leads to fewer flights in the future. On the other hand, research shows that rebound effects frequently accompany sufficient consumer behaviors (e.g., Druckman et al., 2011; Grabs, 2015; Vita et al., 2019). Imposed flying sufficiency could stimulate future flying behavior. Therefore, we develop and empirically test a model that answers the conditions that lead to one or the other outcome.

2.2 *Flying rebounds*

Rebound effects refer to the failed realization of savings in energy use, emissions, or other environmental impacts (Reimers et al., 2021). In this paper, we focus on GHG savings. Macro

rebound effects refer to the difference between potential and actual emissions savings of an economy (Gillingham et al., 2016; Santarius et al., 2018). This paper adds to the literature on micro rebound effects, which describe the gap between the emissions that consumers could potentially save and the GHG savings they actually realize (Dütschke et al., 2018; Reimers et al., 2021). While efficiency-based rebounds are triggered when consumers use energy-efficient products more frequently than the preceding ones (e.g., Chitnis et al., 2013, 2014; Santarius and Soland, 2018), sufficiency-based rebounds are induced by consumers' reduction of their consumption (Sorrell et al., 2020). There is several empirical evidence for sufficiency-based rebound effects in the transport sector, mainly focusing on rebounds related to the usage of vehicles (e.g., Bjelle et al., 2018; Druckman et al., 2011; Murray, 2018).

We introduce the concept of flying rebounds as a specific type of rebound effect stimulated by flying sufficiency. Suppose consumers forego a flight to a vacation destination at a given point in time. In that case, the potential emission savings may not be fully realized, as they might spend the saved financial resources to increase their flying behavior at a later point in time. Indeed, research has anticipated and measured post-COVID-19 effects for consumption in general (Davis et al., 2022), but also specifically in the passenger transport and tourism sector (Mannatuparambil et al., 2022; Huynh et al., 2022).

We ask whether the COVID-19 traveling restrictions lead to consistent (non-)flying behavior or whether they cause more intensive flying intentions in subsequent periods. We propose that how consumers assess the imposed sufficiency strongly influences how they behave in later vacation seasons. Informed by the literature (see supplementary material, SM-1) on economic rebound effects (Druckman et al., 2011; Murray, 2018), negative spillover effects (Tiefenbeck et al., 2013; Truelove et al., 2016), and flight shame (Andersen 2022; Gössling et al., 2020a; Winter

et al. 2021), we suggest the conceptual model depicted in Fig. 1, which guides our research. The imposed flying sufficiency leads to economic and environmental benefits. Whether consumers are aware of the economic benefits or the environmental benefits, or even both, will influence their intention to fly in future vacation seasons. We suggest that the consumers' degree of flight shame influences this effect.

Insert Fig. 1 about here

2.3 *Economic benefits*

The economic literature explains the mechanisms of rebound effects by income effects and substitution effects (Azevedo, 2014; Font Vivanco et al., 2018; Gillingham et al., 2016; Sorrell et al., 2020), with the income effect being particularly relevant for the present consumer-centered view. Income effects typically occur when consumers switch to an energy-efficient alternative or refrain from consumption, implying lower resource consumption. A rebound effect results if consumers use the saved financial resources to raise the consumption of products and services associated with additional GHG.

Most economic studies consider actual spending or emissions without modeling the consumption decision (Font Vivanco et al., 2018). When they find monetary rebound effects, it remains unclear whether these are based on consumers' deliberate decision to reinvest the money in the consumption areas associated with GHG. In this study, we consider the deliberate prospective behavior in a field where consumers save money at a given time and may make a conscious decision to reinvest this money in the future. More specifically, we ask whether consumers who were forced to cancel their vacations abroad and who thus saved money will reinvest this money in flights to a vacation destination in the next period. We suspect that consumers who are aware that they have saved money will deliberately decide to fly more in the future.

H1 If consumers are aware (vs. not aware) of economic savings due to imposed flying sufficiency, they will intend to fly more (less) intensively in the future.

2.4 *Ecological benefits*

Imposed flying sufficiency can potentially cause rebound effects in the next flying season. However, the forced modification in traveling habits could also turn into voluntary sufficiency and stimulate consumers to fly less in the future. It might thus evoke consistent climate-friendly behavior. While monetary effects will foster future flying intentions, consumers' moral-psychological evaluation of the canceled flight's ecological consequences may produce ambiguous results.

On the one hand, several scholars have recently suggested that the concept of moral licensing (Blanken et al., 2015; Khan and Dhar, 2006; Monin and Miller, 2001) may serve as a moral-psychological explanation for rebound effects (Dütschke et al., 2018; Santarius and Soland, 2018; Sorrell et al., 2020; Truelove et al., 2014). If consumers have the impression that they have done morally-laden deeds for the sake of the environment, they might feel licensed to increase emission-intensive consumption subsequently. Hence, moral licensing would suggest inconsistent behavior after imposed flying sufficiency. On the other hand, pro-environmental behavior can also lead to consistent behavior. For example, consumers who canceled flights during the COVID-19 pandemic and who are aware of the positive consequences for the climate might want to act more consistently in future times and keep on reducing unnecessary flights. Research shows that positive spillover effects are more likely when consumers are motivated to help achieve environmental goals (Sorrell et al., 2020; Truelove et al., 2014) and if they have a strong need for consistency (Thøgersen and Ölander, 2003). The initial morally-laden behavior alters

consumers' self-view and increases the desire to maintain and reinforce the changed self-view by future morally-laden deeds (Galizzi and Whitmarsh, 2019).

We refine the assumption in H1 that the awareness of economic savings will raise the likelihood of flying rebounds by suggesting a moderating effect of the awareness of the flying sufficiency's favorable ecological consequences. Empirical research has shown that consumers are more likely to deliberately reduce behaviors harmful to the climate and environment when they are aware of the consequences and consider the problem serious (Lasarov et al., 2019). Hence, we expect that if consumers are pointed to the environmental impacts of flying sufficiency, the awareness of monetary saving will not increase the flying intention for future times.

H2 Consumers' awareness of the ecological consequences will qualify how their awareness of the imposed flying sufficiency's economic consequences affects flying intention. If consumers are aware (vs. not aware) of the imposed flying sufficiency's ecological consequences, the awareness of economic consequences will influence the flying intention negatively (positively).

2.5 *Flight shame*

The term flight shame was coined in 2017 in Sweden (Swedish: *flygskam*) and promoted by Greta Thunberg and the Fridays for Future movement. The objective was to raise awareness of the GHG of flights and to encourage people to fly less and to use more climate-friendly ways of traveling (Andersen, 2022; Gössling, 2019; Hook, 2019). Air travel is often described as the most significant individual climate sin (Baumeister, 2017). Flight shame refers to the uncomfortable feeling of guilt when using planes, due to the negative environmental and climate consequences. Shame is characterized by a perceived threat to one's values (Allpress et al., 2014).

Consumers generally feel shame when they fail to live up to their values and expect others to disapprove of their behavior. Rees et al. (2015) show that feelings of shame influence pro-environmental behavior.

In the past, most studies have reported that consumers' pro-environmental attitudes were unrelated to their flying propensity (Kroesen, 2013; McKercher et al., 2010). While flying used to be associated with social status for decades, the social norm started to change. There are already initial indications in the literature that air travel is no longer unambiguously desirable and associated with high social status (Gössling, 2019); instead, a growing group of people considers unnecessary flights as environmental sins for which the individual air passenger is to blame (Gössling et al., 2020a). Flight shame reduces the willingness to fly (Winter et al., 2021). In this study, we focus on flight shame and not just on social norms, as we believe it has a stronger explanatory power for several reasons. In contrast to the general concept of social norms, flight shame has a specific quality (the perceived social norm not to fly). It is domain-specific and therefore it presumably has a stronger effect on the domain-specific decisions than a general construct. Finally, it is subjective and has an emotional quality that raises the personal relevance.

We propose that the stronger the consumers' support for the concept of flight shame is, the more they will have a stable attitude toward the need to reduce unnecessary flights. Furthermore, as they are generally aware of the environmental consequences of flying, cues highlighting the economic and ecological benefits of canceled flights will not affect their future flying intentions. Therefore, we expect that the interaction effect of economic and ecological hints as specified in hypothesis H2 will be mainly relevant for consumers with a low level of flight shame.

H3 Consumers' degree of flight shame will further qualify the interaction effect of consumers' awareness of the imposed flying sufficiency's economic and ecological consequences

on flying intention. If flight shame is on a low (high) level, there will be an (no) interaction effect of the awareness of economic and ecological consequences on the flying intention as specified in H2.

3 Design

3.1 Object of investigation

Our empirical study focuses on touristic medium-haul flights of German citizens canceled due to travel restrictions caused by the COVID-19 pandemic. A representative survey of the German population by the Fraunhofer Institute for Solar Energy Systems ISE (2020) shows that before the outbreak of the COVID 19 pandemic in 2019, most flights were made for vacation purposes, less for business or other private reasons. Therefore, our target population is very well suited for our study. Furthermore, the foreign passenger flights from the central German airports peaked at 203.6 Mio flights in 2019. It dropped to 51.9 Mio flights in 2020 (a decrease of 74.5%) and rose again to 68.8 Mio flights in 2020 (an increase of 32.6% compared to 2020) (DeStatis 2022). According to a representative survey by VuMa Touchpoints (2019), European flight destinations are most frequently chosen by the German population as their main vacation destination, making these flight destinations exceptionally qualified objects of investigation. Based on Germany as the starting point, European destinations are accessible via short and medium-haul flights. We focus on medium-haul flights to the Canary Islands for our empirical study. They are among the top 5 main vacation destinations in 2019 (see supplementary material, SM-2), most frequently mentioned by German citizens (VuMa Touchpoints 2019), and are difficult to reach by other means of transport.

3.2 *Procedure and treatment*

We ran a 2 vignette (with/without economic hint) \times 2 vignette (with/without ecological hint)-between-subjects design online experiment. We added a fifth group with an unrelated text vignette as further control group. We conducted the online experiment with the help of a survey tool. We used the convenience sampling method to recruit our participants by sharing the link to the online experiment on social media channels, such as Facebook or Instagram. We applied this non-random sampling method to recruit participants in a timely and economical manner (Spilski et al., 2018) and because the randomized assignment of the participants to the experimental groups is more relevant for the internal validity than the randomized drawing of the sample in experimental studies. Participants were forwarded to the online experiment and were randomly assigned to one of the five treatments when clicking on the link. The randomization ensures that there are no systematic differences in the group participants that could influence the results, and it helps ensure the internal validity of the findings (Shadish et al., 2002; Spilski et al., 2018). We found no statistically significant differences across the experimental groups concerning socio-demographic characteristics and the variables relevant for this research (see supplementary material, SM-3). The treatment of the four experimental groups was highly standardized, meaning that all four groups were exposed to the same text vignette, which we adapted in line with our factorial design. This further helped to raise the internal validity.

The treatment started with the title "Your vacation has been canceled!" Those exposed to the economic hint saw the additional subtitle "You will get your money back!" while those exposed to the ecological hint saw the subtitle "Nature takes a deep breath!" Participants in the group with economic and ecological hints saw both subtitles. Participants then read a message that vacations

had to be canceled due to the COVID-19 pandemic. They were asked to imagine that their already booked medium-haul flight and one-week vacation on the Canary Islands were also canceled.

With this fictive situation in mind, they had to read the remainder of the text vignette and answer the subsequent questionnaire. Participants in the economic treatment received more details about the financial resources saved and that they could spend the money for future vacations or other purchases. Subjects in the ecological treatment received more information about the GHG saved and the positive impact on climate and ecological recovery. Those in the economic and ecological condition read both parts of the message. Finally, as an additional control group and a further baseline, we exposed the fifth group to a completely unrelated text vignette about the development of the European Union. Please consult Appendix A for the wording and a systematic description of how the text blocks are combined for different treatment groups.

After reading the text vignette, we asked the participants whether they had read and understood the text. If they negated, they were redirected to the texts. We then instructed them to imagine a time in the future when the COVID-19 pandemic will be under control and traveling will be possible without restrictions. Again, they had to affirm that they had understood the scenario. If not, we repeated the instruction. Afterwards, the participants answered a questionnaire covering the relevant variables. Finally, to thank the participants for filling in the questionnaire they could take part in a raffle and win a voucher worth 25 euros from an online retailer.

3.3 *Methods to ensure high data quality*

To ensure that the treatment is realistic and that there are no systematically different pre-as-

assumptions across the groups which could potentially influence the results we asked the respondents to estimate the typical costs of a one-week vacation on the Canary Islands for one person, including flight and accommodation. The respondents estimate a mean price of 1,146.55 EUR (SD = 697.98). Notably, the answers did not vary significantly across the five groups ($F(4,402) = 1.824$, n.s.). Thus, the answers are not biased by unequal perceptions of the prices of each group.

We further applied several techniques to ensure that the participants answered truly and correctly, and that lack of respondents' attention and common method biases do not affect the respondents' answers and thus do not potentially result in measurement errors and inaccurate study conclusions (Podsakoff et al., 2003). First, we instructed the participants to answer truly and to select the pre-specified answer options which correspond best to their opinions. We ensured them that we will handle their data carefully and that we will store and analyze the data anonymously. To further raise the participants' trust in the research, we provided the name of the research institution, the responsible researcher and an email address to ask for further information about the survey.

Second, we checked whether the participants took enough time to answer the questionnaire seriously. In fact, the minimum answering time is seven minutes and 30 seconds, which indicates that they took time to go through the questionnaire. The mean answering time is 13 minutes and 43 seconds and there is no difference across the five groups ($F = .971$, n.s.).

Third, to further control that participants pay attention and to avoid common method variance, we integrated four calculation tests as filler items to psychologically and temporarily separate the experimental treatment and the dependent variables from the control variables (Podsakoff et al. 2003). Most respondents correctly answered the filler items, which further proved that the respondent's attention was high ([5*2]: 98.3%, [18+20]: 97.3%, [3*3]: 98.5%, [5+2*7]:

84.8%).

Lastly, as a post-hoc analysis to rule out the common method variance, we performed the single-factor test (Fuller et al., 2016). The first unrotated factor accounted for only 33.39 percent of the variance, while the five extracted factors of the multi-item measures accounted for 77.90 percent.

3.4 *Measurement*

To operationalize the dependent variable, we created a two-item scale for flying intention (Cronbach's $\alpha = .865$, Spearman and Brown's $\rho = .865$, $M = 3.477$, $SD = 1.137$). As for all scales, the items were measured on seven-point-rating scales. To measure the moderator variable flight shame, we build on Gössling et al.'s (2020a) study to create a three-item scale ($\alpha = .871$, $M = 3.882$, $SD = 1.142$). To include relevant control variables, we adopted five items from Haws et al.'s (2013) GREEN scale to operationalize green consumption ($\alpha = .887$, $M = 5.054$, $SD = 0.919$). We took two inversely coded items from Lichtenstein et al.'s (1993) price consciousness scale to measure price carelessness ($\alpha = .659$, $\rho = .659$, $M = 3.504$, $SD = 1.127$). Relying on Gurusoy and Gavcar's (2003) study, we measured travel involvement with three items ($\alpha = .898$, $M = 5.184$, $SD = 1.380$). Cronbach's alpha indicates that the internal consistency of all scales is high, and Spearman and Brown's ρ confirms the two-item scales (Eisinga et al., 2013). An exploratory factor analysis (PCA, varimax rotation) yielded five factors, with all items loading on the factors as expected. The wording of all scales and the factor loadings are documented in Appendix B.

3.5 *Sample*

In sum, 407 subjects participated in the study. They were randomly assigned to one of the

four treatments (n = 332) or the control groups (n = 75). The participants' average age is 35.98 years (SD = 13.89), ranging from 17 to 72 years. In sum, 70 percent of the participants are female. We measured income in bands (to 1000 EUR: 17.7%, to 2000 EUR: 19.4%, to 3000 EUR: 19.2%, to 4000 EUR: 17.4%, >4000 EUR: 26.3%). Concerning the respondents' education, 24.6 percent did not reach A-level, while 75.4 percent finished A-levels or higher degrees. The participants' main means of transportation when going on vacation is the car (56.5%), followed by the plane (29.4%). The remaining participants primarily travel by train (8.4%), bus (2.2%), ship (1.2%), or other (2.2%).

4 Results

4.1 Interaction of the economic and ecological benefits

The average flying intention of the four experimental groups is visualized in Fig. 2. The visual inspection indicates that for those groups exposed to treatments without an economic hint, the level of the flying intention does not further depend on whether they have additionally seen an ecological hint. However, for the groups exposed to the economic hint, the flying intention seems to be stronger when they were not exposed to an ecological hint than when they were exposed to an ecological hint.

Insert Fig. 2 and Table 2 about here

We ran hierarchical OLS regressions to analyze the effect of the experimental treatment on the flying intention. Model A in Table 1 includes only the socio-demographics and the attitudes as control variables to set the baseline. Of the socio-demographics, only age had a negative statistically significant influence on the flying intention ($\beta = -.348$, $p \leq .001$). Neither green consumption nor price carelessness yielded significant influence, while travel involvement fosters (β

= .213, $p \leq .001$) and flight shame reduces ($\beta = -.149$, $p \leq .01$) the flying intention.

Model B adds the experimental treatment. The economic hint exerts a significant influence on the flying intention ($\beta = .134$, $p \leq .05$), supporting H1. There is no main effect of the ecological hint. Remarkably, the interaction effect of the economic and ecological hints is also significant ($\beta = -.165$, $p \leq .05$), supporting H2. The effect is negative, which indicates that the positive main effect of the economic treatment is attenuated when it is coupled with an ecological hint.

We used the PROCESS add-on (v3.5.3, Hayes, 2017) to qualify the interaction effect, applying model 1 (continuous variables centralized, bootstrapping with 5,000 samples) to calculate the conditional effects. First, according to the hypotheses, we looked at the effects of the economic treatment conditional upon the ecological treatment. When there is no ecological hint, then the economic hint exerts a significant effect on the flying intention (unstandardized $B = .303$, $t = 2.002$, $p = .046$, CI90[.005, .600]). If the ecological hint was exposed, the economic hint did not exert a significant effect ($B = -.135$, $t = -.902$, $p = .368$, CI90[-.431, .160]). Second, to completely understand the effect, we consider the effects of the ecological treatment conditional upon the economic treatment. When there is no economic hint, then the ecological hint exerts no statistically significant effect on the flying intention ($B = .057$, $t = .372$, $p = .710$, CI90[-.245, .360]). If the economic hint was shown, the ecological treatment attenuated the effect on the flying intention ($B = -.381$, $t = -2.590$, $p = .010$, CI90[-.670, -.092]).

4.2 *The moderating effect of flight shame*

Model C in Table 1 further adds the moderating effect of flight shame to test hypothesis H3. Notably, the direct impact of flight shame on the flying intention disappears in this model, while it now serves as a moderator. There is a marginally significant interaction of flight shame and the

economic hint on the flying intention ($\beta = -.168, p \leq .10$). The negative sign indicates that the higher levels of flight shame attenuate the positive effect of the economic hint on the flying intention. Confirming H3, there is also a three-way interaction of the economic hint, the ecological hint, and flight shame ($\beta = .172, p \leq .05$).

Again, we applied the PROCESS add-on (model 3, continuous variables centralized, bootstrapping with 5,000 samples) to qualify the 3-way-interaction. A spotlight analysis confirms that the interaction effect of the economic and ecological hint is conditional upon the level of flight shame. While there is a statistically significant negative interaction for low (-1 SD: $B = -.881, F(1, 317) = 8.614, p \leq .01$) and medium (M: $B = -.423, F(1, 317) = 3.989, p \leq .05$) levels of flight shame, there is no significant effect at higher levels of flight shame (+1 SD: $B = .034, F(1, 317) = .012, n.s.$). Additionally, a floodlight analysis (Spiller et al., 2013) using the Johnson-Neyman technique demonstrates that the negative interaction effect of the economic and ecological hints on flying intentions is significant if flight shame (centralized) is equal to or lower than a value of 0.19 (40.66% of the sample; Table 2). Fig. 3 visualizes the three-way interaction of economic hint, ecological hint, and flight shame.

Insert Fig. 3 and Table 2 about here

4.3 *Robustness checks*

To ensure the stability of the results, we reran the analysis splitting the sample into those who have formerly been flying (58.5%) vs. those never flying (41.5%). As demonstrated in Table 3, there are no effects for those who have never flown before. However, for those who have been flying before, the pattern of results remains stable.

Insert Table 3 about here

Further, we contrasted the experimental groups against the control group without a flight treatment. We created dummy variables to contrast all four experimental groups against the control group. OLS regression (including control variables: socio-demographics, green consumption, price carelessness, travel involvement, and flight shame) demonstrates that in particular the group exposed to economic and ecological hints significantly contrasts with the control group ($\beta = -.121, p \leq .05$, see supplementary material, SM-4).

We ran another robustness check to ensure that the results were not biased by gender effects. We added interaction terms of gender with the economic hint, the ecological hint, and flight shame. We also added three-way-interactions of gender with the economic hint and the ecological hint, gender with economic hint and flight shame, as well as gender with ecological hint and flight shame. None of the interaction terms reached significance. However, the initial three-way-interaction of economic hint, ecological hint, and flight shame remains statistically significant ($\beta = .175, p \leq .05$).

5 Discussion

The objective of this study was to explore how the imposed flying sufficiency caused by the traveling restrictions during the COVID-19 pandemic will impact consumers' flying behavior. Supporting H1, consumers who are aware that they saved money due to an imposed flying reduction increase their future flying intentions. This direct rebound effect goes beyond the more emotional explanation of the flying intention of revenge traveling (Wassler and Fan, 2021). Notably, the experiment revealed no main effect for the ecological hint. Whether or not consumers are aware that they have saved emissions does not affect their future traveling plans directly. Most importantly, there is an interaction effect of the economic and ecological hints, supporting H2.

The economic hint's effect is conditional upon the ecological hint. If consumers know that they have saved money, they are tempted to spend it on future flights. However, if they are additionally aware that they have saved emissions too, the rebound turns into a positive, consistent, ecological behavior. Confirming H3, flight shame further moderates this effect. The effect only occurs for low and medium levels of flight shame. People with a high level of flight shame wouldn't fly in any event—independently of the knowledge about saved monetary resources due to flying restrictions.

5.1 Conclusion

The paper advances our knowledge in several ways. First, the paper extends the literature on voluntary simplicity. This stream of the literature mainly considers sufficiency as a result of consumers' voluntary reduction of consumption and often reports that consumers experience these deliberate restrictions as meaningful and positive (Alexander and Ussher, 2012; Balderjahn et al., 2020; Boujbel and d'Astous, 2012; Etzioni, 1998). Contrasting the voluntary aspect, we introduce the concept of imposed flying sufficiency, which we were able to analyze due to the COVID-19 restrictions. Voluntary simplifiers engage in sufficient lifestyles for the sake of themselves or the environment and thus consumption reduction fosters their wellbeing, which makes it easier for them to maintain the simplified consumption patterns (e.g., Hüttel et al., 2020). By contrast, the present study indicates that consumers who have been urged to reduce their consumption will not directly stimulate ongoing consumption reduction. Those who are aware of the imposed traveling restrictions' economic savings are willing to spend these financial resources later on for other trips. Only if consumers are also aware of the flying restrictions' ecological consequences (emission savings) will they voluntarily continue the initially imposed sufficiency.

Second, the paper extends the literature on rebound effects on the individual level. There is extensive research in the fields of economics and industrial ecology on the economic mechanisms of rebounds (Azevedo, 2014; Font Vivanco et al., 2018), while more research on the moral-psychological mechanisms of rebound effects is needed (Reimers et al., 2021). We did not find indications of moral licensing effects in the present setting (Dütschke et al., 2018; Santarius et al., 2018; Sorrell et al., 2020). Presumably, this moral-psychological mechanism that stimulates inconsistent behavior is more relevant for indirect rebound effects (rebounds due to raised emissions in other product categories) than for direct rebounds in the same category at later points in time.

Third, the paper adds to the upcoming literature on flight shame (Gössling et al., 2020a; Winter et al., 2021) and sustainable tourism (Grilli et al., 2021; Higgins-Desbiolles, 2018; Wu et al., 2021). We confirm that flight shame plays a moderating role. As a boundary condition, flight shame helps explain when and how consumers will transfer their economic and ecological awareness of the imposed flying sufficiency's consequences into flying intentions. Consumers with a strong level of flight shame are rather unaffected by the canceled flight's economic and ecological implications. They appear to have well-established attitudes toward flying and situational influences will not affect their intentions. However, the lower the level of flight shame, the more consumers respond to the combined effects of economic and ecological awareness.

Finally, the study adds to the literature on the post-pandemic effects on consumer behavior and tourism (Villacé-Molinero et al., 2021; O'Connor and Assaker, 2021; Chen et al., 2021). In the field of traveling and tourism management, studies have already considered the health aspects which affect future traveling in the aftermath of the COVID-19 pandemic ("travel fear;" Zenker et al., 2021; Zheng et al., 2021). Since air transportation contributes significantly to the

transmission of coronaviruses (e.g., Farzanegan et al., 2020), flying rebound effects may have not only ecological consequences but also backfire effects on the containment of the COVID-19 pandemic. This study contributes to the knowledge of post-pandemic effects from a sustainability perspective.

5.2 *Limitations and guidelines for future research*

We call for future research to address this paper's limitations and to further explore the fruitful research directions that are opened up by this paper's empirical findings. First, due to the recruiting procedure via social media and the skewed gender distribution, the sample is not representative of German society, which reduces the generalizability of our findings. Notably, this does not affect the findings' internal validity. However, future studies should replicate the findings in other groups and settings to establish the external validity. We assume that the results can be transferred to other countries that have a similar level of economic development and similar levels of ecological awareness (mainly industrialized Western countries). However, this needs to be tested in empirical studies.

Second, this study was conducted with regard to private, medium-haul flights for touristic reasons. Future studies may apply the model to other circumstances of flying (e.g., business trips, short or long-haul flights, or private trips for other purposes) and other fields of consumption, which are strongly associated with GHG. For example, compared to private flights and especially vacation flights, business trips usually allow less freedom for personal decisions and for acting in accordance with one's own environmental concern to choose, for example, another transportation type. Moreover, this paper used the COVID-19 pandemic as a case study. Notably, this instance of imposed flying sufficiency is a global phenomenon that addressed most people

worldwide. Future studies should transfer the concept to other settings. Presumably, the effects will change when the imposed sufficiency affects only certain subgroups or individuals. Processes of social comparison, fairness, solidarity, and envy, as well as social dilemmas, will presumably play a stronger role in cases where not every country or not everyone is involved.

Third, this study integrates economic mechanisms (in terms of monetary savings) and moral-psychological mechanisms (in terms of the ecological consequences) in an experimental study on rebound effects. Future studies should replicate our results, use actual flying data, and combine these with surveys to generalize our findings. Moreover, due to the operationalization of our dependent and independent variables, we could not quantify the actual rebound effect caused by the study participants (see supplementary material SM-5 for a discussion of rebound scenarios). Future research should further focus on integrating economic and moral-psychological mechanisms, including quantifying rebound effects based on actual behavioral responses and market data (Reimers et al., 2021).

Fourth, this study has shown that flight shame serves as a boundary condition when consumers decide how to balance environmental benefits and egoistic benefits, i.e., spending free resources on future long-distance flights. This moderating role should be further explored in empirical studies focusing on other types of flights, such as short and long-haul flights, business trips, or private trips for other purposes. It is also advisable to consider further criteria that affect consumers' decision making, such as traveling time, prices, flexibility, and convenience. The trade-off between flight shame and these aspects needs to be explored in more detail.

5.3 *Managerial implications*

The results provide several implications for environmental activists, (green) marketers, managers in the traveling and tourists industry, and policymakers. The study enables predictions of how imposed flying sufficiency (such as during the COVID-19 pandemic) will shape consumers' future traveling plans. There will not be a general shift, but heterogeneity according to consumers' awareness of economic saving, the ecological consequences, and their level of flight shame. Communication campaigns, literature, the press, and advertisements can influence these three aspects.

Activists, policymakers, and managers should be aware of potential flying rebounds. In particular, when consumers are aware of their financial savings, they will make intentional plans to reinvest the free resources in future traveling. Raising awareness of the ecological consequences serves as a buffer, especially for those aware of the economic impacts and who are thus most susceptible to flying rebounds. Hence, it is highly relevant for practitioners to know that the combination of the economic and ecological cues affects intentions to fly and travel longer distances in a specific way.

Moreover, managers and policymakers should deal with consumers' flight shame when planning interventions. The study has shown that the ecological and economic hints have different impacts depending on consumers' level of flight shame. Canceled flights' economic and ecological consequences hardly affects consumers with high levels of flight shame. Therefore, environmental activists are well advised to promote an attitudinal change in society. The more people are generally aware that one should avoid flying for environmental reasons, the less they will spend free resources on flights.

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6 Figures

Fig. 1. Conceptual model

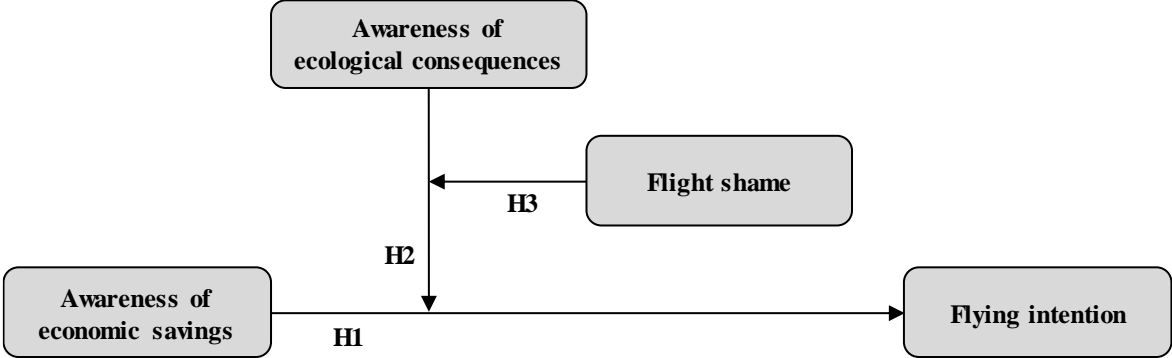


Fig. 2. Interaction of economic and ecological hints

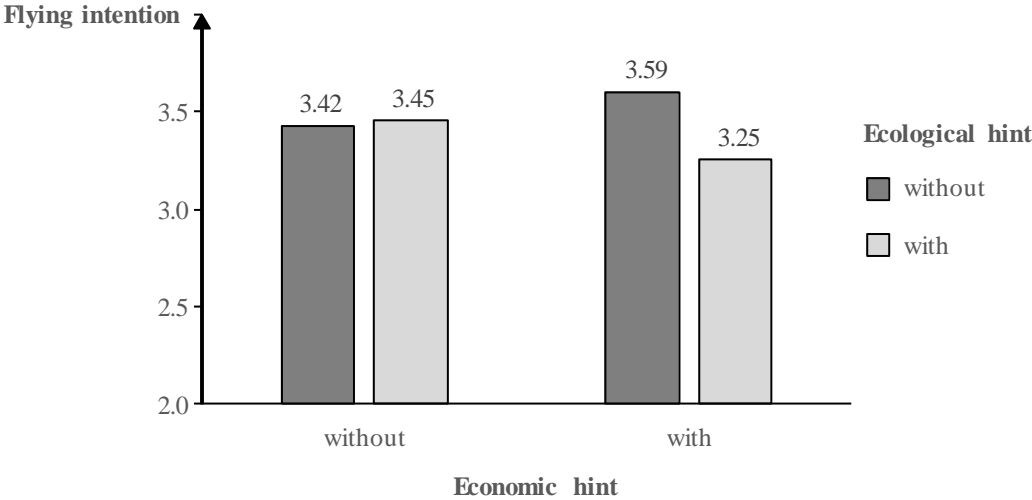
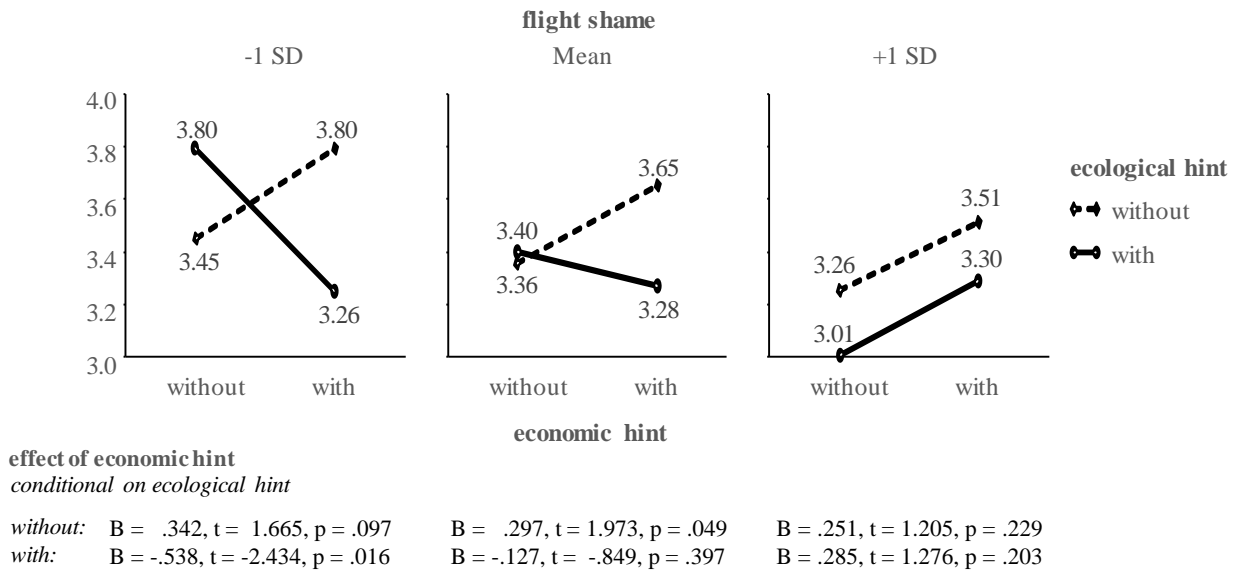


Fig. 3. 3-way interaction of economic hint, ecological hints, and flight shame



7 Tables

Table 1. Effect of experimental treatment and controls on flight intention

| | Model A | | | Model B | | | Model C | | |
|--|----------|--------|------|----------|--------|------|----------|--------|------|
| | β | t | p | β | t | p | β | t | p |
| <i>Socio-demographics</i> | | | | | | | | | |
| Sex | -.063 | -1,386 | .166 | -.103* | -2.036 | .043 | -.102* | -1.984 | .048 |
| Age | -.348*** | -6.336 | .000 | -.382*** | -6.242 | .000 | -.383*** | -6.278 | .000 |
| Income | .031 | .640 | .522 | .028 | .537 | .592 | .037 | .700 | .485 |
| Education | .065 | 1.283 | .200 | .035 | .608 | .544 | .035 | .611 | .542 |
| <i>Attitudes</i> | | | | | | | | | |
| Green consumption | -.066 | -1.241 | .215 | -.049 | -.854 | .394 | -.049 | -.842 | .400 |
| Price carelessness | -.006 | -.139 | .890 | -.036 | -.759 | .449 | -.036 | -.765 | .445 |
| Travel involvement | .213*** | 4.702 | .000 | .192*** | 3.813 | .000 | .194*** | 3.858 | .000 |
| Flight shame | -.149** | -2.723 | .007 | -.142* | -2.360 | .019 | -.086 | -.814 | .416 |
| <i>Treatment</i> | | | | | | | | | |
| Economic hint (econ) | | | | .134* | 2.002 | .046 | .131* | 1.973 | .049 |
| Ecological hint (ecol) | | | | .025 | .372 | .710 | .020 | .293 | .770 |
| Econ \times ecol | | | | -.165* | -2.057 | .041 | -.159* | -1.997 | .047 |
| Econ \times flight shame | | | | | | | -.168+ | -1.904 | .058 |
| Ecol \times flight shame | | | | | | | -.029 | -.320 | .749 |
| Econ \times ecol \times flight shame | | | | | | | .172* | 2.106 | .036 |
| F | 19.929 | | | 12.925 | | | 10.787 | | |
| R ² | .296 | | | .308 | | | .323 | | |
| R ² _{adj} | .272 | | | .284 | | | .293 | | |

Notes. OLS-Regression, standardized coefficients. DV = flying intention. Sex: 0 = male, 1 = female. Education: 0 = no A-levels, 1 = A-levels or higher. Level of significance: + $p \leq .10$, * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

Table 2. Floodlight analysis of the econ × ecol interaction effect conditional on flight shame

| Flight shame | Econ × Ecol | t | p | LLCI | ULCI |
|--------------|-------------|--------|------|--------|-------|
| -2.876 | -1.358** | -2.786 | .006 | -2.316 | -.399 |
| -2.276 | -1.163** | -2.864 | .004 | -1.962 | -.364 |
| -1.676 | -.968** | -2.927 | .004 | -1.618 | -.317 |
| -1.076 | -.773** | -2.902 | .004 | -1.297 | -.249 |
| -.476 | -.578** | -2.594 | .010 | -1.016 | -.140 |
| .019 | -.417* | -1.967 | .050 | -.835 | .000 |
| .424 | -.286 | -1.279 | .202 | -.725 | .154 |
| 1.024 | -.091 | -.339 | .735 | -.617 | .435 |
| 1.624 | .104 | .314 | .754 | -.549 | .757 |
| 2.224 | .299 | .734 | .463 | -.502 | 1.101 |
| 2.824 | .494 | 1.011 | .313 | -.468 | 1.456 |

Notes. Econ × Ecol: Interaction effect of economic and ecological hint. LLCI/ULCCI: lower/higher level of confidence interval 90%, bootstrapping.

Table 3. Robustness check

| | Never flying | | | Flying | | |
|-------------------------------|--------------|--------|------|----------|--------|------|
| | β | t | p | β | t | p |
| <i>Socio-demographics</i> | | | | | | |
| Sex | -.040 | -.442 | .659 | -.105 | -1.611 | .109 |
| Age | -.413*** | -4.026 | .000 | -.343*** | -4.483 | .000 |
| Income | .061 | .702 | .484 | .001 | .018 | .985 |
| Education | .131 | 1.237 | .218 | -.049 | -.719 | .473 |
| <i>Attitudes</i> | | | | | | |
| Green consumption | -.079 | -.800 | .425 | -.084 | -1.126 | .262 |
| Price carelessness | .049 | .620 | .536 | -.125* | -2.011 | .046 |
| Travel involvement | .044 | .535 | .594 | .253*** | 4.005 | .000 |
| Flight shame | -.076 | -.341 | .733 | -.028 | -.218 | .827 |
| <i>Treatment</i> | | | | | | |
| Economic hint (econ) | .172 | 1.284 | .202 | .151+ | 1.743 | .083 |
| Ecological hint (ecol) | .067 | .536 | .593 | -.016 | -.182 | .856 |
| Econ × ecol | -.230 | -1.602 | .112 | -.102 | -.970 | .333 |
| Econ × flight shame | -.088 | -.500 | .618 | -.344** | -3.027 | .003 |
| Ecol × flight shame | .036 | .196 | .845 | -.070 | -.604 | .547 |
| Econ × ecol × flight shame | .023 | .166 | .869 | .383*** | 3.371 | .001 |
| F | 3.650 | | | 7.631 | | |
| R ² | .292 | | | .375 | | |
| R ² _{adj} | .212 | | | .326 | | |

Notes. OLS-Regression, standardized coefficients. DV = flying intention. Sex: 0 = male, 1 = female. Education: 0 = no A-levels, 1 = A-levels or higher. Level of significance: + $p \leq .10$, * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

8 Appendix

Appendix A. Experimental manipulation

Treatment 1-4: Text vignettes

| Part | Text | Experimental group | | | |
|----------------------------|--|--------------------|---------------|------------------|----------------------------|
| | | none | economic hint | eco-logical hint | economic & ecological hint |
| Title | Your vacation has been canceled | ● | ● | ● | ● |
| Subtitle econ | You will get your money back! | | ● | | ● |
| Subtitle ecol | Nature takes a deep breath! | | | ● | ● |
| Message | With the coronavirus outbreak, many countries have put travel restrictions in place to prevent the spread of COVID-19. Vacation packages and flights that had already been booked were canceled. | ● | ● | ● | ● |
| Instruction | Imagine in the following that your planned vacation to the Canary Islands for this year has been canceled by the tour operator. | ● | ● | ● | ● |
| Ecological (part 1) | A short flight from Germany to the Canary Islands and back causes emissions of approx. 1,800 kg CO _{2e} per person. A family of four could drive around 45,000 km in a medium-sized car - around the world, so to speak. | | | ● | ● |
| Economic | Since your trip could not take place as planned, you will be reimbursed for the costs on the basis of the E.U. Package Travel Directive. You will get the four-digit amount for your already paid trip back in full. You now have this money additionally on your account. You can use it e.g. for your next vacation or another purchase. You have not suffered any other financial losses during the pandemic. | | ● | | ● |
| Ecological (part 2) | Because of the pandemic, not only you, but people all over the world have had to change their behavior. This has led to an amazing improvement in GHG. When society as a whole takes action, positive effects on nature become visible quickly and everywhere. | | | ● | ● |

Treatment 5: Control group

| | |
|---------------------|---|
| Title | The European Union |
| News message | After almost six decades, the European Union (E.U.) can look back on a success story. But it is precisely the interaction between the in the meanwhile 28 E.U. member states that is to be further improved. Many of the treaty foundations are no longer felt to be in keeping with the times. Following the rejection of the E.U. Treaty in 2004, the Treaty of Lisbon is intended to close these gaps. |

Appendix B. Measurement scales

| Item | Loading |
|---|---------|
| <i>Flying intention</i> | |
| I plan to do less / just as much / more intercontinental long-distance trips in the future than before. | .939 |
| I plan to fly on vacation less / just as much / more in the future than before. | .939 |
| <i>Flight shame</i> | |
| When flying, I have a really guilty conscience due to climate protection reasons. | .911 |
| I fly less because of climate change | .880 |
| I am ashamed to fly on vacation because I am aware of the ecological damage that flying involves. | .885 |
| <i>Green consumption</i> | |
| It is important to me that the products and services I use do not harm the environment. | .828 |
| I consider the potential environmental impact of my actions when making many of my decisions. | .864 |
| My purchase habits are affected by my concern for our environment. | .868 |
| I am concerned about wasting the resources of our planet. | .787 |
| I would describe myself as environmentally responsible. | .810 |
| <i>Price carelessness</i> | |
| I am not willing to go to extra effort to find lower prices. | .864 |
| The time it takes to find low prices is usually not worth the effort. | .864 |
| <i>Travel involvement</i> | |
| I attach great importance to vacation travel. | .932 |
| It means a lot to me to go on vacation. | .956 |
| Booking a vacation is like buying a gift for myself. | .852 |

Notes. Factor loading based on isolated exploratory factor analysis.