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RESEARCH ARTICLE



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Voluntary carbon offsetting and consumer choices for environmentally critical products—An experimental study

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Abstract

Purchases of voluntary carbon offsets (VCOs) are growing tremendously. At the same time, the number of activities and products for which VCOs are available is increasing. Experts discuss whether offering VCOs is exclusively associated with positive effects on the environment or if it instead may lead to increased consumption of environmentally critical products. To date, empirical evidence on such adverse effects is scarce. Therefore, this study uses a randomized controlled trial design to investigate how the availability of VCOs affects consumers' choices for environmentally critical products. The results suggest that when VCOs are available, the likelihood of environmentally critical consumption increases. From a mental accounting perspective, our findings support the theoretical rationale of VCOs as an instrument for moral licensing. Additionally, our results indicate that individuals tend to trivialize the harmfulness of the environmentally critical product and overestimate the effectiveness of VCOs for environmental protection, which we consider strategies for reducing cognitive dissonance and guilt.

KEYWORDS

cognitive dissonance, consumer behavior, mental accounting theory, moral licensing, randomized controlled trial, voluntary carbon offsetting

1 | INTRODUCTION

“Reduce what you can, offset what you can't” (Carbonfund, 2020). This is how Carbonfund, a large American organization offering voluntary carbon offsets (VCOs), addresses potential customers on its website. Accordingly, consumers are advised to reduce their emission of greenhouse gases (GHGs) from certain activities. If these activities are not avoidable, however, they can purchase VCOs. VCO providers claim that by doing so, customers can reduce their ecological footprint. To achieve this reduction, VCO providers pursue different climate protection measures. These measures aim to reduce GHGs by

an equivalent amount to that originally emitted by environmentally harmful activity. Carbon offsetting projects can work in two different ways. First, they can aim at capturing existing GHGs from the atmosphere, for instance, through reforestation. Second, they can attempt to reduce GHG emissions. For example, investing in solar-powered energy supply in rural areas decreases GHGs against the baseline level of emissions produced by conventional but fossil-intense methods (Lovell et al., 2009). The initial GHG-producing activities may thus be reinterpreted as ostensibly carbon neutral (Spash & Theine, 2018).

Generally, VCOs are becoming increasingly popular among consumers. For example, Germany's largest VCO provider, atmosfair,

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has registered tremendous sales growth in the last several years (atmosfair, 2017, 2018, 2019). Likewise, the number of VCO providers has multiplied in recent years (Spash & Theine, 2018). However, voluntary carbon offsetting may also lead to an increase in environmentally critical consumption and may not induce a positive behavioral change towards climate protection activities (Lange et al., 2017). Rather, the growth and spread of VCO sales in society appear to stem mainly from the desire to stick to established consumption habits while avoiding feelings of guilt (Kotchen, 2009; Rosser, 2011). This criticism has also found its way into the current public and scientific debate on climate protection, where VCOs are discussed controversially.

Various studies investigate what motivates individuals to buy VCOs and how buyers can be profiled (Babakhani et al., 2017; Blasch & Ohndorf, 2015; Denton et al., 2020; Lu & Wang, 2018; McKercher et al., 2010). Lange et al. (2017) state that approximately 50% of Germans believe that offsetting contributes to climate protection, whereas only 11% engaged in carbon offsetting in 2013. A recent study of offsetting behavior found that mainly individuals who are young, educated, and who have a stronger environmental concern engage in offsetting activities (Schwirplies et al., 2019). The main identified drivers for VCO purchases are high knowledge and awareness of VCOs (Babakhani et al., 2017; Denton et al., 2020; Lu & Shon, 2012), high perceived effectiveness and credibility of VCOs (Denton et al., 2020; Schwirplies et al., 2019), high environmental concern (Schwirplies et al., 2019), or high social norms (Blasch & Ohndorf, 2015). Additionally, many researchers deal with the willingness to pay for carbon offsets (Chen, 2020; Choi & Ritchie, 2014; Hinnen et al., 2017; MacKerron et al., 2009; Schwirplies et al., 2019). Moreover, studies show that guilt avoidance plays an important role in the context of VCO purchases (Blasch & Farsi, 2014; Blasch & Ohndorf, 2015; Choi & Ritchie, 2014; Mair, 2011).

However, there is very limited empirical literature on the adverse effects of VCOs and how carbon offsetting affects consumer behavior (Kotchen, 2009). Lange et al. (2017) conducted a representative survey in Germany and the United States and concluded that offsetting may either substitute or complement clean consumption activities, such as saving energy. Substitution is more likely when offsetting is perceived to be effective, whereas complementary use is more likely when offsetting is perceived to have medium effectiveness in climate protection. Günther et al. (2020) find that hostel guests who know that their water usage is compensated by the accommodation show significantly higher water consumption. Even though the participants do not compensate for their environmentally critical behavior themselves, the knowledge of the compensation is sufficient to impact their behavior. Our study goes beyond and investigates whether there is an opportunity to compensate for environmentally critical behaviors already affects consumers' decision making.

Therefore, the following research question arises: Does the *availability of VCOs* affect consumers' choice of environmentally critical products (ECPs)?

This study refers to different theoretical concepts in environmental decision making, such as mental accounting theory, moral licensing,

and cognitive dissonance. We designed a randomized controlled trial (RCT) to empirically address the research question. Experimental research is particularly appropriate in this field of research in that it scrutinizes real instead of stated behavior. This makes it more difficult to engage in socially desirable responses (Blanken et al., 2015). To the best of our knowledge, this is the first study in the context of VCOs and product choice to draw on evidence from experimental research.

2 | THEORETICAL CONCEPTS IN ENVIRONMENTAL DECISION MAKING

Environmental decisions are characterized by a high degree of uncertainty, a strong emotional component, and a social acceptance bias that favors proenvironmental positions (de la Torre-Ruiz et al., 2015). Acknowledging this complexity, different theoretical concepts are applied in scientific discourse to explain environmental decision making.

2.1 | Mental accounting

According to the principle of mental accounting, individuals keep track of their incomes and expenditures over time and allocate them to different mental accounts, for example, groceries, leisure activities, or travel (Thaler, 1985; Thaler, 1999). Incomes and expenses that are booked on different mental accounts are not fungible; that is, they cannot be shifted from one account to another (Thaler, 1999). Within specific accounts, individuals strive to balance expenses and revenues (Heath & Soll, 1996). Although the concept of mental accounting has typically been used to explain financial decision making, Hahnel et al. (2020) have recently transferred this mechanism to the field of environmental decision making. They find that individuals also keep track of their environmentally relevant actions and try to stay within defined budgets. From this perspective, environmentally friendly behaviors are offset against environmentally critical behaviors in the same way that revenues are offset against expenditures (Hahnel et al., 2020).

2.2 | Moral licensing

The reasoning behind moral licensing is based on the assumption that individuals follow the concept of mental accounting and strive for balance within accounts. More specifically, moral licensing implies that humans are concerned with and track their moral self-image over time (Merritt et al., 2010; Ploner & Regner, 2013; Sachdeva et al., 2009). However, studies find that instead of striving for moral excellence, individuals prefer a legitimate and convenient level of moral behavior (Cornelissen et al., 2013; Nisan & Horenczyk, 1990). According to Cornelissen et al. (2013), behaviors are continuously adjusted to keep one's moral self-image fluctuating closely around a desired moral level over time (Nisan & Horenczyk, 1990; Ploner & Regner, 2013).

Following this argumentation, people tend to show compensatory behaviors when facing deviations from their moral budget (Cornelissen et al., 2013; Sachdeva et al., 2009). Consequently, when their self-view as a moral person drops below a certain level, they engage in corrective moral behaviors (Cornelissen et al., 2013). However, when the level of perceived morality surpasses the level at which individuals aspire to be, they feel morally licensed to engage in rather immoral or less altruistic behaviors (Cornelissen et al., 2013).

Studies reveal licensing effects in peoples' everyday behaviors (Effron & Conway, 2015). According to Effron et al. (2013) and Effron and Conway (2015), positive behaviors may act as a guilt-free license for a morally bad choice. Meta-analyses emphasize that moral licensing effects across studies are modest but reliable (Blanken et al., 2015; Hertz & Krettenauer, 2016). In this view, moral licensing is considered a relevant factor in environmental decision making. Specifically, researchers find evidence for morally licensed behaviors in various contexts, for example, in charitable giving, diet and health decisions, job hiring, and racial attitudes, as well as in green consumption decisions (Merritt et al., 2010; Monin & Miller, 2001; Sachdeva et al., 2009). Concerning the latter aspect, a study by Mazar and Zhong (2010) reveals licensing effects from the purchase of ecological products, and Tiefenbeck et al. (2013) find that individuals who took part in a water-saving campaign increased their electricity usage.

2.3 | Cognitive dissonance

Another concept in the context of environmental decision making is cognitive dissonance theory. The theory asserts that humans have an inner drive to keep their attitudes, beliefs, and behaviors consistent (Festinger, 1957; Sharma, 2014). According to cognitive dissonance theory, individuals hold certain cognitions about themselves and their environment, attitudes, opinions, and (past) behavior (Oshikawa, 1969). Specific groups of cognitions can be unrelated, consonant, or dissonant from each other (Sharma, 2014). Dissonant cognitions are considered psychologically uncomfortable and are often associated with feelings of guilt. Consequently, consumers strive for consistency in their behaviors and self-perceptions to avoid this discomfort (George & Yaoyuneyong, 2010). Individuals may experience cognitive dissonance as a result of environmentally critical consumption decisions. For instance, air travelers might feel the desire not to harm the environment. At the same time, their behavior contributes to the extensive emission of GHGs from air travel. From this perspective, especially as the environmental downside of tourism is increasingly addressed in the public debate, studies have found that holidaymakers experience cognitive dissonance (McDonald et al., 2015).

Research shows that individuals can pursue various strategies to reduce inconsistencies between conflicting cognitions. These strategies aim at changing elements of the dissonant relationship. Thus, either the behavior, the attitude, or the perception of one's behavior can be actively transformed (Sharma, 2014). The latter can be achieved by adding new cognitions. These might emphasize positive aspects of the dissonance-producing relationship. Consumers thereby

counterbalance the initial behavior or retroactively give rational meaning to it (Sharma, 2014). In this process of rationalization, they actively seek information supporting their position and justifying their choices (Tanford & Montgomery, 2015). Likewise, individuals can also avoid or ignore information that makes their choices seem dissonant. They may also trivialize dissonant elements and inconsistencies (George & Yaoyuneyong, 2010). In this way, cognitions that ultimately lead to cognitive dissonance are downplayed (George & Yaoyuneyong, 2010).

3 | HYPOTHESES

Following the theoretical rationale of mental accounting and moral licensing, studies reveal that consumers strategically seek opportunities to perform minor good acts when anticipating morally dubious choices (Blanken et al., 2015; McDonald et al., 2015; Merritt et al., 2012; Merritt et al., 2010). These minor good acts could then give individuals a license to engage in environmentally critical behaviors (Merritt et al., 2010). The availability of VCOs could be such a proenvironmental signal that might provoke environmentally critical behaviors. In this view, the purchase of VCOs may provide consumers the opportunity to point to their proenvironmental efforts and morality. This might allow them to license morally questionable future behaviors. However, we argue not only that the actual purchase of VCOs might provoke environmentally critical behavior but also that the option to buy VCOs could be sufficient to induce moral licensing. Just as Gneezy and Rustichini (2000a) found that the opportunity to pay a fine for being late led to subjects being late more often, we assume that the mere opportunity to compensate for carbon emissions leads to subjects behaving in a more environmentally harmful way. The thought of compensating may be sufficient for the VCO to be booked as an "income" on the subject's mental account and thus trigger a moral licensing process. In the same way, subjects facing a VCO option may anticipate the benefits of the VCO for reducing feelings of guilt, which may increase the likelihood of choosing ECPs. Thus, the VCO offer may be interpreted as an instrument to avoid cognitive dissonance from environmentally critical consumption decisions.

Further, VCO offers may displace intrinsic motivations that voluntary efforts are typically based on (Rode et al., 2015; Spash & Theine, 2018). In line with previous findings on the adverse effects of monetary compensation on performance (Gneezy & Rustichini, 2000b), we argue that the monetization of GHG emission reduction that is associated with VCO offers may suppress intrinsically motivated efforts to engage in environmentally friendly behaviors (Falk & Kosfeld, 2006; Lange et al., 2017). The elimination of intrinsic motivation may further increase consumers' likelihood of engaging in environmentally critical behaviors.

In summary, the availability of VCOs may alleviate guilt, prevent the emergence of cognitive dissonance, and crowd out intrinsic motivation. Consequently, consumers may feel morally licensed to engage in environmentally critical behaviors. Therefore, we hypothesize the following:

H1. The option to purchase VCOs increases the likelihood of choosing ECPs.

Cognitive dissonance theory asserts that individuals encounter conflict when deciding between different alternatives (Tanford & Montgomery, 2015). At the same time, they also tend to review the merits and demerits of their purchases (George & Yaoyuneyong, 2010). Therefore, both anticipating and reviewing the purchase can result in different states of cognitive dissonance if a person has contradictory cognitions related to the (planned) purchase. Moreover, studies show that the level of perceived cognitive dissonance is particularly strong when there is high perceived control over the decision and when individuals' positive self-concept is endangered (Thøgersen, 2004). According to Thøgersen (2004), these conditions would hold if consumers expect that their (planned) behavior makes them appear immoral.

As presented in H1, we assume that the offer to purchase VCOs increases the likelihood that consumers choose ECPs over environmentally friendly products (EFPs). We further assume that consumers who choose ECPs face cognitive dissonance for two reasons. First, even though the option to purchase VCOs might itself alleviate associated guilt to a certain extent, environmentally critical consumption is still considered immoral and hence endangers individuals' self-concept. Second, consumers who need to decide between two products have a high degree of control over the decision. Following this argumentation, those who are offered a VCO and who are expected to increasingly engage in environmentally critical consumption (H1) should feel stronger postpurchase cognitive dissonance.

There are different strategies for dealing with cognitive dissonance. One strategy is to avoid inconsistent information by ignoring the negative aspects of the decision (or product) or by trivializing dissonant elements and inconsistencies (George & Yaoyuneyong, 2010). Individuals aim to make contradictory cognitions consistent again (Tanford & Montgomery, 2015). When deciding between two products with different environmental compatibilities, for instance, those who opt for the ECP may downplay the environmental harm of the chosen product to reduce cognitive dissonance. This strategy aims at trivializing the contradiction between behavior and attitude. Further, we argue that the monetization of environmental damage implied by offering VCOs also encourages consumers to trivialize the environmental harmfulness of ECPs. Consumers might be misled into thinking that the environmental damage caused by an ECP will not be too serious if it can be compensated with a VCO. Consequently, we hypothesize the following:

H2. Individuals who are offered the option to purchase VCOs perceive ECPs to be less harmful than individuals who are not offered VCOs.

Individuals who experience stronger cognitive dissonance are not only expected to avoid inconsistent information (e.g., through trivialization as derived in H2) but can also actively seek supportive information. These processes are not mutually exclusive but rather

run in parallel to reduce psychological tension (Monin & Miller, 2001). Hence, the option to purchase VCOs might not only increase the likelihood of choosing ECPs (H1) but also increase the perceived effectiveness of VCOs for environmental protection. In this light, individuals would highlight the environmental contribution of VCOs to further reduce cognitive dissonance and guilt. We thus hypothesize the following:

H3. Individuals who are offered the option to purchase VCOs assess the general effectiveness of VCOs to be higher than individuals who are not offered VCOs.

4 | METHODOLOGY

4.1 | Experimental design

To test the hypotheses, we used an RCT design. Subjects were randomly assigned to the different groups to increase the likelihood that known and unknown influencing factors were evenly distributed across both groups. Whereas social desirability bias is a widely discussed issue in the field of sustainability research, experimental research is well suited to addressing research questions in a moral-related dimension, as subjects need to engage in real behavior and make real decisions, making it more costly or effortful to display moral behavior (Blanken et al., 2015). We also conducted two surveys—before and after the experiment—to obtain additional information about the subjects' attitudes (see Section 4.2 and Appendices A and B).

The experiment comprised two groups, with manipulation in the experimental group being the only difference in the treatment of subjects. Subjects could choose between two products (an ECP and an EFP), which they received after the experiment. As research has found that proenvironmental choices in consumers' everyday life often go along with a certain (perceived) sacrifice (Maniates & Meyer, 2010), the ECP and EFP in our experiment had to meet three criteria. First, they had to differ in their environmental compatibility. Second, one of the products had to be perceived as less valuable than the other. Third, the product costs had to remain within the financial scope of the experiment. Therefore, an avocado, the ECP, and a regional potato, the EFP, were selected. We assume that this product choice illustrates well the moral dilemma in which consumers often find themselves regarding environmentally friendly (consumption) behavior. Avocados represent a rather tempting food trend but are often discredited from an ecological point of view. The regional potato is more environmentally friendly. However, even though its ecological attributes are substantially more favorable, we assumed that participants would perceive the potato as considerably less valuable than the avocado. The results from our preliminary survey confirm this assumption (see Appendix C). Therefore, all participants were exposed to a moral dilemma in their product choice.

In contrast to subjects in the control group, those in the experimental group were offered the option to purchase a VCO if they

chose the ECP over the EFP. If purchased, the price of the VCO (€0.20) was deducted from the payout amount that subjects received for taking part in the experiment. We chose an amount of €0.20 because this is comparable with the price premium people are willing to pay for organic vegetables (Hattam et al., 2012; Hempel & Hamm, 2016).

4.2 | Experimental procedure

We recruited subjects for the experiment through a recruitment system for economic experiments,¹ with 110 students invited to take part in one of five different sessions of the experiment.

4.2.1 | Preliminary survey

Students who registered for the experiment were asked to fill out a short preliminary survey within 1 week of each session (see Appendix A). In the survey, important covariates such as green consumer values, the perceived value of avocados and potatoes and individual preferences for avocados and potatoes were measured. To decrease potential biases, subjects were asked the same questions for various other groceries. Additionally, ID codes were generated for each participant. The IDs were used to anonymously merge both data sets from the preliminary survey and the actual experiment. The preliminary survey decreased potential biases, as it left a relatively large time span between survey and experiment. The time-lagged approach chosen in this study is in line with the procedure of previous experiments (Devine et al., 2012; Sen, 2006).

4.2.2 | Real-effort task

The experiment was conducted on-site, and subjects were randomly assigned to the experimental and control groups. They did not know which group they were in. First, they needed to perform a so-called real-effort task. In everyday life, people develop a feeling of ownership of their monetary income (Hodge & Mason, 1995). This also applies to income spent on purchases of intangible goods such as VCOs. However, subjects taking part in an experiment might not have a feeling of ownership over the expense allowance that they receive for their participation. Even though this appears to be a minor difference, studies find that individuals treat earnings substantially differently—and consequently also consume differently—depending on how the money they are about to spend is obtained (Arkes et al., 1994). For instance, when they receive monetary gains that they did not anticipate, did not earn, or do not feel like they truly earned, they are more inclined to spend this money. These unanticipated, unexpected, or unearned gains are referred to as windfall gains in the literature (Soman & Cheema, 2001). To counter this problem, we asked subjects in this study to work on a real-effort task.

There are a broad variety of real-effort tasks used in economic experiments (Lezzi et al., 2015). The chosen task needed to be relatively trivial and should not be perceived as useless by the subjects. Ultimately, a sorting task using various screws and bolts of different sizes was chosen. Consequently, subjects needed to sort a box of mixed screws by size and received an amount of €10 if they performed the task adequately. To ensure that all subjects put effort into the task, we mentioned that the sorted screws would be briefly checked after the experiment and before the actual payout. Completing the real-effort task took, on average, approximately 15 min.

4.2.3 | Priming with environmental compatibility

Subjects were subsequently shown information on the environmental compatibility of two different products, that is, an avocado (ECP) and a potato (EFP). After subjects were primed with the respective information, they needed to answer questions about the environmental impact of the products. If respondents answered incorrectly, they were shown the product comparison again. In this way, we ensured that all subjects not only paid attention but were also certainly aware of which product was more environmentally friendly.

Cognitive dissonance appears to be especially high when the decision is irrevocable, when the pressure to purchase the product is rather low, and when individuals perceive high control over their behavior (Cummings & Venkatesan, 1976; Tanford & Montgomery, 2015). In the experiment, subjects were simply offered a choice between two products after receiving information regarding their environmental compatibility. Subjects had high control over their behavior and few possibilities to attribute it to an external source. Therefore, we assume that relatively high cognitive dissonance occurred. Indeed, research shows that cognitive dissonance can produce environmentally friendly adjustments to behavior (Gosnell, 2017; Kantola et al., 1984). Accordingly, an increasing number of people might be prone to changing their behavior when exposed to information on the environmental harm that they are responsible for. Unlike subjects in the experimental group, who could purchase the VCO, subjects in the control group had fewer possibilities to reduce this (uncomfortable) dissonance.

4.2.4 | Product choice and VCO offer

All subjects were informed that they may choose one of the two products, the ECP or the EFP, and that this choice was an additional non-cash benefit in return for their performed work. At this point, the manipulation occurred. Subjects that were assigned to the control group needed to make the product decision directly. Afterwards, they were provided information on how VCOs work but without the option to purchase one. In contrast, subjects in the experimental group were told that they would be given the opportunity to purchase a VCO for €0.20 after making the product decision. Further, they were informed that the amount of money would be deducted from

the payout amount of €10 and transferred anonymously to the VCO provider atmosfair. The same information on how VCOs work was shown to the control group and the experimental group. Additionally, respondents received further details on which project would be supported. Then subjects decided on a product. If they selected the ECP, they were offered the option to purchase the VCO.

4.2.5 | Additional survey

Once subjects decided on a product, an additional survey was retrieved (see Appendix B). Concerning the hypotheses on the reduction of cognitive dissonance, subjects needed to rate how environmentally harmful they consider the ECP, that is, the avocado, to be. They also needed to indicate how effective they consider a VCO of €0.20 to be for environmental protection. Last, we collected demographic data.

4.3 | Statistical analysis

Of the 110 subjects invited, 95 took part in the experiment. However, two data points were excluded from the statistical analysis. The first pertained to a respondent claiming to have an allergy to avocados and potatoes, which could influence product choice. Furthermore, the analysis of influential measures implementing casewise diagnostics identified one outlier with a residual value above ± 2 for the continuous variables *green consumer values* and *preference for ECP* (see Appendix D). The outlier was excluded, leaving 93 subjects for further analysis.

Statistical analyses to test the research hypotheses were performed using R and SPSS 25 software. To test H1, we applied a binary logistic regression. Additionally, we used a contingency analysis to determine whether a dependency between group affiliation (experimental or control group) and product choice exists. To test H2 and H3, we performed Mann–Whitney *U* tests for ordinal variables for two independent groups.

Before testing the research hypotheses, we checked the logistic regression assumptions to ensure the validity of the measurements

(Hair et al., 2019). The logistic regression assumptions of independence of observations, linearity of the metric variables with the outcome, and absence of multicollinearity were met (see Appendix E).

5 | RESULTS

5.1 | Descriptive results

The student sample included 54 females, 38 males, and one gender-diverse respondent. The mean age of the sample is 23.49 years. Our sample tends to be young and educated and thus represents well the typical group of VCO buyers identified by Blasch and Farsi (2014). We conducted Mann–Whitney *U* tests for independent samples to compare the experimental and control groups with regard to important covariates from the preliminary survey. The results show successful randomization, as there were no meaningful differences between the two groups (see Appendix F). The final product choices in both groups are displayed in Table 1. Contingency analysis revealed a light dependency between group affiliation and product choice ($p = .049$, phi and Cramer's $V = .204$). The results indicate that more individuals in the experimental group than in the control group chose the ECP. The results of the logistic regression provide further evidence.

5.2 | Logistic regression analysis

Due to the binary structure of the dependent variable (the product choice between the ECP and EFP), we applied logistic regression to test H1. We added general preference for the ECP as a covariate because it is likely to influence the product choice. Further, we added green consumer values adapted from Taufique et al. (2014) as a covariate, as similar constructs were previously found to influence environmental decision making (e.g., Chen, 2020; Schwirplies et al., 2019). The results of the logistic regression testing H1 are presented in Table 2. If the odds ratio is above 1, the odds of the outcome occurring increase as the predictor increases. A value of less than 1 indicates

	Product selection: EFP	Product selection: ECP	Total
Control group (no VCO option)	26	20	46
Experimental group (VCO option)	17	30	47
Total	43	50	93
χ^2	3.873*		
Phi	.204*		
Cramer's V	.204*		
Contingency coefficient	.200*		
N	93		

TABLE 1 Cross table

Abbreviations: ECP, environmentally critical product; EFP, environmentally friendly product; VCO, voluntary carbon offset.

* $p < .05$.

that as the predictor increases, the odds of the outcome occurring decrease (Hair et al., 2019).

As seen in Table 2, the logistic regression model indicates a significant influence of the VCO offer on product choice. Furthermore, the X^2 statistic shows that the model has a good fit. In terms of effect size measures, Nagelkerke's R^2 (.309) indicates that the model has high explanatory power (Backhaus et al., 2008). Being in the experimental group multiplies the odds that a subject chooses the ECP by 4.352. In other words, the odds of a subject consuming the ECP were 4.352 times higher in the experimental group. The results support H1 and suggest that when they have an opportunity to buy VCOs, consumers are more likely to engage in environmentally critical behaviors.

5.3 | Mann–Whitney U tests

To test H2 and H3, we performed Mann–Whitney U tests. The results are shown in Table 3. We find slight evidence for both hypotheses with $p < .1$. Individuals in the experimental group rated the perceived harmfulness of the ECP significantly lower than the subjects in the control group ($p = .099$). This supports H2. H3 is also supported, as the results suggest that individuals in the experimental group rate the perceived effectiveness of VCOs significantly higher than individuals in the control group ($p = .080$).

TABLE 2 Results of the logistic regression model

Dependent variable: Product selection ECP					
	BC	SE	Odds ratio	95% CI for odds ratio	
				Lower	Upper
VCO option	1.471**	.537	4.352	1.520	12.463
Green consumer values	−1.025**	.338	.359	.185	.696
Preference for ECP	0.872***	.245	2.393	1.481	3.867
Constant	1.617	1.509	5.038		
Nagelkerke's R^2	.309				
Cox and Snell R^2	.231				
Model X^2	24.452***				
Model −2LL	103.946				
N	93				

Abbreviations: CI, confidence interval; ECP, environmentally critical product; VCO, voluntary carbon offset.

*** $p < .001$. ** $p < .01$. * $p < .05$.

TABLE 3 Mann–Whitney U test: Experimental and control groups

	Control group (no VCO option) mean/median	Experimental group (VCO option) mean/median	Mann–Whitney U	z-value	$p(> z)$
Perceived harmfulness of ECP (mean/median)	5.890/6.0	5.210/6.0	877	−1.650	.099
Perceived effectiveness of VCOs (mean/median)	3.300/3.0	4.040/5.0	859	−1.748	.080
N	46	47			

Abbreviations: ECP, environmentally critical product; VCO, voluntary carbon offset.

6 | DISCUSSION

6.1 | Interpretation of results

Our results show that the option to purchase a VCO increases consumers' likelihood of choosing ECPs. In the control group, the majority of respondents chose the EFP; that is, they refrained from environmentally critical consumption. Their choice for the EFP might be determined by the desire to avoid cognitive dissonance, that is, feelings of guilt. In contrast, the majority of the experimental group chose the ECP. The findings suggest that the product decision in the experimental group is determined by the VCO offer, which might morally license respondents to opt for the ECP. Following this argumentation, the VCO option might be considered an opportunity to avoid feelings of guilt resulting from environmentally harmful product choices. The influence of the VCO offer on product choice might even be underestimated in our study, as the descriptive results show that the experimental group has a higher preference for the EFP than the control group. This might have led to a bias in favor of the EFP in the experimental group. However, our results confirm that being in the experimental group significantly increases the likelihood of choosing the ECP. Our study supports other empirical findings where small good acts were found to be sufficient to license immoral behaviors. This is true even if individuals do not engage in the compensatory moral

behavior themselves, as shown by Günther et al. (2020). The effect also seems to apply to the mere availability of VCOs, as our results show that the offer is sufficient to change behavior. Further, our results for H1 are in line with previous studies that found an adverse effect of monetary compensation on voluntary efforts (e.g., Falk & Kosfeld, 2006; Gneezy & Rustichini, 2000b). It seems that the monetization of the environmental impact of the ECP choice eliminates intrinsic efforts to behave environmentally friendly.

H2 can be accepted, as the ECP was considered less environmentally harmful in the experimental group than in the control group. These results suggest that subjects in the experimental group—who engage in significantly higher environmentally critical consumption—psychologically trivialize dissonant elements. In other words, it seems that subjects actively downplay the environmental harm of the ECP and thus may try to reduce cognitive dissonance. Indeed, similar strategies have been revealed for air travelers. For example, McDonald et al. (2015) investigate how self-reported green air travelers justify discrepancies between their attitudes and their behaviors. They show that many of these travelers experienced cognitive dissonance and reveal a wide range of strategies to reduce this dissonance, often related to a general social approbation of flying. In this way, they trivialized the environmental harmfulness of their behavior. Further, providing a price for environmental damage through the VCO offer may mislead consumers into thinking that if emissions from a product choice can financially be offset, the product may not be very harmful to the environment.

As our results support H3, we find evidence that the strategy of reducing cognitive dissonance through trivialization might be pursued not only by downplaying the environmental harmfulness of the ECP but also by exaggerating the positive environmental impact of VCOs. We find that individuals who are offered the option to purchase a VCO assess the general effectiveness of VCOs to be higher than

individuals who are not offered a VCO. This supports previous findings that subjects seem to seek supportive information and reinforce certain positive aspects of a product choice to counterbalance dissonant elements (McDonald et al., 2015). Both strategies of trivialization thus seem to provide individuals with a justification for their environmentally harmful behavior and may thus be suitable for reducing cognitive dissonance and guilt.

6.2 | Contributions to research

This study advances existing research in three aspects. First, we provide evidence that the availability of VCOs increases the likelihood of making environmentally critical consumption choices. This effect is illustrated in Figure 1. Although previous studies have shown that compensation for environmental impact induces environmentally critical behavior (e.g., Günther et al., 2020), our results suggest that the mere option to compensate is sufficient to encourage consumers to engage in environmentally critical behavior.

Second, we find evidence that VCOs might be perceived as a moral license to behave in environmentally harmful ways. In line with the principles of mental accounting theory, our findings indicate that individuals seem to weigh environmentally friendly and environmentally harmful behavior against each other and strive for a balanced ratio. However, the fact that the VCO option is sufficient to induce environmentally critical behavior suggests that the mere imagination of engaging in environmentally friendly behavior might be sufficient to be booked as an “income” on a mental account and to justify “expenses” in the form of an environmentally critical consumption choice. Further, our findings suggest that the positive environmental effect of the VCO is booked on the same mental account as the environmentally critical consumption choice. Due to the nonfungibility of

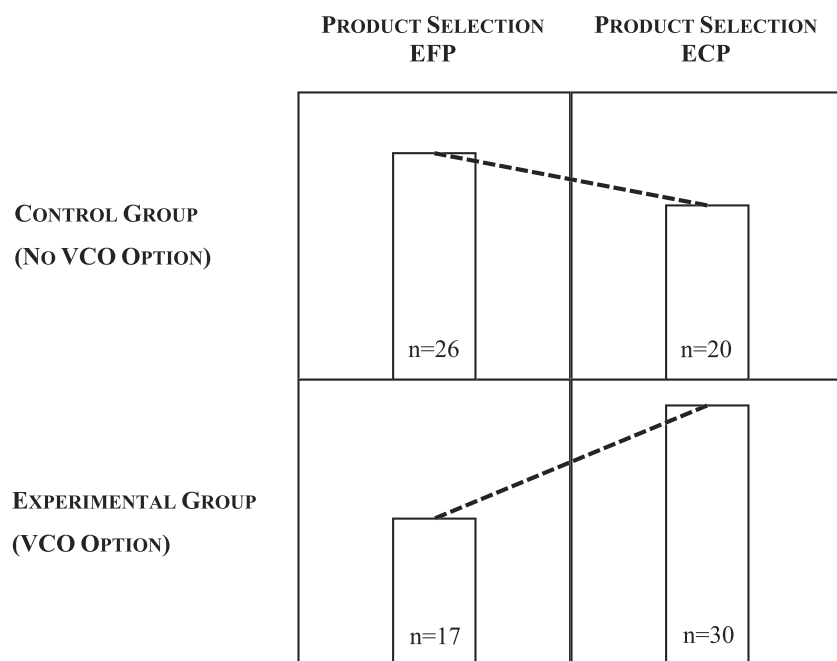


FIGURE 1 Distribution of product selection in test groups. ECP, environmentally critical product; EFP, environmentally friendly product; VCO, voluntary carbon offset

mental accounts (Thaler, 1999), the moral licensing effect found in this study could only be observed if both moral and immoral behaviors were associated with a joint mental account. However, VCOs might not only license immoral behavior but may also prevent future environmentally friendly behavior. Following the rationale that consumers stay within defined mental budgets, those in the control group who have chosen the ECP should be more likely to make more subsequent sustainable food choices—compared with consumers from the treatment group who have chosen climate-neutral ECPs. Consequently, VCOs may also reduce subsequent conservation efforts and thereby increase the adverse impact of VCOs.

Third, our results suggest that consumers anticipate guilt from environmentally critical consumption choices and make use of different strategies to avoid and reduce the underlying dissonant cognitions. We find that if individuals are primed with information regarding the environmental compatibility of two products, the majority avoid cognitive dissonance and choose the EFP. However, with the introduction of a VCO option, the priming effect is undermined. Our results emphasize that introducing VCOs provides consumers with a novel opportunity to avoid cognitive dissonance resulting from an environmentally critical consumption choice. Without offsetting options, a low level of guilt could be realized only by choosing the EFP. With offsetting options, consumers can choose more tempting ECPs while avoiding feelings of guilt, as they might consider the VCO a moral license to engage in environmentally critical behavior. Our findings also confirm the use of trivialization as a strategy to reduce cognitive dissonance in the context of environmentally critical consumption choices. We find that knowledge of an offsetting opportunity leads to trivialization of one's own environmentally critical behavior—by downplaying the ECP's environmental harmfulness and exaggerating the VCOs' positive environmental impact. Table 4 summarizes how VCO offers might broaden consumers' strategies for avoiding and dealing with cognitive dissonance and guilt arising from ECP choices.

6.3 | Practical implications

Our results yield important insights for companies and political bodies alike to induce more sustainable behaviors in society. Based on our findings, we provide recommendations regarding the question of how VCOs should be designed to prevent consumers from using them as indulgences. Further, we provide measures that aim at limiting consumers' opportunities for reducing cognitive dissonance and guilt resulting from ECP choices.

Our findings suggest that the availability of VCOs increases environmentally critical consumption. Drawing from the principles of mental accounting theory, VCOs might be perceived as a moral license for environmentally harmful consumption decisions. However, the moral license can only arise if both the “revenue” from the VCO and an individual's environmentally critical consumption decision as the “expense” are booked on the same mental account. To prevent these moral licensing effects resulting from mental accounting mechanisms,

TABLE 4 Hypothesized strategies for avoiding and dealing with cognitive dissonance

	Product selection: EFP	Product selection: ECP
Control group (No VCO option)	Avoidance of cognitive dissonance through EFP choice	Acceptance of cognitive dissonance
Experimental group (VCO option)	Avoidance of cognitive dissonance through EFP choice	Avoidance of cognitive dissonance through moral licensing and reduction of cognitive dissonance through trivialization, i.e., downplay of environmental harmfulness of ECP and exaggeration of the positive environmental impact of VCOs

Abbreviations: ECP, environmentally critical product; EFP, environmentally friendly product; VCO, voluntary carbon offset.

Hahnel et al. (2020) suggest fostering a stronger division between different mental accounts. As resources cannot be transferred between accounts, separate mental accounts for VCOs and product choices could prevent adverse effects. A study by Gerpott and Mahmudova (2010) reinforces the effectiveness of differentiated mental accounts for preventing moral licensing, as their results confirm that resources of different mental accounts do not affect each other. A solution to prevent the creation of joint mental accounts could be to remove the direct link between the VCO and the product choice. Instead of offering an offset payment for a specific product, consumers could generally be provided with the opportunity to pay a voluntary contribution to carbon reduction programs—independent of the specific consumption decision. Further, VCOs could also be labeled as an offset for the environmental impact caused by an individual's everyday behaviors, independent of any consumption choices. Proactively fostering the differentiation of mental accounts through more explicit labeling of VCOs might thus prevent moral licensing effects.

Furthermore, the results of our study suggest that the monetization of environmental damage eliminates intrinsic motivation to behave environmentally friendly. Because intrinsic motivation as a fundamental principle of voluntary efforts is undermined by the availability of VCOs, voluntary participation in offsetting programs seems to be ineffective, and mechanisms for mandatory participation should be considered. One approach for mandatory participation is so-called integrated carbon offsets (ICOs), where the price for the carbon offset is incorporated into the product price. Previous research has found that ICOs do not reduce anticipated guilt from environmentally critical consumption choices (Bösehans et al., 2020). Thus, in contrast to VCOs, ICOs might be appropriate to prevent moral licensing effects. However, Hahnel et al. (2020) argue that carbon pricing must be salient and transparent and that explicit carbon taxes should be

preferred over those hidden in product prices. Their suggestion is supported by Chetty et al. (2009), who found that commodity taxes more strongly influence purchases when the tax is explicitly highlighted at the point of sale. Explicit labeling of carbon prices would also provide consumers with regular feedback on their carbon consumption and thus contribute to a more realistic assessment of their environmental impact (Hahnel et al., 2020).

The measures presented above are aimed at preventing moral licensing effects caused by VCO offers. However, our study also indicates that individuals may use trivialization as a strategy to reduce guilt from ECP choices. Therefore, measures could be developed to limit consumers' possibilities of reducing cognitive dissonance. If trivialization of one's environmental impact would become more difficult, individuals might refrain from environmentally critical consumption. If individuals would be very clearly confronted with the negative environmental impact of their consumption decisions, it might become harder to deny or trivialize them. Findings by Günther et al. (2020) support this suggestion, as they found that real-time feedback on the environmental impact prevents an increase in critical consumption. Another opportunity would be to provide more transparent information about the effectiveness of carbon offsetting initiatives. There are serious concerns regarding the credibility of VCO providers and the effectiveness of the VCO market (Anderson, 2012; Walters & Martin, 2013). Studies find that the majority of carbon offsetting projects fail to achieve targeted GHG reductions (Cames et al., 2016). If consumers were better educated about these issues, their opportunities to reduce cognitive dissonance, for example, by overstating the positive effect of VCOs as found in this study, would be further reduced.

However, the variety of different labels and price levels make it difficult for consumers to assess the proenvironmental impact of the different VCOs on the market (Gössling et al., 2007). Due to information asymmetries, consumers may be encouraged to shift to the cheapest VCO providers. Processes of adverse selection could even drive higher quality VCO providers out of the market (Spash & Theine, 2018). To avoid this outcome, policy measures need to ensure that prices for carbon offsetting are comparable across different providers. Regulations may consider the lack of comparability of different VCO providers and their services. Legislators could define a minimum price for CO₂ equivalents. Further, similar narrow frames could be set for estimating the GHGs produced by certain activities. Finally, legislators could also specify a certain carbon offsetting project mix in which VCO providers would need to invest as part of different GHG reduction schemes. Further, regulation may aim to ensure that carbon offsetting initiatives do not support projects that would have been carried out anyway, even without the efforts and financing of VCO providers (Spash & Theine, 2018). For instance, VCO providers could be obliged to certify their projects with external labels. Although such labels are not exempt from criticism, they often require rigorous documentation and transparency—especially on GHG savings (Spash & Theine, 2018). One example is the so-called Gold Standard. To date, only a few VCO providers voluntarily work with this standard, as it is relatively costly to fulfill rigorous criteria. Therefore, the VCO

providers that work with such standards inevitably have higher administrative costs and offer more expensive VCOs (Spash & Theine, 2018).

6.4 | Limitations and future research

This study has some limitations that future research should address. First, all subjects in the experiment were students. In terms of the generalizability of the results, the question arises whether the sample is representative of the broader population. Nevertheless, the sample represents well the consumer group that typically purchases VCOs (Blasch & Farsi, 2014). Second, although RCTs have many advantages, they are not exempt from limitations and methodological weaknesses. For instance, they are tightly controlled to ensure that group differences can be inferred from the experimental manipulation. Hence, the experimental conditions are as artificial as possible to eliminate unobserved influence from relevant confounding variables. However, this could cause individuals to deviate from their typical behavior. Future researchers should consider using more natural settings, for example, through field studies. As there are no comparable studies, this paper aimed to investigate whether the availability of VCOs increases environmentally critical consumption. Therefore, we used a strongly broken-down product decision. In the course of future studies, it would be interesting to investigate this effect in the domains where VCOs are most popular—such as the transport and mobility sector. Drawing from mental accounting theory, we used the concepts of moral licensing and cognitive dissonance to explain the underlying psychological mechanisms between VCOs and environmental product choice. However, we cannot clearly show that the behavioral effects observed in this study are associated with these theoretical concepts. Rather, the findings may also result from the mere desire to avoid guilt. Further, we encourage future studies to investigate whether the measures suggested in this study, such as ICOs and carbon taxes, are successful in preventing moral licensing.

7 | CONCLUSION

To the best of our knowledge, this is the first study to draw on experimental research to explore how the opportunity to purchase VCOs affects consumers' product choices. Additionally, we investigate consumers' strategies to reduce cognitive dissonance in environmental decision making. We reveal moral licensing effects that encourage consumers to engage in environmentally critical consumption in the experimental group. Our results indicate that individuals trivialize the environmental consequences of their behavior by downplaying the product's harmfulness and exaggerating the effect of VCOs in an attempt to reduce cognitive dissonance. Our study uncovers the fundamental principle of how consumers use VCOs to justify environmentally critical behaviors. From this perspective, the possibility of purchasing "forgiveness" (Dhanda & Hartman, 2011) eliminates the need to change environmentally harmful lifestyles.

CONFLICT OF INTEREST

None declared.

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ENDNOTE

¹ The online recruitment system for economic experiments (ORSEE) is managed by the Institute of Public Finance at the University of Muenster, Germany.

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APPENDIX A.

PRELIMINARY SURVEY

TABLE A1 Items from the preliminary survey**Green consumer values**

Source: Adapted from Taufique et al. (2014)

Scale: 1 = *totally disagree* to 7 = *totally agree*

- [1] I consider myself an environmentally friendly consumer.
- [2] It is important to me that the products I use do not harm the environment.
- [3] I am concerned about the waste of the planet's resources.
- [4] My purchasing behavior is influenced by my concern for the environment.
- [5] I consider the potential environmental impact of my actions when making decisions.

Food preferencesScale: 1 = *not at all* to 5 = *very much*

- [1] How much do you like bananas?
- [2] How much do you like potatoes?
- [3] How much do you like avocados?
- [4] How much do you like apples?

Perceived valueScale: 1 = *not at all valuable* to 5 = *very valuable*

- [1] How valuable do you consider bananas to be?
- [2] How valuable do you consider potatoes to be?
- [3] How valuable do you consider avocados to be?
- [4] How valuable do you consider apples to be?

Allergies

Scale: yes, no

- [1] Are you allergic to bananas?
- [2] Are you allergic to potatoes?
- [3] Are you allergic to avocados?
- [4] Are you allergic to apples?

ID code

- [1] Please enter the first two letters of your mother's first name.
- [2] Please enter the first two letters of your father's first name.
- [3] Please enter the third letter of your birthplace.
- [4] Please enter your month of birth as a two-digit number.

APPENDIX B.

SURVEY CONDUCTED AFTER THE EXPERIMENT

TABLE A2 Items from the experiment**Manipulation check**

- [1] Which product causes the (about eight times) higher CO₂ emissions per kilo?
- [2] Which product has the (about eight times) higher water consumption per kilo?
- [3] Which product has the (approximately 150 times) longer transport route?
- [4] Which product is cultivated outside Europe in tropical areas?

Perceived effectiveness of VCOsScale: 1 = *not at all effective* to 7 = *very effective*

- [1] How effective do you estimate a one-time compensation donation of €0.20 in general to protect the environment?

Perceived environmental harmfulness of ECPScale: 1 = *not at all environmentally harmful* to 7 = *very environmentally harmful*

- [1] Please indicate how harmful to the environment you consider avocados in general.

Demographics

- [1] Please indicate your age in years.
- [2] Please indicate your gender.
- [3] Please indicate your field of study.

Abbreviations: ECP, environmentally critical product; VCO, voluntary carbon offset.

APPENDIX C.

VALUES OF ECP AND EFP

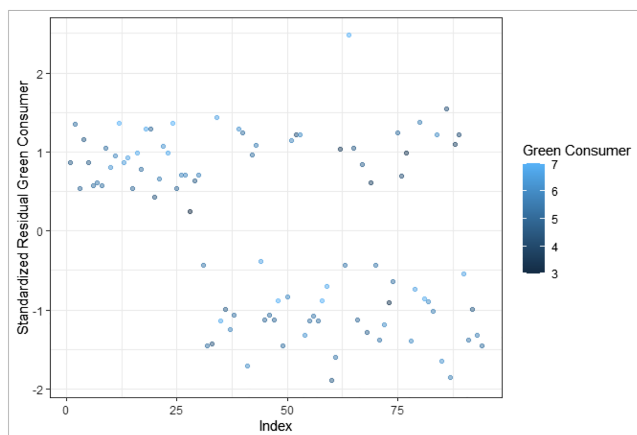
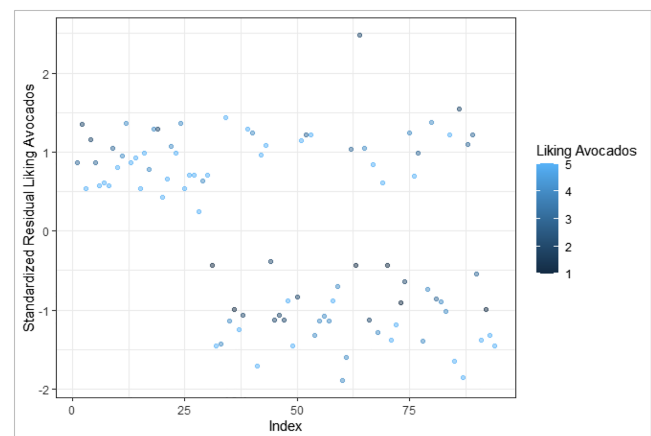
TABLE A3 Wilcoxon test for related samples

N	93
Test statistic	924.500
Standard error	221.436
Standardized test statistic	-3.886
Significance (2-sided test)	.000
Value of ECP (mean/median)	4.06/4
Value of EFP (mean/median)	3.15/3

Abbreviations: ECP, environmentally critical product; EFP, environmentally friendly product.

APPENDIX D.

ANALYSIS OF OUTLIERS

**FIGURE A1** Outlier analysis for residuals of green consumer values [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com)]**FIGURE A2** Outlier analysis for residuals of preference for environmentally critical product [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com)]

APPENDIX E.

LOGISTIC REGRESSION ASSUMPTIONS

TABLE A4 Box-Tidwell test for green consumer values

Dependent variable: Product selection ECP				
	BC	SE	Odds ratio	Sig.
Green consumer values	−9.711	6.990	.000	.165
Green consumer values * log (green consumer values)	3.480	2.593	32.448	.180
Constant	1.617	1.509	956,624,541	.140
Nagelkerke's R^2	.067			
Cox and Snell R^2	.050			
Model X^2	4.778 ⁺			
Model −2LL	123.620			
N	93			

Abbreviation: ECP, environmentally critical product.

⁺ $p < .1$.

Dependent variable: Product selection ECP				
	BC	SE	Odds ratio	Sig.
Preference for ECP	3.643	2.468	38.217	.140
Preference for ECP * log (preference for ECP)	−1.442	1.114	.236	.195
Constant	−6.087 ⁺	3.559	.002	.087
Nagelkerke's R^2	.140			
Cox and Snell R^2	.105			
Model X^2	10.312 [*]			
Model −2LL	118.086			
N	93			

Abbreviation: ECP, environmentally critical product.

^{*} $p < .05$. ⁺ $p < .1$.**TABLE A5** Box-Tidwell test for preference for ECP**TABLE A6** Variance inflation factor

Independent variable	Preference for ECP	Green consumer values
VIF (<3)	1.5318	1.5361

Abbreviations: ECP, environmentally critical product; VIF, variance inflation factor.

APPENDIX F.

COMPARISON OF THE EXPERIMENTAL AND CONTROL GROUPS

TABLE A7 Mann-Whitney U test: Experimental and control groups

	Experimental group (mean/median)	Control group (mean/median)	z-value	$p(> z)$
Green consumer values	5.532/5.4	5.304/5.4	−.409	.409
Preference for ECP	3.830/4	3.910/4	−.272	.786
Preference for EFP	4.260/4	3.960/4	−1.667	.095
Age	23.3/23	23.7/23.5	−1.171	.242

Abbreviations: ECP, environmentally critical product; EFP, environmentally friendly product.