Effect of executional greenwashing on market share of food products: An empirical study on green-coloured packaging

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A B S T R A C T

Greenwashing refers to the strategies adopted by some manufacturers to convey environmentally friendly production methods using claims, green-coloured packaging, and nature-evoking images without reflecting an actual environmental commitment. This phenomenon constitutes a threat to the development of an environmentally and economically sustainable market. Evaluating the impacts of these practices on the purchase behaviour of food consumers is crucial to provide manufacturers, retailers, and policymakers with meaningful guidance. This study aims to analyse the effect of the green-coloured packaging of two chocolate bars on consumers' choices. We implemented an online choice experiment with 737 Italian consumers following a between-subject approach. In the control treatment, we used the original packaging of both chocolate bars, whereas, in the other two treatments, we coloured the packaging of one chocolate bar green and retained the other's original colour. We estimated how the market shares changed when the packaging was greenwashed and segmented our sample according to respondents' attitudinal traits. Our findings demonstrate that greenwashing food products can potentially increase their market share compared to ordinary food, thus supporting the concerns of consumer organisations. However, the present study was inconclusive in identifying a profile of consumers who are most likely to be taken in by greenwashing. In the conclusion, we provide practical implications for policymakers, industry, and retailers for counteracting greenwashing.

1. Introduction

Facing the global increase in environmental awareness, several manufacturers have started implementing more sustainable production methods (Heras-Saizarbitoria et al., 2020). To promote their less resource-intensive products, firms use green communication strategies in labelling and advertising (Szabo and Webster, 2021). However, some companies deceptively overstate the environmental benefits of their activities (Delmas and Burbano, 2011; Ruiz-Blanco et al., 2022). Such practice is called "greenwashing"[1] (Parguel et al., 2011) and refers to the "act of misleading consumers regarding the environmental practices of a company or the environmental benefits of a product or service" (TerraChoice, 2009).

Greenwashing can be classified into two main categories (Parguel et al., 2015). The first, called "claim greenwashing", refers to the use of textual information in communication and entails several possible strategies such as omission of information, use of false claims, and employment of ambiguous wording that may deceive consumers about the product or brand's environmental friendliness (de Freitas Netto et al., 2020; Kangun et al., 1991). The other category, called "executional greenwashing", uses nature-evoking elements to incorrectly let consumers associate environmentally friendly features with brands or products (Parguel et al., 2015). These elements can be visual, such as colours (e.g., green, blue) and pictures (e.g., forests, mountains, oceans), or aural (e.g., sea, birds) (Hartmann and Apaolaza-Ibáñez, 2009; Parguel et al., 2015). Therefore, to mislead consumers in their evaluation of a product's environmental impact, "claim greenwashing" uses written information, while "executional greenwashing" implements marketing communication based on implicit features. Whereas textual elements involve a rational evaluation process, implicit components trigger an unconscious affective mechanism of persuasion in consumers (Labrecque et al., 2013; Schmuck et al., 2018a).

The practice of greenwashing leads to several issues, such as consumers being influenced and confused in their purchase intentions

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[1] The neologism was coined in 1996 by Westerveld to define the hypocritical communication implemented by hotels on the re-use of towels (Pearson, 2010).

(Martínez et al., 2020), as they are unable to distinguish between genuinely environment-friendly products and greenwashed products (Chen and Chang, 2013; European Commission, 2021; Shahrin et al., 2017; Zhang et al., 2018). Manufacturers implementing green marketing strategies that do not reflect their real environmental commitment may gain unfair advantages both economically and in terms of brand image. At the same time, companies that are more environmentally friendly may experience a decrease in consumer confidence driven by widespread greenwashing messages; and thus, lose the potential sales of their more sustainable products (Mateo-Márquez et al., 2022; Naderer and Opree, 2021). Furthermore, retailers may lose consumer trust if they place products with misleading environmental information on their shelves (Guyader et al., 2017). All these dynamics constitute a threat to the development of an environmentally and economically sustainable market (Jakubczak and Gotowska, 2020). The risk is that food manufacturers may be caught in a prisoner's dilemma situation where, at equilibrium, all firms do not invest in environmental production since their market shares are unchanged with respect to the "greenwashers", but their net profits will reduce by the additional costs if they opt for greener methods of production.

The consequences of greenwashing worry international stakeholders, who seek measures for regulating the use of misleading environmental claims and labels (Schmuck et al., 2018b; Sun and Zhang, 2019). In fact, the lack of regulation and punishment systems has been identified as the most powerful motivation for greenwashing (Lyon and Montgomery, 2015). The existing measures mainly focus on car advertising by prohibiting the use of the claims "green", "clean", or "environmentally friendly", as in Norway, or by not allowing the inclusion of visual elements evoking positive environmental effects, as in Australia and France (Parguel et al., 2015). Consumer advocates such as the European Consumer Organisation (BEUC) have asked whether greenwashing can affect the market of green products and, in this sense, jeopardise the global objective of reducing the environmental impact of global human consumption (BEUC, 2020). In particular, the evaluation of greenwashing effects concerning implicit elements that are less discernible by consumers, such as images, colours, or sounds, appears to be a challenging task for international policymakers. Therefore, it is essential to explore the effects of these techniques on consumer choices and attitudes to address policy interventions and protect consumers from misleading elements.

In recent years, the literature has extensively focused on the practice of greenwashing (de Freitas Netto et al., 2020; Eng et al., 2021; Guerreiro and Pacheco, 2021; Ruiz-Blanco et al., 2022; Schmuck et al., 2018b). The majority of the studies have focused on the definitions, forms, and characteristics of greenwashing (see the literature review of de Freitas Netto et al. (2020)). Some studies have tested whether environmental claims and implicit nature-evoking elements have a positive effect on consumer perceptions (Magnier and Schoormans, 2017; Parguel et al., 2015; Samaraweera et al., 2020). However, only few research has assessed the impacts of greenwashing techniques on consumers' purchase choices. Experimental studies testing the impact of greenwashing on the choice of food products are scant and do not perform market share simulation analysis. Empirical evidence in this field are needed to give policymakers, industry, and retailers guidance on regulating the use of executional greenwashing. The most insidious implicit elements, i.e. visual items, require particular attention as their use is not regulated and manufacturers can easily implement communication strategies based on, for example, green or blue colours often associated with nature, environmental friendliness, and healthiness (Marozzo et al., 2020; Xue and Muralidharan, 2015). If these schemes have a positive effect on consumer choices, all firms can reap the advantages, even the not sustainable ones.

To contribute to the debate, this study aims to investigate the impacts of green-coloured packaging on consumers' food choices by conducting a choice experiment on chocolate bars. By analysing the effects of this strategy used in executional greenwashing (Magnier and Schoormans, 2017), we intend to shed new light on the issue by answering the following research questions: *i)* Can green-coloured packaging increase the market share of a food product? *ii)* Are there any attitudinal characteristics, such as receptiveness to green communication or attentiveness to sustainable foods, which make individuals more susceptible to greenwashing? Our results can improve the understanding of the impact of greenwashing on the food sector, help design possible interventions to regulate such practices, and make consumers aware of this marketing pitfall.

The remainder of this paper is organised as follows. After the literature review on the effects of nature-evoking visual elements on consumers preferences, the methodology section describes the experiment and the econometric model. Then, results are presented. Finally, the last section discusses the outcomes and conclusions of the study.

2. The effect of green visual cues on consumers' purchase intentions

Visual cues such as images and colours convey meanings and influence individuals' cognitive and affective responses (Grandi and Cardinali, 2022; Grossman and Wisenbilt, 1999; Samaraweera et al., 2020, 2020van Esch et al., 2019). In green marketing, product packaging and advertising are increasingly using nature-evoking visual elements (de Freitas Netto et al., 2020). It is well known that these strategies affect consumers' evaluation of products and their attitudes towards the products/brands (Hartmann and Apaolaza-Ibáñez, 2009; Parguel et al., 2015; Seo and Scammon, 2017).

Nature-evoking images play a relevant role in attracting consumers' attention and influencing their purchase intentions (Schmuck et al., 2018a; Xue and Muralidharan, 2015). Consumers may associate green pictures, icons, and colours with environmentally friendly product features, similar to labels reporting true and clear information about environmentally friendly characteristics of products (Hartmann and Apaolaza-Ibáñez, 2009). Images of nature have a more positive impact on consumers' emotions and attitudes towards brands than images representing a desert or an urban scene (Hartmann and Apaolaza-Ibáñez, 2010). Furthermore, the combination of graphical elements and textual information elicits a superior and positive effect on purchase intention and brand attitude (Hartmann and Apaolaza-Ibáñez, 2009; Schmuck et al., 2018b; Xue and Muralidharan, 2015).

Besides graphical elements, marketers make liberal use of colours for product and packaging design, logos, and advertising to grab purchasers' attention and signal the environment-friendly characteristics of the products (Guyader et al., 2017; Labrecque et al., 2013; Samaraweera et al., 2020). Colours are aesthetic stimuli that shape individuals' perceptions through embodied and referential meanings (Dewey, 1929, 1934). Embodied meaning is derived from characteristics intrinsic to the stimulus that trigger automatic physiological reactions, while referential meaning comes from a network of semantic linkages resulting from exposure to the stimulus (Labrecque et al., 2013). Therefore, colours carry intrinsic meanings and is able to shape consumers' perceptions (Lim et al., 2020). For instance, the colour green is associated with nature and safety and is perceived by consumers as a cue signalling an environmentally friendly product or brand (Labrecque and Milne, 2012; Lim et al., 2020). These associations often occur unconsciously (Elliot et al., 2007); thus, green has become a visual tool for persuasive communication used by firms practising greenwashing (Seo and Scammon, 2017).

Existing studies focusing on the colour green's effect on consumers' product evaluation have arrived at differing conclusions. By conducting an experiment to analyse the effect of the colours used in car advertising, Lim et al. (2020) found that green is associated with environmental friendliness and is more effective than grey in improving consumer attitudes and increasing purchase intentions. Seo and Scammon (2017) tested the effect of differently coloured product packages (green, blue, red, yellow, and grey) on consumers' environmental evaluation of

brands and concluded that green elicits the most positive judgements. Additionally, by analysing consumer interactions with the packaging colour of a fictitious energy drink claiming to be environmentally friendly, they observed that green packaging in and of itself is incapable of influencing consumers' evaluation of a brand's environmental friendliness (Seo and Scammon, 2017). Considering this, it may be that the colour green represents a visual cue that helps consumers process the meaning of claims when there is a claim-colour match. In their study using an all-purpose cleaner, Samaraweera et al. (2020) observed the impact of green and white labels signalling the product's eco-friendliness and images of nature on consumers' willingness to pay (WTP) in both laboratory and field settings. Differently from the other studies, they found consumers willing to pay more for the product when it had a white label rather than a green one. The authors argued that this outcome was due to the superior readability of the white label, which better attracted the consumers' attention to the claim. Moreover, as opposed to other research, they did not observe any effect of an image of nature on consumers' WTP.

Responses to deceptive green advertising messages have also been analysed with regard to consumer characteristics, such as involvement with the product and environment (Parguel et al., 2015; Xue and Muralidharan, 2015). Findings showed that consumers who were highly involved with the product displayed more positive environmental perceptions and higher purchase intentions when exposed to green elements than those with low involvement (Xue and Muralidharan, 2015). Moreover, consumers who were highly involved with the environment were found to be more influenced by advertising with pleasant nature imagery combined with functional attributes (Schmuck et al., 2018b).

Another factor that plays a role in defining the effectiveness of nature-evoking elements is consumers' knowledge about environmental issues. Parguel et al. (2015) found that participants with low knowledge of environmental issues were more misled by nature-evoking elements than those with high knowledge. The evidence for the relationship between environmental knowledge and concern with the effect of misleading nature-evoking elements in advertising has also been observed in food products, such as coffee and water (Lim et al., 2020; Schmuck et al., 2018b). Concerning sociodemographics, the literature did not evidence a correlation of these characteristics with consumers' knowledge of greenwashing or the deceptive effects induced by greenwashing strategies (Jakubczak and Gotowska, 2020).

The above review has detected two main gaps. First, research on the effects of greenwashing in the food sector is scarce (Montero-Navarro et al., 2021). Existing studies have mainly focused on cars, home cleaners, and electronic goods (Hartmann and Apaolaza-Ibáñez, 2009; Magnier and Schoormans, 2017; Parguel et al., 2011; Samaraweera et al., 2020; Xue and Muralidharan, 2015). Since food purchases are made regularly by consumers and account for a significant proportion of overall consumer spending (Eurostat, 2020), further analyses in the food context would be highly useful as nature-evoking elements like colours and images are widespread in advertising and packaging in this sector. The implications would support policymakers in regulating the use of green elements, raise consumer awareness of the practice of greenwashing, and provide guidance to the food industry and retailers for curbing the phenomenon of greenwashing. The second gap relates to the methodologies applied. Most of the previous studies collected consumer responses through questionnaires using Likert or semantic differential scales and then applied methodologies such as structural equation models, fuzzy inference systems, or statistical tests (e.g., parametric, non-parametric) (Herbes et al., 2020; Martínez et al., 2020; Xue and Muralidharan, 2015). To our knowledge, no studies have yet been carried out to test greenwashing strategies (e.g., colours) through choice experiments that are considered to be effective in eliciting consumer preferences as they present more realistic choice scenarios (Carlsson and Martinsson, 2001; Lusk and Schroeder, 2004). Moreover, none of the previous studies simulated how green visual cues impact the market share of food products.

3. Methodology

3.1. The survey

Data were gathered in Italy during May 2021 through an online questionnaire administered to 737 consumers. Respondents were included if they were consumers of milk chocolate and above the age of 18. Participants were recruited voluntarily; no fees were paid. The respondents were contacted via e-mail and social networks and invited to fill in the online questionnaire. Online methods have been proven superior to traditional offline (i.e. paper and pencil) surveys (Sethuraman et al., 2005) because they increase the speed and cost-effectiveness of data collection (McCullough, 1998). Moreover, online data collection was selected for obtaining higher response rates and a sample with broader geographical coverage. Informed consent was obtained from all individual participants before starting the questionnaire. The survey included several sections dedicated to the choice experiment and the collection of consumption, psychographic, and sociodemographic information of the participants.

3.2. Experimental design

In this study, a choice experiment was used to elicit consumer preferences for chocolate bars. The use of choice experiments has been extensively employed to investigate food demand in consumer studies (e.g., Boncinelli et al., 2021; Dominici et al., 2020; Fang et al., 2021; Park et al., 2021; Villas-Boas et al., 2021; Yang et al., 2021). In choice experiments, respondents face different hypothetical purchasing scenarios and perform repeated choices among product alternatives. Choice experiments have the advantages of analysing the preferences for multiple attributes and levels (Adamowicz et al., 1998; Louviere et al., 2000). We conducted a labelled choice experiment with two 150g milk chocolate bars of two different brands and a no-choice option. A milk chocolate bar was chosen due to the environmental issues linked to its ingredients (milk powder, sugar, cocoa, and palm oil) and production process (Bianchi et al., 2021; Konstantas et al., 2018). Therefore, such a product seemed appropriate for analysing the effect of a greenwashing feature on consumers' choices. We selected two real brands with no presence in Italy to avoid brand-specific preferences: Hacendado, sold in Spain, and Alpen Gold, sold in eastern Europe. Hereinafter, we refer to the two brands anonymously, as we do not intend to link our results with the name of these brands. The other attributes were price (€1.25, €2.00, €2.75, and €3.50) and milk origin (100% milk from the mountains, none). The price levels were selected according to the actual prices of 150g milk chocolate bars sold in Italian supermarkets. The milk origin attribute was selected considering, on the one hand, the most common attributes included in chocolate bars on the actual market, while, on the other, the most valuable characteristics to consumers according to the literature. In particular, Del Prete and Samoggia (2020) underlined the importance of the origin of the chocolate ingredients. According to a fractional orthogonal design, eight choice sets were created in a single block,[2] using the software Ngene 1.2 (ChoiceMetrics Ltd.).

The experiment follows a between-subject design. Respondents were randomly assigned to one of three groups (a similar procedure was established by several scholars e.g., Gilmour et al., 2019; Lusk et al., 2018; Scozzafava et al., 2020; Van Loo et al., 2020): Control, Green Brand A, and Green Brand B. In the control setting, both brands' original packaging colour was retained. In the other two treatments, we modified the colour of one brand's packaging to green in all choice sets, while the other retained its original colour. In all treatments, we modified the real packaging to delete other logos or claims which were not of interest to this experiment.

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[2] The experimental design is available from the corresponding author upon request.

The colour green was chosen to modify the background colour of the packaging because consumers associate it with environmental friendliness (Lim et al., 2020; Seo and Scammon, 2017). The implementation of this design enabled us to verify whether green-coloured packaging can increase the market share of green-packaged or greenwashed food products. The conception of this experiment followed the approach of Parguel et al. (2015), who modified the background of car advertisements and tested the misleading effect of nature-evoking elements on consumers' evaluation of firms' ecological images.

Table 1 presents the description of the three treatments. Due to the hypothetical setting of the experiment and to explain the importance of making truthful choices, a cheap talk script introduced the participants to the choice experiment (Tonsor and Shupp, 2011). In the script, we pointed out the importance of the participants making each selection like they would if they faced the same choices in a store.

3.3. Estimation procedure

We estimated three utility functions for the three treatments with NLOGIT 5.0 by implementing a Random Parameter Logit (RPL) model that accommodates taste heterogeneity (Fiebig et al., 2010). Based on the random utility theory (McFadden, 1974), we specified that the utility U of each respondent n to choose the alternative j could be described as follows:

$$U_{nj} = \alpha_{nj} + \beta_n \, Mountain_{nj} + \gamma \, Price_{nj} + \varepsilon_{nj} \tag{1}$$

where α_j is an alternative-specific constant representing utility for brand j relative to the opt-out option, β is the marginal utility for "100% mountain milk", and *Mountain* is a dummy codifying the presence of the attribute "100% mountain milk" in alternative j faced by consumer n. The parameter γ is the marginal utility for price, and *Price* is the price of alternative j faced by consumer n. The non-price parameters are random, following the standard normal distribution.

Using the parameters estimated with the RPL, we performed the unconditional market share simulation (Lusk and Tonsor, 2016) under the assumption that both chocolate bars have the same price of €2.37 i. e., the average of the price levels, and both bars were made with "100% mountain milk". This procedure enabled us to predict the market shares for each chocolate bar across the three treatments when the prices were fixed. Furthermore, the demand curves of the two chocolate bars under the experimental conditions were estimated based on the unconditional market shares (Caputo et al., 2020; Lusk et al., 2018; Lusk and Tonsor, 2016).

3.4. Segmentation

According to previous studies, involvement with the environment and knowledge about environmental issues are effective variables for detecting consumer segments defined by different responses to misleading and nature-evoking elements in advertising (Lim et al., 2020; Parguel et al., 2015; Schmuck et al., 2018b; Xue and Muralidharan, 2015). These variables can be useful in identifying the consumers who are more susceptible to the marketing strategies used in greenwashing practices.

In this study, we analysed the choices of two different segments of

Table 1
Description of the three treatments.

Treatment name	Description
Control	Original packaging colours of the two brands
Green Brand A	Green-coloured packaging of Brand A and original packaging colour of Brand B
Green Brand B	Green-coloured packaging of Brand B and original packaging colour of Brand A

consumers identified through the responses given to the statements about sustainable eating and receptivity to green communication on two scales. For measuring consumers' involvement in sustainable eating, we asked respondents to state their agreement with four statements on the scale used by Van Loo et al. (2017). For assessing consumers' receptivity to green communication, we used a nine-item scale (Paço et al., 2019). The responses were recorded through a 5-point Likert scale (-2 = *Strongly disagree*, 2 = *Strongly agree*); the summary statistics are shown in Appendix. For each respondent, we summed up the scores of the items on each scale. Then, we classified the consumers who achieved a total score higher than zero on each scale. The participants with a score higher than zero on the sustainable eating scale were classified as "Sustainable Eaters", while those with a score higher than zero on the scale about receptivity to green communication were classified as "Receptive Consumers". Belonging to one segment did not exclude the participant from being a member of another segment, and consumers who did not achieve a score higher than 0 were excluded from the analyses. After identifying these two segments and the respondents belonging to them, we tested for participants that were most likely to be taken in by the green packaging.

4. Results

4.1. The sample

We collected 737 valid questionnaires about milk chocolate. The sample had an acceptable variance in sociodemographic characteristics. As often seen in such online surveys, there were too few respondents in the older and less-educated ranks.[3] Table 2 presents the sociodemographic information of the sample.

Five per cent of the respondents consumed milk chocolate bars every day, 27% ate milk chocolate bars a few times per week, 24% consumed the product twice or thrice a month, and 44% consumed milk chocolate bars once a month or less. Ninety-six per cent of the sample did not know Brand A, and 94% of those interviewed had not come across Brand B.

The random assignment of the respondents in the treatments generated three groups of 253, 239, and 245 individuals. We performed Kruskal-Wallis equality-of-populations rank tests (Kruskal and Wallis, 1952) to investigate whether there are differences across the three treatments according to their sociodemographic characteristics. All the tests on gender ($\chi^2(2) = 0.91$, p = 0.63), age ($\chi^2(4) = 0.33$, p = 0.85), education ($\chi^2(2) = 2.31$, p = 0.32), occupational status ($\chi^2(2) = 2.42$, p = 0.30), and economic status ($\chi^2(2) = 0.57$, p = 0.75) reject the null hypothesis. Therefore, the random assignment of the participants to one of the three treatments created homogenous groups according to these variables.

4.2. Choice experiment results for the three treatments

Using a homogeneity test, we tested whether the treatments in the choice experiment resulted in significant changes in the estimates of preferences. The Likelihood Ratio test was equal to 40.4, thus we rejected the null hypothesis of equality among the three groups. This indicates that the comparison across the groups is appropriate.

Table 3 shows the estimation results of RPL models of the Control, Green Brand A, and Green Brand B treatments. In these three, the

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[3] It is worth pointing out that the representativeness of the sample cannot be actually assessed as the population of interest in this research is not the Italian population, rather the Italian milk chocolate consumers. Moreover, even if the socio-economic characteristics of the target population are unknown, it is reasonable to expect a higher consumption rate amongst the younger people. Adding up to this, online survey research in literature commonly reports the sample as being slightly biased towards the younger and well-educated classes as these are the main features of Internet users.

Table 2
Sociodemographic characteristics of the full sample and treatment groups.

	Full sample	Control group	Green Brand A	Green Brand B
	(n = 737)	(n = 253)	(n = 239)	(n = 245)
Gender				
Male	45.85	41.84	42.04	43.29
Female	52.96	55.65	57.14	55.22
Not declared	1.19	2.51	0.82	1.49
Age group				
<36	66.80	68.62	65.71	67.03
36–50	19.76	17.57	19.60	19.00
51–65	7.51	7.95	10.61	8.68
>65	5.93	5.86	4.08	5.29
Education				
Primary school or none	0.54	0.40	0.84	0.50
Middle school	2.31	2.37	2.09	2.45
High school	29.44	26.48	28.87	33.06
Tertiary education	67.71	70.75	68.20	64.08
Occupational status				
Employee	55.50	52.17	56.49	57.96
Student	29.31	32.41	28.87	26.53
Retired worker	7.19	7.91	6.69	6.94
Unemployed	6.92	6.72	6.28	7.76
Homemaker	1.08	0.79	1.67	0.81
Economic condition[a]				
With high facility	9.23	8.30	7.53	11.84
With facility	29.85	28.46	31.80	29.39
With a few facilities	33.92	34.78	30.54	36.33
With a few difficulties	15.20	17.79	16.32	11.43
With difficulty	5.83	5.53	8.37	3.67
With high difficulty	5.97	5.14	5.44	7.34

Notes: [a] Respondents' answers to the question "How do you make ends meet?"

negative and statistically significant price coefficients indicate that an increase in the price of the chocolate bars reduces their utility to consumers. The estimates of the alternative specific constants (Brand A and Brand B) indicate the utility of each chocolate bar relative to the opt-out option. The positive and statistically significant coefficients of Brand A and Brand B show that by keeping the price constant, on average, consumers prefer to buy one of the two chocolate bars than not buy anything. In particular, Brand B is preferred over Brand A in all treatments, including the treatment in which the Brand A bar was shown with green packaging. The positive coefficients of Mountain in the three treatments indicate that the attribute "100% mountain milk" increases the utility of milk chocolate bars to consumers. The statistically significant standard deviations indicate that there are variations in preferences within the three treatments as well.

Fig. 1 displays the unconditional predicted market shares for the chocolate bars in the three treatments when their price is €2.37. In the control treatment, when the packaging of both bars is presented with their real colour, the market share of Brand A is 40%, while for Brand B

is 28%. The replacement of the real colour of Brand A with green led to an increase of its market share to 45% (+5% compared with the Control treatment) and a shift of the choice share of Brand B to 29% (+1% compared with the Control treatment). In the Green Brand B treatment, we observe a choice share of 40% for Brand A (equal to the Control treatment) and a market share of 33% for Brand B (+5% compared with the Control treatment). From the shares of the No Choice option, we observe that the replacement of the packaging colour induced participants to choose a product, with a consequent decrease of the No Choice share from 32% to 26% in the Green Brand A treatment and 27% in the Green Brand B treatment.

To make our results more evident, we analysed the trends of market shares in relation to price changes by estimating the demand curves (Table 3). Fig. 2 shows the demand curves of Brand A (Fig. 2A) and Brand B (Fig. 2B) when they are displayed in their actual colour and green. These results provide an answer to the first research question; for both chocolate bars, the replacement of the real packaging colour with green leads to an increase in the market share.

We tested the effect of the treatments by estimating two models by pooling the data of the control group with each treatment and interacting a treatment dummy variable with the alternative specific. These two models were estimated in the WTP space to account for taste heterogeneity and the scale of the sub-groups. The sign and the significance of the interaction terms indicate that the green packaging treatment changed the WTP for the products (Table 4).

4.3. Analysis of consumer segments

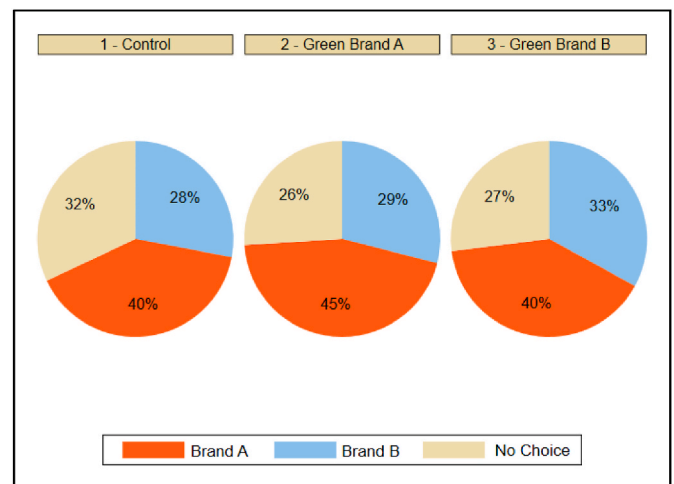To test whether individuals with specific psychographic traits are

Fig. 1. Unconditional market shares by treatments.

Table 3
Random Parameter Logit model results for the three treatments.

Variable		Control		Green Brand A		Green Brand B	
Brand A	Mean	3.37***	(0.41)	4.07***	(0.44)	3.76***	(0.53)
	SD	5.16***	(0.58)	4.80***	(0.47)	6.10***	(0.70)
Brand B	Mean	3.70***	(0.48)	4.42***	(0.49)	3.99***	(0.54)
	SD	5.63***	(0.58)	5.58***	(0.55)	6.24***	(0.71)
Mountain	Mean	0.84***	(0.18)	1.25***	(0.17)	1.28***	(0.17)
	SD	1.67***	(0.17)	1.70***	(0.18)	1.55***	(0.20)
Price	Mean	−1.00***	(0.07)	−1.13***	(0.08)	−0.96***	(0.07)
Log-likelihood		−1433		−1346		−1348	
Observations		2024		1912		1960	
Individuals		253		239		245	
Akaike information criteria		2885.5		2711.3		2716.4	
Bayesian information criteria		2892.4		2718.3		2722.3	

Notes: Numbers in parentheses are standard errors; SD = Standard deviation; *** denotes statistical significance at the 1% level.
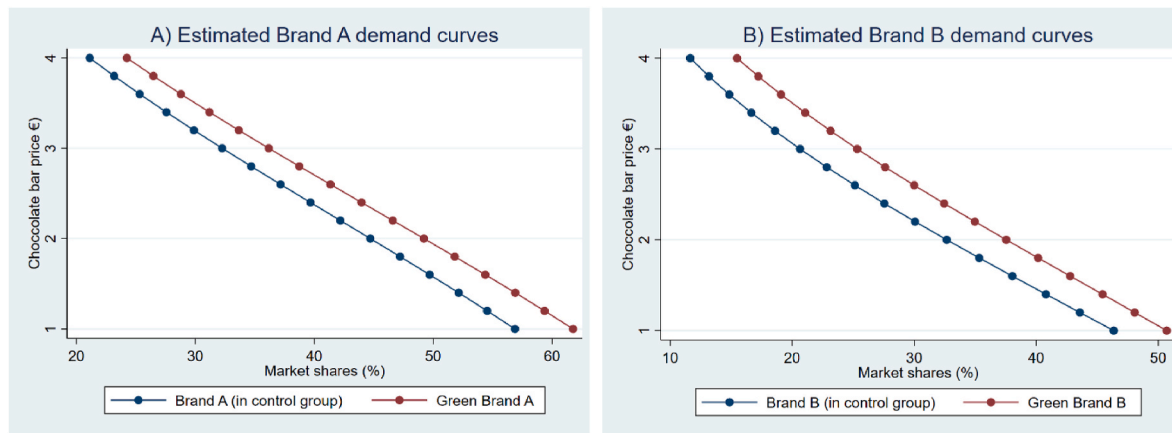
Fig. 2. Demand curves for Brand A (A) and Brand B (B) with the real colour and green packaging. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

Table 4
Results of the models in WTP space relative to pooled consumers belonging to different treatments.

Variable		Control + Green Brand A		Control + Green Brand B	
Brand A	Mean	3.87***	(0.11)	3.93***	(0.10)
	SD	3.32***	(0.16)	3.33***	(0.16)
Brand B	Mean	4.36***	(0.11)	4.28***	(0.11)
	SD	3.98***	(0.17)	3.90***	(0.16)
Mountain	Mean	1.10***	(0.05)	1.06***	(0.05)
	SD	1.40***	(0.07)	2.04***	(0.12)
Brand A*TreatGA	Mean	0.25***	(0.06)		
Brand B*TreatGB	Mean			0.15**	(0.07)
Tau	Mean	1.65***	(0.05)	−1.50***	(0.02)
Log-likelihood		−2699		−2755.7	
Observations		3936		3984	
Individuals		492		498	
Akaike information criteria		5421.752		5535.358	
Bayesian information criteria		5497.087		5610.839	

Notes: Numbers in parentheses are standard errors; SD = Standard deviation; *** and ** denote statistical significance at the 1% and 5% levels, respectively; TreatGA is the dummy variable codifying the Green Brand A treatment; TreatGB is the dummy variable codifying the Green Brand B treatment.

more likely to be lured by greenwashing, we identified two groups: sustainable eaters (82% of the sample) and receptive consumers (83% of the sample). A Pearson χ^2 test between treatments and segments revealed that the segments are homogenously distributed among the three treatments (p = 0.45 for sustainable eaters and p = 0.84 for receptive consumers).

To explore the preferences of sustainable eaters and receptive consumers, we implemented RPL models accounting for the interaction between chocolate bars and group membership. Table 5 shows the results of the model with the interaction between chocolate bars and the membership of the sustainable eater segment. In the Control and Green Brand A treatments, Brand B was the favourite bar, followed by Brand A. In the Green Brand B treatment, the coefficients of the two bars are not statistically significant. Therefore, consumers do not gain utility from choosing a chocolate bar. The attribute "100% mountain milk" increases the utility for the consumers in the three treatments; the price coefficient is negative and statistically significant per the economic theory. The only statistically significant interaction term is that between Brand B and being a sustainable eater in the Green Brand A treatment. This means that sustainable eaters prefer the Brand B bar in the Green Brand A treatment.

Table 6 reports the results of the RPL model with the interaction between chocolate bars and the membership of the receptive consumer segment. The preference structure of the main effects follows those of the previous model (Table 6). The interactions report different significances compared to the previous models accounting for the interactions between chocolate bars and sustainable eaters (Table 5). In this model, receptive consumers of the Green Brand A treatment prefer the Brand B bar, and in the Green Brand B treatment, they prefer the Brand A bar. The results in Tables 5 and 6 regarding the interaction terms provide an answer to the second research question. Being a sustainable eater or receptive consumer does not increase the likelihood of being lured by

Table 5
Random Parameter Logit model with interactions for the three treatments.

Variable		Control		Green Brand A		Green Brand B	
Brand A	Mean	2.70***	(0.74)	2.79***	(0.55)	2.25	(1.51)
	SD	5.16***	(0.59)	5.36***	(0.73)	6.29***	(0.77)
Brand B	Mean	2.80***	(0.87)	3.65***	(0.59)	2.45	(1.53)
	SD	5.66***	(0.59)	6.22***	(0.85)	6.46***	(0.79)
Mountain	Mean	0.84***	(0.18)	1.24***	(0.18)	1.32***	(0.18)
	SD	1.67***	(0.17)	1.71***	(0.19)	1.58***	(0.21)
Price	Mean	−1.00***	(0.07)	−1.14***	(0.08)	−0.96***	(0.07)
BrandA*SustainableEaters	Mean	1.04	(0.92)	0.73	(0.70)	1.66	(1.67)
BrandB*SustainableEaters	Mean	0.78	(0.80)	1.38**	(0.64)	1.65	(1.66)
Log-likelihood		−1432		−1344		−1348	
Observations		2024		1912		1960	
Individuals		253		239		245	
Akaike information criteria		2888.3		2712.3		2720	
Bayesian information criteria		2893.8		2717.5		2725.6	

Notes: Numbers in parentheses are standard errors; SD = Standard deviation; *** and ** denote statistical significance at the 1% and 5% levels, respectively; SustainableEaters is the dummy variable codifying the membership to the sustainable eater segment.

Table 6
Random Parameter Logit model with interactions for the three treatments.

Variable		Control		Green Brand A		Green Brand B	
Brand A	Mean	2.67***	(0.87)	2.76***	(0.60)	0.30	(0.88)
	SD	5.07***	(0.62)	5.03***	(0.47)	6.21***	(0.68)
Brand B	Mean	3.06***	(1.00)	3.32***	(0.67)	−0.35	(0.83)
	SD	5.53***	(0.60)	5.75***	(0.52)	6.42***	(0.70)
Mountain	Mean	0.89***	(0.19)	1.27***	(0.17)	1.33***	(0.18)
	SD	1.65***	(0.17)	1.72***	(0.18)	1.60***	(0.21)
Price	Mean	−1.00***	(0.07)	−1.14***	(0.08)	−0.95***	(0.07)
Brand A*Receptive	Mean	0.88	(0.95)	1.51*	(0.84)	4.42***	(1.03)
Brand B*Receptive	Mean	0.94	(0.84)	1.70**	(0.76)	3.49***	(1.06)
Log-likelihood		−1432		−1345		−1345	
Observations		2024		1912		1960	
Individuals		253		239		245	
Akaike information criteria		2887.8		2713.2		2713.8	
Bayesian information criteria		2893.8		2719.5		2719.6	

Notes: Numbers in parentheses are standard errors; SD = Standard deviation; ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively; Receptive is the dummy variable codifying the membership to the receptive consumer segment.

green packaging.

5. Discussion and conclusion

This study investigates the effect of the use of green packaging, a strategy adopted in executional greenwashing, on consumers' purchasing preferences for milk chocolate bars. Understanding how consumers perceive colours in food packaging and advertising is pivotal for marketers and policymakers aiming to avoid consumer confusion and deception. Our results demonstrate that greenwashing food products can potentially increase their market share against food products that are not greenwashed.

This finding is in line with those of studies regarding non-food products. For cars, Lim et al. (2020) observed a higher purchase intention when respondents were exposed to advertising that used the colour green. They detected that consumers associated the colour green with environment-friendliness, and its use could improve their attitude towards the product. Furthermore, using fictitious branded products, Seo and Scammon (2017) found that the colour green elicited the most positive judgements of a brand's environmental impacts compared to other colours. An implicit element such as the colour of a product's packaging is a communication tool that can generate added value for the consumer (Marozzo et al., 2020).

Our findings can also be compared with the results of studies analysing other strategies of executional greenwashing. In testing car advertising, Parguel et al. (2015) found that the use of nature-evoking pictures had the misleading effect of improving a brand's image. The same outcome was evidenced by Xue and Muralidharan (2015) with green visuals used in the advertising of high-involvement products, such as cars and televisions. These findings confirm that using nature-evoking colours and images as marketing tools can mislead consumers by acting on their subconscious minds.

In this study, consumers who are sustainable eaters and receptive to green communication were not found to be more susceptible to being deceived by the green colour of the chocolate bar packaging. This outcome is not congruent with the findings of Schmuck et al. (2018a), who concluded that more environmentally-involved consumers were more influenced by nature-evoking advertisements. This discrepancy may be due to the different scales used for measuring the attitudes (environmental concern, attitudes toward green products, and green purchase behaviour in Schmuck et al. (2018a) compared to sustainable eating and receptivity to green communication in this study) and the type of products (mobile phone in Schmuck et al. (2018a) compared to chocolate bars in this study).

This research adds two main contributions to the previous literature. First, we demonstrated that the green-coloured packaging can potentially increase the market share of greenwashed food products against

food products that are not greenwashed. Therefore, green firms can be damaged by the greenwashing behaviour of other firms. These insights may be considered by practitioners to implement packaging decisions and measures to help consumers make informed purchase decisions. Second, the novelty of estimating the possible effects of greenwashing through a choice experiment proved to be an effective methodological approach to evaluate the practice's impacts on consumer demand for products. Therefore, choice experiments can be designed for testing the effectiveness of interventions to contain and combat the practice of greenwashing.

Furthermore, this study provides practical implications for policymakers, industry, and retailers. Our findings about the increased market share of food products with green-coloured packaging support the concern of consumer organisations and call the attention of policymakers to find a way to limit or repress this practice that potentially jeopardises public efforts towards greener economies. However, since the effectiveness of some potential tools is yet to be tested, suggesting possible and specific public interventions is very challenging. The effectiveness of greenwashing is of great concern as it is enough to simply use the colour green to achieve an increase in the market share of a product. In particular, executional greenwashing requires specific interventions due to the implicit nature of its elements, such as images or colours, which are more difficult to recognise but, at the same time, are effective in misleading consumers. Proposals to combat greenwashing are mainly based on the request to test the truthfulness of the claims and logos and demonstrate with measures. However, these regulations are not effective in combatting executional greenwashing. Should policymakers regulate the use of colours or symbols in food markets, for example, by requesting producers to accomplish specific environmental benefits to gain the right to use the colour green in their marketing communication? Such a policy seems too pervasive and restrictive of firms' freedom. Moreover, its effectiveness is doubtful.

On the other hand, from the perspective of firms, there is no primary way for a sole food manufacturer to combat greenwashing. Incentives to do so would be low since the costs may be high while the benefits would be available for the entire industry. A practicable solution could be the use of industry self-regulation (ISR), where the food manufacturers agree to act against the use of executional greenwashing and regulate themselves by using marketing tools consistent with their environmental practices. The use of ISR could be effective since food manufacturers would not be willing to be labelled as "greenwashers" as it would mar their reputation, and firms do not gain from deliberately misleading consumers. However, the success of ISR is challenged by several factors, such as the effective compliance of participants to ISR rules or freeriding behaviour. Therefore, policymakers can encourage ISR in different ways such as through support the compliance or enforcement of various schemes.

Another strategy could be to work on consumer education and awareness. Since the promotion of firms' green features is a valuable strategy for sustainable development, policymakers should intervene to inform consumers about greenwashing strategies and teach them how to differentiate between true environmental cues and false, misleading ones. Raising consumer awareness about the marketing tactics used by firms that greenwash would help them make informed choices and support the development of an environmentally and economically sustainable market (Fernandes et al., 2020; Naderer and Opree, 2021). However, since the present study was inconclusive in identifying a profile of the consumers more likely to fall prey to greenwashing, we cannot provide information to better target these policies. Our hypothesis that sustainable eaters are the at-risk group is not supported by the data. Findings indicate that sustainable eaters and non-sustainable eaters have the same probability of being attracted and misled by green packaging. The same conclusion applies to the consumers receptive to green communication. In our study, green packaging of food products imparts the same effect on participants regardless of their involvement in sustainability issues (i.e., sustainable consumption and receptiveness to green communication). Other characteristics might be more useful to profile consumers more susceptible to greenwashing tactics in the food industry, such as involvement with the product or the reputation of the manufacturer, as observed for other goods (Xue and Muralidharan, 2015). Generally speaking, encouraging consumers to link the environmental properties of the products sold with public or private logos and regulated claims could mitigate the negative impacts of greenwashing. This could be effective if the assumption of the rational consumer is verified. However, the evidence that food choices are not consistent with this assumption and are driven by a few easy information-processing steps is largely demonstrated in psychology and behavioural economics (see, for instance, choice heuristics, bounded rationality, or attribute non-attendance).

The outcomes of this study about the positive impact of green-coloured packaging on consumers' choices can also have important implications for retailers. The former can play a central role in curbing greenwashing and guiding consumers' sustainable choices (Guyader et al., 2017). Retailers could offer only products and brands which actually guarantee compliance with environmental standards while possibly avoiding packaging with greenwashed features, such as those using misleading colours. In this way, retailers could help consumers make informed choices and increase their trust in sustainable products. Another strategy that retailers could use in their shops is the introduction of dedicated shelves with environmentally friendly products that are appropriately signposted to attract the attention of shoppers. By using these insights, retailers can contribute to controlling the phenomenon of greenwashing and thus not be an accomplice of the greenwashing manufacturers.

The present study has some limitations that can be overcome by further research. Firstly, in our experiment, we used a chocolate bar, which is a hedonic product not frequently consumed during a typical week and has low value for consumers. Further studies should confirm whether our findings are consistent across other food categories, such as staple foods or fine foods. Another limitation of this research is the online administration of the survey and the hypothetical nature of the choice experiment. Consequently, the results of this experiment may be affected by hypothetical bias. To overcome this limitation, future studies should implement incentive-compatible methods, such as real choice experiments or experimental auctions or apply revealed preference methods (e.g., scanner data analysis) to examine the actual consumption behaviour. Another recommendation for further studies concerns the identification of consumer groups more susceptible to greenwashing since the profiles addressed through our analysis (i.e. consumers attentive to sustainable foods and consumers receptive to green communication) did not provide results. For instance, purchase frequency, involvement with the product, and brand reputation could be possible variables to be considered in future analyses.

CRediT authorship contribution statement

Fabio Boncinelli: Conceptualization, Methodology, Software, Investigation, Formal analysis, Data curation. **Francesca Gerini:** Conceptualization, Methodology, Investigation, Formal analysis, Data curation, Writing – original draft, Writing – review & editing, Visualization. **Giovanna Piracci:** Methodology, Writing – review & editing, Visualization. **Roberto Bellia:** Investigation. **Leonardo Casini:** Conceptualization, Validation, Resources, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix

Table A1

Summary statistics of the items used for detecting sustainable eaters and receptive consumers (N = 737).

Item	Mean	Median	IQR
Involvement in sustainable eating[a]			
Sustainable eating is very important to me	1.01	1	1
I care a lot about sustainable eating	0.92	1	2
Sustainable eating means a lot to me	0.82	1	1
I am very concerned about the consequences of what I eat in terms of sustainability	0.8	1	2
Receptivity to green communication[b]			
I support brands that support the environment.	1.23	1	1
I tend to pay attention to advertising messages that talk about the environment.	0.94	1	2
The use of green messages in ads affects my attitude toward the ads.	0.64	1	1
I respond favourably to brands that use green messages in their advertising.	0.71	1	1
I am the kind of consumer who responds favourably when brands use green messages in their ads.	0.66	1	1
I think that green advertising is valuable.	0.68	1	1
Green advertising is a necessary form of advertising.	0.61	1	1
I am the kind of consumer who is willing to purchase products marketed as being green.	0.65	1	1
I tend to pay attention to green advertising messages.	0.63	1	1

Notes: IQR is the interquartile range.
[a] Scale of Van Loo et al. (2017).
[b] Scale of Paço et al. (2019). The responses were recorded through a 5-point Likert scale (−2 = strongly disagree, 2 = strongly agree).

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