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# Targeted Information and Sustainable Consumption: Field Evidence<sup>\*</sup>

Loukas Balafoutas Esther Blanco Raphael Epperson

November 13, 2024

## Abstract

Technological progress offers new and promising ways to provide targeted information to consumers and facilitate behavioral change. We conduct a randomized controlled trial with a global supermarket chain and food producer to evaluate the effectiveness of a targeted information intervention that offers consumers individualized feedback about the sustainability of purchased products and close substitutes. We find that the majority of consumers access the information, independently of whether they have bought sustainable or unsustainable products in the past. Yet, providing the targeted information has no significant impact on consumption choices, which is neither driven by inattention to information nor price differentials.

## JEL Classifications: D12, D82, Q53

**Keywords**: Information provision, pro-environmental behavior, sustainability, label credence goods, randomized controlled trial

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# 1 Introduction

The recent 2022 Intergovernmental Panel on Climate Change (IPCC) report on mitigation of climate change identifies the need for further research on the "dynamic interaction between individual, social, and structural drivers of change" (IPCC, 2022, ch. 5). One of the potential structural barriers for consumers to making more sustainable consumption choices is the information asymmetry prevalent in markets. That is the case because attributes of products – including sustainability attributes – are oftentimes difficult to ascertain for consumers, even after purchase or consumption (e.g., Baksi and Bose, 2007; Dulleck et al., 2011; Etilé and Teyssier, 2016; Balafoutas and Kerschbamer, 2020; Arguedas and Blanco, 2024). Examples include the extent of recycled components in packaging, the accuracy of Corporate Social Responsibility claims, and whether production is based on regenerative agriculture.

Information provision is often put forward as a simple way to facilitate sustainable consumption, building upon the idea that consumers would adjust their choices if they were sufficiently informed. Previous information interventions on sustainable consumption have shown mostly no or small positive effects (for reviews, see Byerly et al., 2018, and Taufique et al., 2022; for a meta-analysis, see Nisa et al., 2019). However, technological progress offers new and promising ways to provide information to consumers in a more targeted fashion. For example, smartphone applications allow providing consumers with direct information about the sustainability of their purchases and introducing (more sustainable) substitutes into the consumers' consideration sets. Such targeted information provision could prove helpful in steering behavioral change.

In this project, we evaluate the effectiveness of a targeted intervention offering access to information on the sustainability of products in a field setting. We conduct a randomized controlled trial (RCT) in Spain ( $N \approx 1,000$ ) in cooperation with the international supermarket chain Carrefour, the food company Danone, and the app developer recycl3R.<sup>1</sup> First, we explore to what extent consumers access targeted information about product sustainability and whether information acquisition depends on purchasing history. Consumers who have bought unsustainable products in the past are the primary target of information interventions, yet they might be especially motivated to avoid new information to protect their self-image. Second, we evaluate the impact of providing such targeted information on consumption choices, again considering the overall effect as well as heterogeneity by purchasing history.

We implement the randomized control trial in Carrefour's app ReciclaYa. The app allows consumers to obtain information on the separation and recycling of products and earn discounts for future purchases through self-reported recycling activities, specifically the recycling of products in their Carrefour bills. An internal survey suggests that both the discounts as well as the

<sup>&</sup>lt;sup>1</sup>The Carrefour Group has over 300,000 employees in eight countries (France, Spain, Italy, Belgium, Romania, Poland, Brazil, and Argentina) and reported over 80 billion euros in net sales in 2023 (Group, 2024). Danone is a global and leading player in the food industry with net sales of about 28 billion euros in 2023 (Danone, 2024). recycl3R develops services to facilitate recycling and works with different partners from the industry including Carrefour (https://recycl3r.com/about-us/, last accessed on July 23, 2024).

information on recycling motivate consumers to use the app. In the randomized controlled trial, we provide a random subset of consumers with the opportunity to acquire targeted information about the sustainability of a purchased product and close substitutes. We focus on plastic water bottles from Danone, commercialized through two brands that differ in the share of recycled material used (0-25% for the "unsustainable" and 100% for the "sustainable" brand). The use of recycled plastic is a crucial component in reducing the substantial carbon footprint of plastic (Zheng and Suh, 2019; Cabernard et al., 2022) and mitigating environmental pollution (Bening et al., 2021; Nikiema and Asiedu, 2022). Most of the bottles from the sustainable brand included the unverifiable message "100 percent made out of other bottles" on their packaging, while the unsustainable product did not include any message. In addition, both water brands were suitable for low-sodium diets and for the preparation of infants' food, making them a rather homogeneous product.

When purchasing one of the considered products, consumers are randomized into a treatment or control group and receive a short "Thank you for your purchase" message in the app. Treated consumers then have the opportunity to access information on the recycled material in the purchased product and close substitutes. Finally, all consumers are offered a EUR 5 voucher for future purchases of water bottles and need to select for which of the two brands they would want the voucher to be issued. In addition to the voucher choice, we track consumers' purchasing decisions for seven months, including a pre- and post-intervention period. The design and analysis of the randomized control trial have been pre-registered on *aspredicted.org* (see online Appendix A or https://aspredicted.org/V2P\_CH3).

Our results show that about 60% of treated consumers access the information about product sustainability. This is a high share given the opportunity cost of time, and remarkably similar to the results obtained in laboratory experiments on information avoidance on pro-social choices (Vu et al., 2023), where the opportunity cost of time is virtually zero. We do not observe significant differences in information acquisition between consumers with a history of purchasing the unsustainable product and those who bought the sustainable product in the past. This points to the capacity of information campaigns to reach also consumers whose shopping bag is not particularly sustainable. Yet, we find that providing targeted information has no notable impact on consumption choices. Our sample size allows us to exclude small effect sizes of 0.11 standard deviations. This lack of effectiveness is again independent of consumers' purchasing history. Exploratory analyses suggest that the lack of effectiveness is neither explained by inattention nor price differentials, but rather by a reluctance to switch to another brand.

This study generates novel empirical evidence that can help close the knowledge gap on the dynamic interaction between individual consumption choices and structural information asymmetries as drivers of change in sustainable consumption. In particular, it makes three main contributions to the literature. First, it sheds light on the effectiveness of targeted information interventions. In contrast to previous studies that provide the same information on product attributes to all consumers, e.g., through product labels (e.g., Teisl et al., 2002; Bjørner et al., 2004; Elofsson et al., 2016; Brunner et al., 2018; Lohmann et al., 2022), our information intervention is individualized and based on previous purchase decisions. In particular, the information on product sustainability is tailored to the specific product that has been bought and introduces close substitutes to the consumer's consideration set. Evidence on such targeted information provision is scarce. In a recent innovative study, Fosgaard et al. (2024) show that providing individualized feedback on carbon emissions from grocery shopping, together with social comparisons and goal setting, helps consumers reduce their carbon footprint. The authors identify the combined effect based on a sample of 258 individuals from the Danish population that are randomized into different apps developed for the scientific study. The latter allows them to incorporate carbon footprints from several food items and collect detailed information on real consumption choices. In our study, we isolate the effect of providing individualized information on the sustainability of purchased products (recycled material) and close substitute. In addition, we use an existing and established app that, by the time of the RCT, had about 25,000 registered users.<sup>2</sup> Thus, we present results for a natural environment where the intervention has been designed and implemented following the common practice for the launch of promotions in the app.

Second, our study contributes to the literature on voluntary information acquisition and moral wiggle room. A large number of laboratory studies have shown that individuals might strategically avoid information about the consequences of their actions, leading to lower levels of pro-social behavior (e.g., Dana et al., 2007; Larson and Capra, 2009; Feiler, 2014; Exley and Kessler, 2023; for a review, see, Vu et al., 2023). At the same time, the empirical evidence in the context of environmental externalities from consumption is rather mixed (Felgendreher, 2018; Momsen and Ohndorf, 2020, 2022; d'Adda et al., 2024) and evidence from field related settings is scarce (Freddi, 2021; Epperson and Gerster, 2024). While the opportunity to avoid information is technically inherent in many information interventions previously studied in the field – e.g., by not opening information letters with the electricity bill (Allcott, 2011; Allcott and Rogers, 2014; Andor et al., 2022) – the information acquisition stage is usually not observed. Our design allows us to measure information acquisition on product sustainability in a natural environment and test whether consumers who have bought unsustainable products in the past are more likely to avoid such information. Observing the information acquisition stage allows us to better understand the mechanisms by which information interventions can drive behavioral change.

Third, we tackle the consumption of label credence goods (e.g., Cason and Gangadharan, 2002; Dranove and Jin, 2010; Dulleck et al., 2011; Bartling et al., 2015; Etilé and Teyssier, 2016; Pigors and Rockenbach, 2016a,b; Balafoutas and Kerschbamer, 2020; Arguedas and Blanco, 2024), where consumers face uncertainty regarding product attributes. Such label credence

 $<sup>^{2}</sup>$ As of July 2024, this number has risen to over 220,000.

goods have qualities that are difficult to judge even after consumption and thus, while consumers know what they want, they do not observe what they get. The sustainability attribute on which we base the intervention, namely the extent of recycled material in packaging, is one for which consumers often lack information and cannot assess the truthfulness of producers' claims since certifications are not available. Hence, consumers face an information asymmetry with producers, and our results offer much needed evidence on the usefulness of targeted information interventions in alleviating information asymmetries in label credence goods markets.

# 2 Randomized Controlled Trial

# 2.1 Design

The treatment in the randomized controlled trial (RCT) provides consumers with the opportunity to receive information about the sustainability of a purchased product and close substitutes. To identify suitable products, the study started with a market research conducted by recycl3r at Carrefour shops based on the following criteria. First, the product is a label credence good, i.e., a good with unobservable characteristics that the consumer cannot assess even after consumption (Balafoutas and Kerschbamer, 2020). Second, the product has close substitutes that are also commonly purchased, meaning that it is a rather homogeneous product other than the sustainability attribute. An additional requirement from Carrefour was that the treatment does not compare products across different producers.

We identified plastic water bottles from two brands of the producer Danone, as ideal candidates. Both brands offer plastic water bottles in various sizes, but one brand (Font Vella) used either no or at most up to 25% recycled plastic, whereas the bottles of the other brand (Lanjarón) consist of 100% recycled plastic at the time of the RCT. For the purpose of this paper, we refer to the latter as the sustainable brand. We consider bottles of the sizes 0.33L, 0.5L, 1L, 1.5L, 2L, and 6.25L.<sup>3</sup> For most bottle sizes of Lanjaron (all but the 0.33L and 1.5L), the message "100 percent made out of other bottles" was displayed in the label, as a self-reported claim of the sustainability of the package that could not be verified by consumers. The bottles from Font Vella did not contain any claim regarding the share of recycled material.

Consumers are assigned to the RCT and randomized into treatment or control upon uploading a purchase bill with one of the considered water bottles. Figure A.1 illustrates the treatment variation. Upon uploading the bill, consumers receive a "Thank you" message for purchasing the product (Screen 1). In the treatment group, the "Thank you" message additionally asks consumers whether they would like to receive information on the amount of recycled material in the purchased product and close substitutes. If consumers click the button "know more," they see the information screen that shows the share of recycled plastic for four different products

 $<sup>^{3}</sup>$ In the pre-registration, we forgot to mention the bottle size of 1.5L. It should be clear from the experimental design that this size was also to be considered. We thus include the bottles of 1.5L in our main analyses.



Figure 1: Treatment Variation

*Notes:* The figure illustrates the treatment variation based on screenshots from the English wording. In general, the app offers five different languages: Spanish, Catalan, Euskara (Basque), Galician, and English. Online Appendix Figure A.1 provides screenshots from the Spanish wording.

(Screen 2). The four products are the initially purchased water bottle, a water bottle of the same size but from the other brand, and one additional bottle from each brand with the next larger size than the initially purchased product (or the next smaller size for the 6.25L bottles). In addition, the screen shows the current online price of each bottle. Average prices range from EUR 0.5 to EUR 2.25 and differ between the sustainable and unsustainable brand by 0

to 8 cents when conditioning on bottles size (see online Appendix Table A.7).<sup>4</sup> At the end, all consumers are offered a voucher choice where they can decide for which of the two brands they would like to receive a EUR 5 voucher that is applicable to future purchases (Screen 3). Upon submitting their choice, consumers are redirected to the webpage of ReciclaYa where they enter their email address and loyalty card number to receive the voucher via email. Receiving vouchers for future purchases – also simply referred to as "discounts for future purchases" – is an integral part of the app ReciclaYa and we follow the standard procedures for implementation (see online Appendix B for details). In addition, consumers are used to product promotions via Carrefour's loyalty card. These aspects ensure that the voucher is perceived as a natural component of the consumption environment. Consumers are not aware that they are part of a randomized controlled trial.

The voucher choice serves as our main outcome variable for evaluating the impact of the information intervention for three reasons. First, it enables us to guarantee having an observation for each participant during the period of the RCT. Second, it ensures a clear choice where consumers are forced to make a decision in favor of exactly one of the two brands. Third, it mitigates the role of forgetting due to the minimal delay between receiving information on product sustainability and making a choice. As a robustness check, we also estimate the effect of the information intervention on purchases made (see Section 3.4), which confirms our main results.

The RCT started on September 23, 2022, and ended on December 3, 2022, once the preregistered number of 1,000 participants with valid voucher choices had been reached. At the beginning of the RCT, a promotion was announced on the app that up to 1,000 vouchers for one of the two brands would be issued to the first consumers who buy one of the considered bottles. A second announcement was made on November 11, 2022, informing about the prolongation of the opportunity to receive a voucher.

# 2.2 Data

We have collected the following data for all consumers who were assigned to the RCT. First, we observe the uploaded purchase of a water bottle that triggered the assignment to the RCT (referred to as *initial purchase*). Second, we elicit the choices made in the app, including the information acquisition choice in the treatment group and the voucher choice. Third, we obtain data on all uploads of purchases of the considered water bottles before and after the initial purchase for the period from June 23, 2022, until January 25, 2023. Finally, we have data on consumer characteristics from voluntary questions during the registration on the app – e.g.,

 $<sup>^{4}</sup>$ The online prices are retrieved from an endpoint of Carrefour. In about 33 percent of cases, at least one of the bottles on the information screen had a missing price because the product was not sold online at the point of making the request. This is mainly driven by one particular bottle – Lanjarón 0.5L – for which a price was always missing (see online Appendix Table A.7 for details by product). Note that current online prices are only recorded for treated consumers who access the information screen.

gender, age, and number of household members. The data on the initial purchase and choices in the app build the basis for our main pre-registered analyses, while the rest is used for robustness checks.

Our final sample consists of 984 consumers (see online Appendix C for details of applying the pre-registered exclusion criteria). Online Appendix Table A.5 reports their characteristics, overall and by treatment. For the purpose of this paper and in line with our pre-registration, we classify consumers who upload a product from the sustainable brand as their initial purchase as *sustainable* consumers. Analogously, consumers who upload a product from the unsustainable brand as their initial purchase are classified as *unsustainable* consumers. The share of sustainable consumers amounts to 40% in the final sample. In online Appendix D, we show that our results are robust to using classification rules that consider a more extensive purchase history of consumers.

# 3 Results

# 3.1 Information Acquisition

About 63% of consumers in the treatment group decide to acquire information about the recycled material in the purchased product and close substitutes (see Figure 2). We do not observe significant differences in information acquisition by consumer type: Consumers who have bought the unsustainable product show the same propensity to access the information as consumers who have bought the sustainable product (61.8% vs. 64.8%, p = 0.53,  $\chi^2$ -test).

Consumers who access the information spend a considerable amount of time on the information screen. The average and median time spent amount to 11 seconds and 9 seconds, respectively (see online Appendix Figure A.2 for the distribution). Similar to the decision of acquiring information, there is no evidence of heterogeneity by consumer type (p = 0.70, Wilcoxon rank-sum test).

# 3.2 Voucher Choice

In the control group, 42% of consumers choose the voucher for the sustainable brand, and sustainable choices are more common among sustainable than unsustainable consumers (80% vs. 17%, p < 0.001,  $\chi^2$ -test). The information intervention does not affect these choice patterns. The average effect of the information intervention is estimated to be -0.6 percentage points based on an Ordinary Least Squares (OLS) regression with a treatment dummy and an indicator for the consumer types as independent variables (see Figure 3). This estimate is not significantly different from zero (p = 0.82). The asymptotic 95% confidence interval ranges from -5.4 to 4.2 percentage points and suggests a precisely estimated null effect. In standardized terms, the 95% confidence interval excludes small effects sizes of 0.11 standard deviations.



Figure 2: Information Acquisition

Notes: The figure shows the share of consumers in the treatment group who access the information on the recycled content of the purchased product and close substitutes. The first bar reports the share of information acquisition based on the overall sample (N = 443). The second and third bar report the share of information acquisition for consumers who have bought an unsustainable product (N = 267) and sustainable product (N = 176), respectively. The whiskers represent 95% confidence intervals.

When considering heterogeneity by consumer types, we observe that neither sustainable nor unsustainable consumers show a significant response to the information intervention (see lower part of Figure 3). Results are robust to controlling for available consumer characteristics (see online Appendix Table A.6).

Overall, 82% of consumers stick with the brand of their initially purchased product and this share is similar across the treatment and control group (82.8% vs. 81.9%, p = 0.69,  $\chi^2$ -test). The low propensity to choose another brand is not a consequence of large price differentials. Conditional on bottle size, the price differentials between the sustainable and unsustainable products on the information screen range from EUR -0.05 to EUR 0.12 while the average displayed price of a product is EUR 0.95 (see online Appendix Figure A.3 and online Appendix Table A.7 for further details). In addition to being small, these differences have little predictive power for the voucher choice of consumers who acquire the information and thus learn about prices: If only one brand provides the cheapest product on the information screen, consumers select this brand in only 56 percent of the cases.<sup>5</sup> Likewise, the price difference between brands is not a significant predictor of the voucher choice in OLS or Logit regressions (see online Appendix Table A.8). This does not imply that consumers are generally insensitive to prices. Both the propensity to buy at least one of the water bottles considered in the RCT as well

<sup>&</sup>lt;sup>5</sup>Similar results apply when focusing on the cheapest price per liter (where 49% of consumers choose the associated brand) and the cheapest price among products with the same bottles size as the initial product (where 60% of treated consumers choose the associated brand).



Figure 3: Treatment Effect

*Notes:* The figure shows the estimated treatment effects on the propensity to choose a voucher for the sustainable brand. The average treatment effect (ATE) is estimated based on an OLS regression with a treatment dummy and an indicator for the consumer type as independent variables. The estimates for the conditional average treatment effects (CATEs) for sustainable and unsustainable consumers as well as their difference are estimated based on a similar OLS regression that also includes the interaction of the treatment dummy and the indicator variable for the consumer type. The whiskers represent 95% confidence intervals.

as the number of bottles bought substantially increased with the announcement of the EUR 5 voucher at the start of the RCT (see online Appendix Figure A.4).

# 3.3 Attrition

In line with the pre-registration, we have excluded 136 consumers who did not complete their voucher choice from the main analysis (see online Appendix C.2), e.g., because they did not submit their contact details to receive the voucher or did not select a brand. The attrition rate differs significantly between the treatment and control group (15.9% vs. 8.8%, p < 0.001,  $\chi^2$ -test). In the following, we present exploratory analyses which suggest that the attrition does not alter the interpretation of our main results. In online Appendix C.2, we additionally shed some light on the reasons for the observed drop outs.

The estimated difference in information acquisition between unsustainable and sustainable consumers remains small and insignificant when considering observations that are affected by attrition but submit an information choice while passing the other pre-registered exclusion criteria (see online Appendix Figure A.5). To shed light on the robustness of the results on the impact of the information intervention, we consider different scenarios. In Scenario A, we look at the extreme case that all consumers without submitted voucher choice would have chosen the sustainable brand. In Scenario B, we consider the other extreme that all consumers

	Scenario A (1)	Scenario B (2)	Scenario C (3)
Panel A. ATE			
Treated	$0.030 \\ (0.025)$	-0.032 (0.024)	-0.010 (0.023)
Sustainable consumer	$0.565^{***}$ (0.025)	$0.592^{***}$ (0.025)	$0.641^{***}$ (0.024)
Constant	$0.224^{***}$ (0.020)	$0.176^{***}$ (0.018)	$0.165^{***}$ (0.018)
Observations	1,120	$1,\!120$	1,120
Panel B. Heterogeneity			
Treated	$\begin{array}{c} 0.032 \\ (0.033) \end{array}$	-0.032 (0.028)	-0.032 (0.028)
Sustainable consumer	$0.568^{***}$ (0.035)	$0.593^{***}$ (0.034)	$0.615^{***}$ (0.034)
Treated×sust. consumer	-0.007 (0.050)	-0.001 (0.050)	$0.057 \\ (0.048)$
Constant	$0.223^{***}$ (0.022)	$0.176^{***}$ (0.020)	$0.176^{***}$ (0.020)
Observations	1,120	$1,\!120$	1,120

 Table 1: Effect of Information Intervention on Voucher Choice Accounting for Attrition

Notes: Panels A and B show estimation results from OLS regressions. The dependent variable is the voucher choice of consumers. Consumers without submitted voucher choice are treated as having chosen the sustainable brand (column 1), as having chosen the unsustainable brand (column 2) or as having chosen the brand of the water bottle they initially purchased (column 3). For those consumers who made a voucher choice but did not enter their email address or loyalty card number to receive the voucher, we always use the submitted choice. Consumers who face technical problems or initially upload products of both brands are always excluded. Robust standard errors in parentheses.

p < 0.1, p < 0.05, p < 0.05, p < 0.01.

without submitted choice would have chosen the unsustainable brand. In the final Scenario C, we assume that all consumers without submitted choice would have adhered to the brand of the water bottle they initially purchased. For those consumers who submit a voucher choice but do not enter their email address or loyalty card number to receive the voucher, we always use the submitted choice. Columns 1 to 3 of Table 1 present the estimation results for the effect of the information intervention under the different scenarios. Compared to the pre-registered estimation presented in Section 3.2, the point estimates of the average treatment effect and conditional average treatment effects by consumer type become slightly larger in absolute terms but stay insignificant at the five percent level across all scenarios.

# 3.4 Purchases

Our data allow us to estimate the effect of the information intervention on the purchases that were made in supermarkets and uploaded to the app. We focus on two different periods. First,

	D	uring voucher	period	After voucher period		
	None (1)	Sustainable (2)	Unsustainable (3)	None (4)	Sustainable (5)	Unsustainable (6)
Panel A. ATE						
Treated	0.020 (0.032)	$0.010 \\ (0.025)$	$-0.047^{*}$ (0.028)	$0.000 \\ (0.029)$	-0.021 (0.021)	0.009 (0.026)
Sustainable consumer	-0.042 (0.033)	$0.339^{***}$ (0.028)	$-0.286^{***}$ (0.027)	$0.007 \\ (0.030)$	$0.120^{***}$ (0.023)	$-0.144^{***}$ (0.025)
Constant	$0.505^{***}$ (0.025)	$0.090^{***}$ (0.016)	$0.445^{***}$ (0.024)	$0.699^{***}$ (0.023)	$0.089^{***}$ (0.015)	$\begin{array}{c} 0.263^{***} \\ (0.022) \end{array}$
Observations	984	984	984	984	984	984
Panel B. Heterogeneity						
Treated	$0.027 \\ (0.041)$	0.019 (0.024)	-0.063 (0.041)	-0.005 $(0.038)$	-0.001 (0.022)	-0.009 (0.037)
Sustainable consumer	-0.034 (0.044)	$\begin{array}{c} 0.349^{***} \\ (0.037) \end{array}$	$-0.304^{***}$ (0.037)	$0.002 \\ (0.040)$	$\begin{array}{c} 0.142^{***} \\ (0.032) \end{array}$	$-0.164^{***}$ (0.032)
Treated×sust. consumer	-0.017 (0.066)	-0.022 (0.056)	$0.040 \\ (0.054)$	$0.011 \\ (0.060)$	-0.050 (0.046)	$0.044 \\ (0.050)$
Constant	$0.502^{***}$ (0.028)	$0.086^{***}$ (0.016)	$0.452^{***}$ (0.028)	$\begin{array}{c} 0.702^{***} \\ (0.025) \end{array}$	$0.080^{***}$ (0.015)	$\begin{array}{c} 0.271^{***} \\ (0.025) \end{array}$
Observations	984	984	984	984	984	984

 Table 2:
 Effect of Information Intervention on Purchases

Notes: Panels A and B show estimation results from OLS regressions. Columns 1 to 3 focus on the period during which the voucher is valid, while columns 4 to 6 focus on the period thereafter. The dependent variable in column 1 and 4 is whether the individual purchases any of the considered water bottles during the respective period. The dependent variable in column 2 and 5 is whether the individual purchases at least one bottle of the sustainable brand during the respective period. The dependent variable in column 3 and 6 is whether the individual purchases at least one bottle of the unsustainable brand during the respective period. Robust standard errors in parentheses. \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01.

we estimate the effect on purchases during the period for which the voucher from the RCT was communicated to be valid.<sup>6</sup> The dates were chosen for administrative reasons (see online Appendix B for details). Second, we estimate the effect on purchases after the voucher had expired (including purchases until January 25, 2023).

Table 2 presents the estimation results for the extensive margin, including (i) the propensity to purchase any of the considered water bottles, (ii) the propensity to purchase at least one sustainable bottle, and (iii) the propensity to purchase at least one unsustainable bottle during the considered period. In line with the main findings based on the voucher choice, the estimated treatment effects for purchases in supermarkets are all close to zero and not significant at the

<sup>&</sup>lt;sup>6</sup>For consumers who completed their voucher choice between September 23 and November 10, this period extends from the day of the voucher choice until November 10. For consumers who completed their voucher choice at a later point, this period extends from the day of the voucher choice until December 24. Consumers who made their voucher choice towards the end of the respective voucher period had little time left to make use of the voucher. We show that the estimated treatment effect on the voucher choice as well as on the purchases are robust to excluding those consumers (see online Appendix Figure A.6 and online Appendix Table A.9, respectively).

five percent level. In the online appendix, we show that the results are largely robust to using the number of sustainable/unsustainable bottles purchased (online Appendix Table A.10) or the amount of recycled/unrecycled plastic implied by the observed purchases (online Appendix Table A.11) as outcome variable. We also show that the results are similar if we include subjects who did not complete their voucher choice but fulfill the other exclusion criteria (see online Appendix Table A.12).

# 4 Conclusion

This study generates novel empirical evidence on the causal impact of offering access to targeted information on the sustainability of products. Specifically, it evaluates the extent to which consumers (i) willingly access targeted information on products' sustainability that they could avoid at no cost, and (ii) update subsequent purchase decisions. By conducting a randomized control trial with a major international supermarket chain, where we follow their standard procedures of interacting with customers through an app, this project generates empirical evidence that can help close the knowledge gap on the dynamic interaction between individual consumption choices and structural problems of asymmetric information in markets as drivers of change in sustainable consumption.

In short, our results suggest that interventions offering access to targeted information on the sustainability of products are effective in informing consumers but fail to trigger changes in purchase decisions. It is in our view remarkable that the voluntary access to information is high in the field setting that we investigate: About 60% of treated consumers access the information about product sustainability, independently of whether they have bought sustainable or unsustainable products in the past. Given the opportunity cost of time, and competition for attention in our modern lives, this is a high number. Moreover, consumers who chose to access the information spend on average 11 seconds on the information screen of the app, with 87% of them spending more than 5 seconds. Taken together, these two pieces of evidence point to a high interest of consumers in the sustainability attributes of the products that they purchase as well as close substitutes.

At the same time, our evidence suggests that providing such information has no notable impact on consumption choices. Based on a sample size of about 1,000 consumers we can exclude small effect sizes of 0.11 standard deviations. This lack of effectiveness is again independent of the sustainability of consumers' purchasing history.

Our driving compass in designing and implementing the randomized controlled trial was to maintain the natural features of the decision environment, including the way in which promotions and information are commonly offered by Carrefour to consumers. This approach comes with some limitations in terms of availability of additional data on motivations for product choice, self-identification as "sustainable consumers," or motivations to use the app ReciclaYa. Thus, it prevents us from drawing final conclusions why unsustainable consumers in the study did not change their behavior after being offered the information on product sustainability. With the available data we can show (i) that a large majority (62%) of treated unsustainable consumers access the information, (ii) that they devote a considerable amount of time to the information screen (average of 11 seconds and median of 9 seconds for those acquiring the information), and (iii) that price differentials between the sustainable and unsustainable products are small (EUR -0.05 to EUR 0.12) while having little predictive power for product choice. To minimize the impact of taste-based considerations, we selected a rather homogeneous product, namely low-sodium water suitable for low-sodium diets and for the preparation of infants' food. Motivations for the reluctance to shift to more sustainable alternatives that are consistent with the data could be related to brand loyalty (DeCicca et al., 2021), inertia in consumption (e.g., Hortaçsu et al., 2017), or other psychological factors.

In sum, our results could be interpreted as a cautionary note about the effectiveness of targeted information provision in shifting consumption patterns. On the one hand, they highlight that even unsustainable consumers are reachable and willing to access information on product attributes related to sustainability. On the other hand, the information alone was not sufficient to trigger more sustainable consumption patterns despite the fact that close substitutes were readily available at similar prices. These findings question information provision policies as isolated tools to steer transformative behavioral change, even in light of the new ways in which this information can be delivered to consumers. These results should not, however, be interpreted as a disqualifier of targeted information interventions as part of policy packages, as their capacity to reach unsustainable consumers can be a powerful channel to unleash the potential for other accompanying policies. Future research on such policy packages as well as on other products for which sustainability attributes include an information asymmetry is needed.

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# Online Appendix for Targeted Information and Sustainable Consumption: Field Evidence<sup>\*</sup>

Loukas Balafoutas Esther Blanco Raphael Epperson

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## A Pre-registration





### CONFIDENTIAL - FOR PEER-REVIEW ONLY

Information Acquisition and Sustainable Consumption (#107257)

Created: 09/18/2022 12:52 PM (PT)

This is an anonymized copy (without author names) of the pre-registration. It was created by the author(s) to use during peer-review. A non-anonymized version (containing author names) should be made available by the authors when the work it supports is made public.

#### 1) Have any data been collected for this study already?

No, no data have been collected for this study yet.

#### 2) What's the main question being asked or hypothesis being tested in this study?

We will examine the following Research Questions (RQ):

1. Does the likelihood of acquiring information about product sustainability differ between consumers of sustainable and unsustainable products? 2. Consumer preferences:

a. Does offering information about the sustainability of purchased products and close substitutes affect individuals' preferences for sustainable products? b. Does this effect differ between consumers of sustainable and unsustainable products?

#### 3) Describe the key dependent variable(s) specifying how they will be measured.

For RQ1: Whether a consumer (in the treatment "Info") acquires information about the recycled material of the purchased plastic water bottle. For RQ2 (a & b): Whether a consumer chooses a voucher for brand A (i.e., for water bottles that are made 100% from recycled plastic). Details of the voucher decision are explained in section 4 below.

Based on the above definitions, both dependent variables will be binary.

#### 4) How many and which conditions will participants be assigned to?

Participants are users of an app from a large supermarket chain. We focus on plastic water bottles from two brands (A and B) with sizes 0.33L, 0.5L, 1L, 2L, and 6.25l. After having uploaded a purchase with at least one of the considered water bottles, participants will be assigned to one of two treatments (only the first time the product is bought during the intervention period):

1. "No Info": Participants receive a "thank you" message for purchasing the product.

2. "Info": Participants receive a "thank you" message as in the treatment "No Info" but are additionally asked whether they would like to know more about the quantity of recycled material of this and other bottles. They can click on "Know more" or "Close." If they click on the former, they will receive information about the share of recycled material for four water bottles (including the one they have just uploaded).

Directly after having been assigned to a treatment (and seeing the messages associated with the treatment), all participants face a voucher decision. In the voucher decision, participants choose for which brand (A or B) they would like to receive a 5€ voucher (or they can close the window without making a choice). Finally, they enter their email address and loyalty card number to receive the voucher.

#### 5) Specify exactly which analyses you will conduct to examine the main question/hypothesis.

RQ1: We conduct a Chi-squared test to check for a significant difference in the likelihood of acquiring information (in treatment "Info") between consumers who uploaded a sustainable product (brand A) and consumers who uploaded an unsustainable product (brand B).

RQ2a: We conduct an OLS regression where we regress the outcome variable on a dummy for being assigned to treatment "Info" and a dummy for whether the consumer is classified as having uploaded a sustainable product. We test whether the coefficient of the treatment dummy is significantly different from zero using heteroskedasticity robust standard errors.

RQ2b: We conduct an OLS regression similar to the one for RQ2a but interacting the dummy for being assigned to treatment "Info" and the dummy for whether the consumer is classified as having uploaded a sustainable product. We test whether the coefficient of the interaction term is significantly different from zero using heteroskedasticity robust standard errors.

#### 6) Describe exactly how outliers will be defined and handled, and your precise rule(s) for excluding observations.

We will exclude observations: (a) if they faced severe technical malfunctions (e.g., seeing a product in the "thank you" message that they did not purchase or not receiving any message); (b) if a consumer uploaded a product from both brands in the upload that determined the treatment assignment; (c) if a consumer made an invalid voucher choice (e.g., closed the window without choosing a brand for the voucher or entered a loyalty card number that had already been used).

# 7) How many observations will be collected or what will determine sample size? No need to justify decision, but be precise about exactly how the number will be determined.

The experiment will start in mid-September (the exact date depends on technical aspects). It will end on December 31 or once a sample size of 1,000 observations with a valid voucher choice has been reached.

Version of AsPredicted Questions: 2.00

Available at https://aspredicted.org/V2P\_CH3





8) Anything else you would like to pre-register? (e.g., secondary analyses, variables collected for exploratory purposes, unusual analyses planned?)

To further explore the decision to acquire information and information processing, we analyze the following outcomes as secondary analyses: (i) time spent on the screen of the first message in treatment "Info", (ii) time spent on the screen that provides the information about the products in treatment "Info" (if the consumers decided to receive the information).

To learn more about the impact of information, we estimate the average effect of information for those who acquire information (separately by whether consumers are classified as having uploaded a sustainable product). We use 2SLS regressions where the assignment to treatment "Info" serves as an instrument for acquiring information.

As robustness checks, we run OLS regressions for RQ1, RQ2a, and RQ2b, including the following covariates: gender, age, single household, having been an app user before 2022, and self-reported recycling behavior. For RQ2a and RQ2b, we also check whether excluding observations who selected a voucher shortly before its expiration date affects the results.

Version of AsPredicted Questions: 2.00

Available at https://aspredicted.org/V2P\_CH3

# **B** Voucher Details

## **B.1** Announcements

As described in Section 2.1 of the paper, the randomized controlled trial started with an announcement on the app on September 23, 2022, that up to 1,000 vouchers for one of the two brands would be issued to the first consumers who buy one of the considered bottles.<sup>1</sup> The wording of the announcement reads as follows:

## Spanish:

Regalamos  $5 \in$  de descuento a las primeras 1.000 personas que actualicen su App e incluyan en ReciclaYa botellas de agua mineral natural Font Vella o Lanjarón sin sabor (solo 0.33, 0.50, 1, 1.50, 2 y 6.25 litros). Podrás elegir una de estas 2 marcas y todo lo que gestes hasta el 10 de noviembre se te devolverá en tu ChequeAhorro (con un límite de  $5 \in$ ).

## English:

We are giving away  $5 \in$  discounts to the first 1,000 people who update their App and include in ReciclaYa bottles of unflavored natural mineral water from Font Vella or Lanarón (only 0.33, 0.50, 1, 1.5, 2 and 6.25 litres). You can choose one of these 2 brands and everything you spend until November 10th will be returned in your ChequeAhorro (with a limit of  $5 \in$ ).

A second announcement was made on November 11, 2022, informing about the prolongation of the opportunity to receive a voucher. The wording of the second announcement reads as follows:

## Spanish:

Sólo nos quedan 200 descuentos de  $5 \in$ . Si aún no has participado en la promoción, puedes conseguirla incluyendo una compra en ReciclaYa de agua mineral natural sin sabor Font Vella o Lanjarón (solo botellas de 0,33, 0,50, 1, 1,5, 2 y 6,25 litros). A partir de entonces, podrás elegir una de estas marcas y todo lo que gastas en esa marca hasta el 24 de diciembre te será devuelto en tu ChequeAhorro de enero (con un límite de  $5 \in$ ).

## English:

We only have 200 discounts of  $5 \in$  left. If you have not yet participated in the promotion, you can get it by including a purchase in ReciclaYa of Font Vella or Lanjarón unflavoured natural mineral water (only bottles of 0.33, 0.50, 1, 1.5, 2)

<sup>&</sup>lt;sup>1</sup>The announcement also mentions the requirement to update the app, which was a technical requirement for the randomized controlled trial to be implemented.

and 6.25 litres). After that, you will be able to choose one of these brands and everything you spend on that brand until 24 December will be refunded in your January ChequeAhorro (with a limit of  $\in 5$ ).

# B.2 Procedures

The implementation of the EUR 5 voucher that consumers received as part of the randomized control trial followed the standard procedures in the app ReciclaYa. The app allows consumers to collect points for self-reported recycling activities which can be exchanged for discounts for future purchases. More specifically, the points collected through ReciclaYa have an "exchange rate" of 2 points equal EUR 0.01 (with the points per recycling activity changing over time and amounting to an average of 6.64 points per product in 2024). They are redeemed via the Carrefour Loyalty Card and the appropriate monetary credit is assigned to the next "ChequeAhorro," a bi-monthly discount voucher that Carrefour clients can use when doing their purchases.

With the EUR 5 voucher, consumers received up to EUR 5 back when purchasing the considered water bottles from the selected brand during a pre-defined time period. The time period was set to start right after the voucher choice and end some days before the next ChequeAhorro (to leave time for calculating the monetary amount spent and to be given back). Consumers then received the amount of money they spent (up to a maximum of EUR 5) as monetary credit for future purchases (similar to the exchange of points) in the upcoming ChequeAhorro.

This approach implies that consumers who received the voucher between September 23, 2022, and November 10, 2022, get up to EUR 5 back in the ChequeAhorro on November 23, 2022, for all purchases made since the voucher choice until November 10, 2022. Consumers who received the voucher after November 10, 2022, get up to EUR 5 back in the ChequeAhorro on January 17, 2023, for all purchases made since the voucher choice until December 24, 2022. For purchases to be considered they had to be uploaded to the ReciclaYa app.<sup>2</sup>

Any communication regarding the voucher clearly indicated that the voucher is for *future* purchases. In addition, consumers received a short confirmation email after completing the voucher choice that defined the end of the valid voucher period as well as the relevant products. In contrast to the initial planning and because of technical reasons, it was eventually not possible to only apply the voucher to future purchases, i.e., purchases that were uploaded after the voucher choice. For the first voucher period, the voucher had to be applied from September 15 to November 10, 2023. For the second voucher period, the voucher had to be applied from

 $<sup>^{2}</sup>$ Some consumers uploaded purchases to the ReciclaYa app that were not linked to their loyalty card. As a result, these purchases were not automatically considered by Carrefour for the calculation of the monetary credit in the ChequeAhorro. The credits were thus manually adjusted to account for this. During the first voucher period, this led to a delay of receiving the full credit for some consumers since these manual adjustments were implemented using the ChequeAhorro on January 17, 2023. As a compensation for this delay, all of the consumers with a voucher choice during the first period received an extra credit of EUR 1, for the ChequeAhorro on January 17, 2023.

November 11, 2023, to January 7, 2024. However, it is very unlikely that consumers could have expected that. In addition, the longer application periods are to consumers' advantage.

# C Sample

## C.1 Exclusion of Consumers with Incomplete Voucher Choices

In total, 1,000 consumers completed the voucher choice, i.e., they selected a brand for which the voucher should be issued and provided their email address and loyalty card number to receive the voucher. In line with the pre-registration, we exclude from our analyses 11 consumers (1.1%) who uploaded bottles from both brands as their initial purchase and 5 consumers (0.5%) for whom the data suggests that they encountered technical problems.<sup>3</sup> Hence, our final sample consists of 984 consumers.

## C.2 Attrition

Besides the consumers with complete voucher choices (also referred to as "valid voucher choices" in the pre-registration), there are 136 additional consumers who were assigned to the randomized controlled trial but failed to complete the voucher choice (while neither having uploaded products from both brands nor clearly facing a technical problem). This corresponds to an attrition rate of about 12%. We have pre-registered to not count these incomplete observations towards our sample. In Section 3.3 of the paper, we show that this attrition has little impact on the interpretation of the main results.

The attrition rate differs significantly between the treatment and control group (15.9% vs. 8.8%, p < 0.001,  $\chi^2$ -test). On the one hand, the differential attrition could be a technical result. Consumers in the treatment group face an additional decision (whether to receive information on product sustainability) and up to one additional screen (the information on product sustainability) compared to the control group. Hence, they have more opportunities to drop out and a potentially higher (cognitive) load. On the other hand, the differential attrition might reflect a behavioral response to the treatment. For example, consumers who face the opportunity to receive information might decide not to continue in order to avoid learning anything about product sustainability. Even if they select not to receive information, they might fear that the voucher choice between the different brands reveals some information. Similarly, they might prefer not to engage in the decision between the different brands once the issue of product sustainability has been made salient.

While our data does not allow us to conclude to what extent each explanation applies, two pieces of evidence suggest that the differential attrition is at least partly a behavioral response. First, even after focusing on consumers who reach the voucher choice screen, consumers in the treatment group are significantly more likely to not submit a voucher choice (6.0% vs. 1.5%,

<sup>&</sup>lt;sup>3</sup>Cases where the data suggests technical problems are (i) consumers who received the information screen although they decided not to receive the information and (ii) consumers who received a voucher although we do not observe a voucher choice in the data. We include 4 consumers who did not submit a voucher choice in the app but selected a brand for the voucher after reaching out to the customer support. Similarly, we include 5 consumers who made a voucher choice in the app but provided their email address and loyalty card number only after contacting the customer support.

 $p < 0.001, \chi^2$ -test, see Appendix Table A.1 for details about the attrition by screen). Second, the overall attrition in the treatment group is predominantly driven by consumers who decide not to access the information and thus do not face an additional screen compared to the control group. In particular, 63% of consumers affected by attrition in the treatment group do not choose the information (although consumers not choosing the information only account for 41% of the entire treatment group).<sup>4</sup> Similarly, 73% of those dropping out on the voucher choice screen in the treatment group do not choose the information (although consumers not choosing the information only account for 41% of consumers in the treatment group that reach the voucher choice screen).

rabie min. Internetion by bereen and readment						
	Control (%)	Treatment (%)	$\begin{array}{c} \text{Comparison} \\ (p\text{-val}) \end{array}$			
Panel A. Accumulated Attrition						
Screen1 – "Thank you" message (+ info choice)	2.7	1.7	0.26			
$Screen 2 - Information \ screen^a$		4.4				
Screen3 – Voucher choice	3.7	9.9	0.00			
Screen4 – Contact details (for receiving voucher)	8.8	15.9	0.00			
Panel B. Conditional Attrition						
Screen1 – "Thank you" message (+ info choice)	2.4	1.7	0.44			
$Screen 2 - Information \ screen^{a}$		4.5				
Screen3 – Voucher choice	1.4	6.0	0.00			
Screen4 – Contact details (for receiving voucher) <sup><math>b</math></sup>	5.3	6.7	0.31			

Table A.1: Attrition by Screen and Treatment

Notes: The table reports the share of consumers who do not complete the respective screen (Panel A) and the share of consumers who do not complete the respective screen conditional on reaching the screen (Panel B). Some consumers did not complete a screen (e.g., because they exited the app) but still received a voucher because they reached out to the customer service to eventually make their decision. These consumers are treated as having made a voucher choice and having completed the contact details for receiving the voucher (because they eventually did). Comparisons are based on  $\chi^2$ -tests. Consumers who face technical problems or upload products from both brands as their initial purchase are excluded.

 $^{a}$  Only consumer who are in the treatment group and acquire information can reach and complete the information screen.

 $^{b}$  The conditional attrition for providing the contact details is conditional on completing the voucher choice (since the data do not offer separate information on whether the screen with the contact details has been reached).

<sup>&</sup>lt;sup>4</sup>Deciding not to receive the information includes subjects who do not make a choice.

# D Classification of Consumers

In the main analysis, we classify consumers who upload a product from the sustainable brand as their initial purchase as *sustainable* consumers. Analogously, consumers who upload a product from the unsustainable brand as their initial purchase are classified as *unsustainable* consumers. This classification rule was specified in our pre-registration and is predictive of purchases made before being assigned to the randomized controlled trial (see Table A.2). For example, sustainable consumers had bought significantly fewer bottles from the unsustainable brand and significantly more bottles from the sustainable brand compared to unsustainable consumers.

Table A.2. The values by Consumer Type					
Variable	Unsustainable Consumer	Sustainable Consumer	$\begin{array}{c} \text{Comparison} \\ (p\text{-value}) \end{array}$		
Purchased from sustainable brand	$0.15 \\ (0.01)$	0.24 (0.02)	0.00		
Purchased from unsustainable brand	$0.28 \\ (0.02)$	$0.14 \\ (0.02)$	0.00		
Bottles from sustainable brand	$1.38 \\ (0.27)$	4.20 (0.90)	0.00		
Bottles from unsustainable brand	4.38 (0.61)	$1.20 \\ (0.23)$	0.00		
Amount of recycled plastic	48.45 (7.93)	141.17 (27.97)	0.00		
Amount of nonrecycled plastic	$119.31 \\ (16.00)$	$31.36 \\ (6.16)$	0.00		
Observations	592	392			

Table A.2: Pre-values by Consumer Type

*Notes:* Based on purchases that were made before the assignment to the randomized controlled trial and that were uploaded between July 23, 2022, and January 25, 2023. The initial purchase that triggered the assignment to the randomized controlled trial is not included. Standard errors in parentheses. *p*-values for comparisons are based on OLS regressions with an indicator variable for the consumer type and heteroskedasticity robust standard errors.

In addition, Table A.3 and Table A.4 show that our results regarding the heterogeneity by consumer type are robust to using different classification rules that consider a more extensive purchase history of consumers. In particular, we consider all purchases that were made before the assignment to the randomized controlled trial (RCT) and uploaded up to three months before the RCT started. In column 1 of each table, we define consumers as *sustainable* if they have purchased more sustainable than unsustainable bottles until being assigned to the RCT (including their initial purchase that triggered the treatment assignment). Similarly, consumers are classified as *unsustainable* if they have purchased more unsustainable bottles. Consumers with an equal number of bottles from each brand are excluded (2 percent of the main sample). In column 2, we classify consumers by whether they have exclusively purchased sustainable products before being assigned to the RCT (including the initial purchase). Hence, we exclude consumers who purchased water bottles from both brands (14

percent of the main sample). In column 3, we apply the same classification as in column 2 but focus on consumers who made at least two purchases of the considered products (50 percent of the main sample).

	(1)	(2)	(3)
Unsustainable consumers	0.618	0.628	0.593
	(0.020)	(0.022)	(0.028)
Sustainable consumers	0.637	0.651	0.562
	(0.024)	(0.026)	(0.037)
$\chi^2$ -test ( <i>p</i> -value)	0.688	0.638	0.666
Observations	962	842	496

Table A.3: Information Acquisition under Different Consumer Classifications

*Notes:* Each column refers to a different classification rule for consumer types (see Appendix D). Standard errors in parentheses.

	(1)	(2)	(3)
Panel A. ATE			
Treated	0.012	-0.005	-0.055*
	(0.025)	(0.025)	(0.028)
Sustainable consumer	$0.635^{***}$	$0.679^{***}$	$0.770^{***}$
	(0.026)	(0.026)	(0.030)
Constant	$0.151^{***}$	$0.151^{***}$	$0.126^{***}$
	(0.019)	(0.020)	(0.023)
Observations	962	842	496
Panel B. Heterogeneity			
Treated	-0.006	-0.018	-0.063*
	(0.031)	(0.032)	(0.033)
Sustainable consumer	$0.615^{***}$	$0.665^{***}$	$0.762^{***}$
	(0.035)	(0.036)	(0.039)
$Treated \times sust.$ consumer	0.046	0.032	0.021
	(0.051)	(0.052)	(0.062)
Constant	$0.159^{***}$	$0.157^{***}$	$0.129^{***}$
	(0.021)	(0.022)	(0.025)
Observations	962	842	496

Table A.4: Effect of Information Intervention under Different Consumer Classifications

*Notes:* Panels A and B show estimation results from OLS regressions under different classification rules for consumer types (see Appendix D). The dependent variable is always whether the consumer chose a voucher for the sustainable brand. Robust standard errors in parentheses.

p < 0.1, p < 0.05, p < 0.05, p < 0.01.

# E Additional Tables

	All	All		Control		Treatment	
Variable	Mean (sd)	N	Mean (sd)	N	Mean (sd)	N	p-value
Sustainable consumer	$0.40 \\ (0.49)$	984	$0.40 \\ (0.49)$	541	$0.40 \\ (0.49)$	443	0.95
Female	$0.65 \\ (0.48)$	983	$0.64 \\ (0.48)$	541	$0.67 \\ (0.47)$	442	0.21
Age	40.21 (10.58)	961	$40.58 \\ (10.56)$	531	$39.75 \ (10.59)$	430	0.23
Household members	$3.11 \\ (1.10)$	981	3.11 (1.09)	541	$3.10 \\ (1.10)$	440	0.83
Used app before 2022	$\begin{array}{c} 0.37 \ (0.48) \end{array}$	983	$0.38 \\ (0.48)$	541	$\begin{array}{c} 0.37 \ (0.48) \end{array}$	442	0.89
Recycles	0.98 (0.14)	983	0.98 (0.13)	541	0.98 (0.15)	442	0.50

# Table A.5: Consumer Characteristics

*Notes:* Only consumers in the main sample of the main analysis are considered. The number of observations slightly differs across variables as all but the first variable are based on voluntary questions during the registration on the app. The last column reports *p*-values for the comparison of the means across treatment groups based on regressing the variable on a treatment dummy with heteroskedasiticity robust standard errors.

	Information	Sustainable	Sustainable
	acquisition	voucher	voucher
Treated		-0.002	-0.010
		(0.025)	(0.032)
Sustainable consumer	0.033	$0.638^{***}$	$0.629^{***}$
	(0.049)	(0.026)	(0.035)
$Treated \times sustainable consumer$			0.021
			(0.052)
Controls	Yes	Yes	Yes
Observations	428	959	959

Table A.6: Estimation Results including Controls

*Notes:* Each column refers to a separate OLS regression which controls for gender, age (below 30 years, above 60 years, or in between), whether the consumer lives in a single household, whether the consumer has used the app before 2022, and whether the consumer has reported to recycle waste at home. In column 1, the dependent variable is whether a consumer acquires information (conditional on being in the treatment group). In columns 2 and 3, the dependent variable is whether a consumer for the sustainable brand. Robust standard errors in parentheses.

p < 0.1, p < 0.05, p < 0.01

Bottle size (L)	Brand	Average	Standard deviation	Share of missings	Total instances
0.33	Font Vella	0.50	0.01	0.00	51
0.33	Lanjarón	0.54	0.01	0.00	51
0.50	Font Vella	0.63	0.01	0.00	87
0.50	Lanjarón	—	_	1.00	87
1.00	Font Vella	0.61	0.03	0.00	84
1.00	Lanjarón	0.69	0.02	0.00	84
1.50	Font Vella	0.69	0.00	0.00	116
1.50	Lanjarón	0.69	0.00	0.00	116
2.00	Font Vella	0.91	0.01	0.01	144
2.00	Lanjarón	0.90	0.00	0.01	144
6.25	Font Vella	2.24	0.04	0.01	76
6.25	Lanjarón	2.25	0.05	0.01	76

Table A.7: Statistics about Product Prices Shown on Information Screen

*Notes:* The table is based on the data from the information screens that were shown to treated consumers who decided to acquire the information on sustainability. Only treated consumers in the final sample of the main analysis are considered. Prices displayed on the information screen are current online prices that were retrieved from an endpoint of Carrefour. If the product was not sold online at the time of making the request, the price of this products was missing on the information screen.

		Dependent variable: sustainable voucher						
	(1)	(2)	(3)	(4)	(5)	(6)		
Panel A. OLS regressions								
Price difference	-0.007	-0.006	-0.007					
	(0.007)	(0.005)	(0.005)					
Price difference $< 0$				-0.014	0.023	-0.012		
				(0.098)	(0.068)	(0.067)		
Price difference $> 0$				-0.070	-0.060	-0.083*		
				(0.071)	(0.050)	(0.050)		
Sustainable consumer		$0.727^{***}$	$0.731^{***}$		$0.729^{***}$	$0.733^{***}$		
		(0.042)	(0.044)		(0.042)	(0.044)		
Panel B. Logit regressions								
Price difference	-0.007	-0.007	-0.007					
	(0.007)	(0.005)	(0.005)					
Price difference $< 0$				-0.013	0.021	-0.005		
				(0.094)	(0.065)	(0.065)		
Price difference $> 0$				-0.070	-0.061	-0.083**		
				(0.070)	(0.049)	(0.049)		
Sustainable consumer		$0.727^{***}$	$0.731^{***}$		$0.729^{***}$	$0.732^{***}$		
		(0.042)	(0.042)		(0.041)	(0.041)		
Controls	No	No	Yes	No	No	Yes		
Observations	278	278	266	278	278	266		

Table A.8: Price Differences and Voucher Choice

*Notes:* Each column refers to a separate regression with choosing the voucher for the sustainable brand as dependent variable. The independent variable *price difference* is the amount of cents by which the cheapest product price of the sustainable brand (that is shown on the information screen) exceeds the cheapest product price of the unsustainable brand (that is shown on the information screen). In about 26% of cases, this price difference is exactly zero. Only data from treated consumers who access the information screen are used. Panel A reports results from OLS regressions. Panel B reports average marginal effects from logit regressions. Controls include gender, age (below 30 years, above 60 years, or in between), whether the consumer lives in a single household, whether the consumer has used the app before 2022, and whether the consumer has reported to recycle waste at home. Robust standard errors in parentheses.

p < 0.1, p < 0.05, p < 0.01

	D	uring voucher	period	After voucher period		
	None (1)	Sustainable (2)	Unsustainable (3)	None (4)	Sustainable (5)	Unsustainable (6)
Panel A. ATE						
Treated	$0.020 \\ (0.033)$	0.011 (0.026)	-0.046 (0.029)	-0.002 (0.030)	-0.024 (0.022)	0.013 (0.027)
Sustainable consumer	-0.036 (0.034)	$\begin{array}{c} 0.343^{***} \\ (0.029) \end{array}$	$-0.300^{***}$ (0.028)	-0.006 (0.031)	$0.128^{***}$ (0.024)	$-0.138^{***}$ (0.026)
Constant	$0.487^{***}$ (0.026)	$0.095^{***}$ (0.017)	$0.459^{***}$ (0.025)	$0.701^{***}$ (0.024)	$0.090^{***}$ (0.015)	$0.262^{***}$ (0.022)
Observations	923	923	923	923	923	923
Panel B. Heterogeneity						
Treated	$0.025 \\ (0.043)$	0.018 (0.026)	-0.062 (0.042)	-0.011 (0.039)	$0.000 \\ (0.023)$	-0.002 (0.038)
Sustainable consumer	-0.031 (0.046)	$0.352^{***}$ (0.039)	$-0.318^{***}$ (0.038)	-0.016 (0.042)	$0.156^{***}$ (0.034)	$-0.157^{***}$ (0.034)
Treated×sust. consumer	-0.012 (0.068)	-0.019 (0.059)	$0.039 \\ (0.056)$	0.023 (0.062)	-0.061 (0.048)	$0.040 \\ (0.052)$
Constant	$0.485^{***}$ (0.029)	$0.092^{***}$ (0.017)	$0.466^{***}$ (0.029)	$0.705^{***}$ (0.026)	$0.079^{***}$ (0.015)	$0.269^{***}$ (0.025)
Observations	923	923	923	923	923	923

 Table A.9:
 Effect of Information Intervention on Purchases for Restricted Sample

Notes: Panels A and B show estimation results from OLS regressions. Columns 1 to 3 focus on the period during which the voucher was communicated to be valid, while columns 4 to 6 focus on the period thereafter. The dependent variable in column 1 and 4 is whether the individual purchases any of the considered water bottles during the respective period. The dependent variable in column 2 and 5 is whether the individual purchases at least one bottle of the sustainable brand during the respective period. The dependent variable in column 3 and 6 is whether the individual purchases at least one bottle of the unsustainable brand during the respective period. Only consumers who completed their voucher choice such that they had at least one week to use the voucher are included. Robust standard errors in parentheses. \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01.

	Table A.	10: Effect of	Information	Intervention	on Purchase	es in Bottles		
		During vou	cher period			After vouc	cher period	
	Unwi	nsorized	Win	sorized	Unwi	nsorized	Wins	orized
	Sustainable bottles (1)	Unsustainable bottles (2)	Sustainable bottles (3)	Unsustainable bottles (4)	Sustainable bottles (5)	Unsustainable bottles (6)	Sustainable bottles (7)	Unsustainable bottles (8)
Panel A. ATE								
Treated	-0.367	-0.554	-0.024	-0.457	-0.627	-0.315	-0.372	-0.265
	(0.438)	(0.374)	(0.232)	(0.320)	(0.473)	(0.689)	(0.285)	(0.487)
Sustainable consumer	$2.963^{***}$	$-2.466^{***}$	$2.290^{***}$	$-2.349^{***}$	$1.752^{***}$	$-2.125^{***}$	$1.308^{***}$	-1.911***
	(0.572)	(0.354)	(0.270)	(0.299)	(0.617)	(0.654)	(0.339)	(0.450)
Constant	$0.745^{***}$	$3.849^{***}$	$0.590^{***}$	$3.605^{***}$	$0.818^{***}$	$3.608^{***}$	$0.703^{***}$	$3.094^{***}$
	(0.230)	(0.341)	(0.158)	(0.292)	(0.258)	(0.668)	(0.194)	(0.472)
Observations	984	984	984	984	984	984		
Panel B. Heterogeneity								
Treated	-0.148	-0.710	-0.148	-0.651	-0.184	-1.531	-0.184	-1.039
	(0.196)	(0.556)	(0.196)	(0.477)	(0.236)	(0.965)	(0.236)	(0.721)
Sustainable consumer	$3.210^{***}$	$-2.642^{***}$	$2.150^{***}$	$-2.567^{***}$	$2.252^{**}$	-3.500***	$1.520^{***}$	-2.786***
	(0.961)	(0.520)	(0.376)	(0.420)	(1.048)	(0.801)	(0.511)	(0.584)
Treated $\times$ sust. consumer	-0.549	0.393	0.312	0.486	-1.113	$3.056^{**}$	-0.472	$1.944^{**}$
	(1.079)	(0.698)	(0.540)	(0.595)	(1.157)	(1.338)	(0.664)	(0.909)
Constant	$0.646^{***}$	$3.920^{***}$	$0.646^{***}$	$3.692^{***}$	$0.618^{***}$	$4.157^{***}$	$0.618^{***}$	$3.443^{***}$
	(0.156)	(0.396)	(0.156)	(0.340)	(0.192)	(0.778)	(0.192)	(0.553)
Observations	984	984	984	984	984	984	984	984
<i>Notes:</i> Panel A and B show valid, while columns 5 to 8 fc	estimation resu ocus on the peri-	ldts from OLS regr od thereafter. The	essions. Colum ) outcome varia	ins 1 to 4 focus of ble is the number	n the period du of sustainable l	ring which the vo oottles or unsusta	ucher was comn inable bottles pu	nunicated to be urchased during

4 T J έ the considered time period. In columns 3 to 4, the outcome variable is winsorized at 25 bottles (affecting less than 2 percent of consumers) to reduce the impact of outliers. In columns 7 to 8, the outcome variable is winsorized at 50 bottles (affecting less than 2 percent of consumers) to reduce the impact Robust standard errors in parentheses. \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01.

Tal	ble A.11:	Effect of Inf	ormation I	ntervention	on Purcha	tses in Gran	us	
		During vou	cher period			After vouc	her period	
	Unwi	nsorized	Wins	orized	Unwir	isorized	Wins	orized
	Recycled plastic (1)	Unrecycled plastic (2)	Recycled plastic (3)	Unrecycled plastic (4)	Recycled plastic (5)	Unrecycled plastic (6)	Recycled plastic (7)	Unrecycled plastic (8)
Panel A. ATE								
Treated	-9.001 (12.283)	-17.319*(10.264)	-1.917 (6.842)	-14.515* (8.434)	-20.203 (13.892)	-9.671 (18.643)	-10.965 $(8.009)$	-6.469 (12.034)
Sustainable consumer	$86.249^{***}$ (15.791)	$-60.706^{***}$ (9.986)	$66.619^{***}$ (7.934)	$-57.887^{***}$ (8.042)	$56.916^{***}$ (18.032)	$-59.986^{***}$ (17.506)	$38.791^{***}$ (9.574)	$-49.048^{***}$ (11.139)
Constant	$29.374^{***}$ (6.488)	$101.596^{***}$ (9.000)	$26.179^{***}$ (4.572)	$94.523^{***}$ (7.580)	$28.320^{***}$ (7.653)	$100.277^{***}$ (18.343)	$23.871^{***}$ (5.487)	$80.066^{***}$ (11.684)
Observations	984	984	984	984	984	984		
Panel B. Heterogeneity								
Treated	-2.271 (5.924)	-19.510 (14.842)	-2.271 (5.924)	-18.446 (12.330)	$-11.096^{*}$ (6.566)	$-46.798^{*}$ (26.725)	$-10.582^{*}$ (6.278)	-29.932*(17.749)
Sustainable consumer	$93.851^{***}$ (25.660)	$-63.181^{***}$ (14.967)	$66.219^{***}$ (11.088)	$-62.329^{***}$ (11.545)	$67.204^{**}$ (29.984)	$-101.926^{***}$ (22.002)	$39.223^{***}$ (14.142)	$-75.552^{***}$ (14.519)
Treated $\times {\rm sust.}\ {\rm consumer}$	-16.902 (30.145)	5.503 (19.562)	0.888 (15.843)	9.874 (15.938)	-22.871 (34.123)	$93.242^{***}$ (35.567)	-0.962 (18.844)	$58.925^{***}$ (22.468)
Constant	$26.338^{***}$ (4.478)	$102.584^{***}$ (10.359)	$26.338^{***}$ (4.478)	$96.297^{***}$ (8.773)	$24.213^{**}$ (5.736)	$117.022^{***}$ (21.462)	$23.698^{***}$ (5.404)	$90.648^{***}$ (13.686)
Observations	984	984	984	984	984	984	984	984
Notes: Panels A and B sho communicated to be valid, w plastic in grams implied by t 700 grams (affecting less tha at 1100 grams (affecting less * $p < 0.1$ , ** $p < 0.05$ , *** $p <$	w estimation while columns the observed pr un 2 percent of s than 2 percet < 0.01.	results from OI 5 to 8 focus on 1 archases during consumers) to nt of consumers	LS regressions the period the the considere reduce the im to reduce th	. Columns 1 t reafter. The o d time period. pact of outlier ne impact of o	o 4 focus on 1 utcome variab In columns 3 s. In columns tiliers. Robusi	the period duri le is the amoun to 4, the outcon 7 to 8, the outc t standard erroi	ng which the t of recycled c ne variable is come variable rs in parenthe	voucher was r unrecycled vinsorized at s winsorized ses.

	D	uring voucher	period	1	After voucher	period
	None (1)	Sustainable (2)	Unsustainable (3)	None (4)	Sustainable (5)	Unsustainable (6)
Panel A. ATE						
Treated	$0.038 \\ (0.030)$	-0.006 (0.023)	$-0.051^{**}$ (0.026)	0.021 (0.026)	-0.027 (0.018)	-0.007 (0.023)
Sustainable consumer	$-0.055^{*}$ (0.031)	$\begin{array}{c} 0.322^{***} \\ (0.026) \end{array}$	$-0.253^{***}$ (0.025)	-0.009 (0.027)	$\begin{array}{c} 0.113^{***} \\ (0.021) \end{array}$	$-0.117^{***}$ (0.022)
Constant	$0.537^{***}$ (0.024)	$0.090^{***}$ (0.015)	$0.410^{***}$ (0.023)	$\begin{array}{c} 0.732^{***} \\ (0.021) \end{array}$	$0.081^{***}$ (0.013)	$0.233^{***}$ (0.020)
Observations	1,120	$1,\!120$	1,120	1,120	1,120	$1,\!120$
Panel B. Heterogeneity						
Treated	$0.041 \\ (0.038)$	0.010 (0.022)	$-0.068^{*}$ (0.037)	$0.018 \\ (0.033)$	-0.007 (0.019)	-0.027 (0.032)
Sustainable consumer	-0.051 (0.042)	$\begin{array}{c} 0.341^{***} \\ (0.036) \end{array}$	$-0.273^{***}$ (0.035)	-0.013 (0.038)	$0.138^{***}$ (0.030)	$-0.141^{***}$ (0.030)
Treated×sust. consumer	-0.008 (0.062)	-0.040 (0.052)	$0.043 \\ (0.049)$	$0.008 \\ (0.054)$	-0.053 (0.042)	$0.051 \\ (0.044)$
Constant	$0.536^{***}$ (0.026)	$0.082^{***}$ (0.014)	$\begin{array}{c} 0.418^{***} \\ (0.026) \end{array}$	$\begin{array}{c} 0.734^{***} \\ (0.023) \end{array}$	$0.071^{***}$ (0.014)	$\begin{array}{c} 0.242^{***} \\ (0.023) \end{array}$
Observations	1,120	1,120	1,120	1,120	1,120	1,120

 Table A.12:
 Effect of Information Intervention on Purchases Accounting for Attrition

*Notes:* Panels A and B show estimation results from OLS regressions. Columns 1 to 3 focus on the period during which the voucher was communciated to be valid, while columns 4 to 6 focus on the period thereafter. The dependent variable in column 1 and 4 is whether the individual purchases any of the considered water bottles during the respective period. The dependent variable in column 2 and 5 is whether the individual purchases at least one bottle of the sustainable brand during the respective period. The dependent variable in column 3 and 6 is whether the individual purchases at least one bottle of the unsustainable brand during the respective period. Consumers without valid voucher choice are included unless they violate one of the other exclusion criteria. We define their voucher period as the one that would have been implied by their voucher choice date, if available, and their treatment assignment date otherwise. Robust standard errors in parentheses.

p < 0.1, p < 0.05, p < 0.05, p < 0.01.

# F Additional Figures



Figure A.1: Screenshots (Spanish)

*Notes:* The figure shows screenshots of the original treatment screens in Spanish. The control group only received Screen 1 (but without the information offer) and Screen 3.



Figure A.2: Time Spent on Information Screen

*Note:* The figure shows the distribution of the time spent on the information screen for consumers in the treatment group who accessed the information on the recycled content of the purchased product and close substitutes.



Figure A.3: Distribution of Price Differentials

*Note:* The figure shows the distribution of price differentials between sustainable and unsustainable products conditional on product size, based on the prices displayed on the information screen of treated consumers who decided to acquire the information.



Figure A.4: Buyers and Bottles Bought over Time

*Note:* The figure shows (i) the number of individuals in the sample who buy at least one of the considered water bottles in a given week and (ii) the number of considered bottles that are bought in a given week.



Figure A.5: Information Acquisition Accounting for Attrition

Notes: The figure shows the share of consumers in the treatment group who access the information on the recycled content of the purchased product and close substitutes including all consumers who are affected by attrition but made an information choice and pass the other pre-registered exclusion criteria. The first bar reports the share of information acquisition based on the overall sample (N = 518). The second and third bar report the share of information acquisition for consumers who have bought an unsustainable product (N = 318) and sustainable product (N = 200), respectively. The whiskers represent 95% confidence intervals. There is no significant difference in information acquisition between sustainable and unsustainable consumers (p = 0.33,  $\chi^2$ -test).



Figure A.6: Treatment Effect for Restricted Sample

*Notes:* The figure shows the estimated treatment effects on the propensity to choose a voucher for the sustainable brand. The average treatment effect (ATE) is estimated based on an OLS regression with a treatment dummy and an indicator for the consumer type as independent variables. The estimates for the conditional average treatment effects (CATEs) for sustainable and unsustainable consumers as well as their difference are estimated based on a similar OLS regression that also includes the interaction of the treatment dummy and the indicator variable for the consumer type. Only consumers who completed their voucher choice such that they had at least one week to use the voucher are included. The whiskers represent 95% confidence intervals.

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# Working Papers in Economics and Statistics

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Loukas Balafoutas, Esther Blanco, Raphael Epperson

Targeted Information and Sustainable Consumption: Field Evidence

# Abstract

Technological progress offers new and promising ways to provide targeted information to consumers and facilitate behavioral change. We conduct a randomized controlled trial with a global supermarket chain and food producer to evaluate the effectiveness of a targeted information intervention that offers consumers individualized feedback about the sustainability of purchased products and close substitutes. We find that the majority of consumers access the information, independently of whether they have bought sustainable or unsustainable products in the past. Yet, providing the targeted information has no significant impact on consumption choices, which is neither driven by inattention to information nor price differentials.

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