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Does the presentation of true costs at the point of purchase nudge consumers toward sustainable product options?

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Abstract

Do true cost campaigns (TCCs)-which display prices at the point of purchase that include social and environmental negative externalities-nudge consumers toward more expensive sustainable products? From a theoretical point of view, the answer is promising: Communicating true costs means introducing external reference prices that provide a benchmark for consumers to assess price acceptability. Showing true costs triggers a general reference to the price of sustainability, and the higher price of sustainable products becomes at least partially explained by their lower "hidden costs" (i.e., costs to compensate for all environmental and social impacts). In two empirical studies, we demonstrate that for TCCs to be effective, the hidden costs for the sustainable products must be lower than those for the conventional alternatives. Interestingly, under this condition, TCCs have an effect in markets characterized by a larger (study 1) and a smaller (study 2) green gap. In both studies, we find that increased perceived price fairness explains the effect of TCCs, as measured by the relative preference for the sustainable compared to the conventional product. In addition, we see that the price difference between the two products plays a significant role in forming this preference judgment, independent of other factors included in the model and especially independent of TCC.

Keywords True costs of products \cdot Sustainable consumption \cdot Dual role of price \cdot External reference prices \cdot Price fairness

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1 Introduction

We are in a climate crisis, which is also a consumption crisis (IPCC, 2022). A major problem is that the prices of sustainable products are generally higher than those of conventional products. Although many consumers see a quality advantage in sustainable products, they ultimately choose the conventional option—simply because of the lower price (e.g., Gleim et al., 2013), a phenomenon also known as the "attitude-behavior gap" or "green gap" (e.g., Johnstone & Tan, 2015). Companies must find ways to encourage more sustainable consumption.

In this context, we look at a price-related marketing tool increasingly being used in practice and causing a stir (Penny, 2023; Rewe, 2023): so-called true cost campaigns (TCCs) that communicate "true costs" of products by displaying them next to the regular retail prices that consumers continue to pay. The product's true costs represent the price that consumers would theoretically have to pay if the hidden costs to compensate for all environmental and social impacts that affect soil, climate, water, or health were considered in the product's value chain (Chouinard et al., 2011).

All products—conventional *and* sustainable—have such hidden costs that are *not* reflected in the retail price. However, they are lower for sustainable than for conventional products, the latter being more detrimental to the environment (Penny, 2023). True cost reports exist for different industries, e.g., for food (Gemmill-Herren et al., 2021). But do TCCs really encourage sustainable purchasing decisions?

From a theoretical point of view, the answer is promising: Communicating true costs means introducing external reference prices that provide a benchmark for consumers to assess price acceptability (e.g., Kopalle & Lindsey-Mullikin, 2003). We thus assume that showing true costs triggers a general reference to the price of sustainability and that the higher price of sustainable products becomes at least partially explained by their lower hidden costs. This would consequently induce higher price transparency, which should go hand in hand with greater perceived price fairness (of the price of the sustainable product), a mechanism known for other pricing tactics such as partitioned pricing (Bürgin & Wilken, 2022). This should ultimately increase the relative preference for the sustainable product, an effect generally in line with the literature on the dual role of price (Bornemann & Homburg, 2011; Völckner, 2008): Price communication generates higher perceived quality (in our case, a higher price communicates a sustainability benefit). The customer continues to pay the unchanged retail price but can now understand it better, which should generate higher preferences for the (still more expensive) sustainable product. The following two empirical studies examine the effectiveness of TCCs, which is not only a price-related instrument to reduce the green gap and thus foster sustainable consumption, but more generally relates to the societal debate on food prices and thus in the tension between sustainability and affordability of products (Gemill-Herren et al. 2021). Before turning to the empirics (the two studies differ in terms of consumers' market-level green gap, the starting point for our considerations), we first present the conceptual model.

2 Conceptual model

Price plays a dual role in the formation of a product's perceived value by consumers. Perceived value comes from a trade-off between attributes perceived as benefits or as sacrifices (Sweeney & Soutar, 2001). Price can be seen as a sacrifice, as it constitutes the financial cost a consumer pays to purchase a product. Sustainable products typically necessitate higher development costs (Bissinger, 2019), which consumers often underestimate (Samoggia, 2016), resulting in a higher perceived sacrifice (Pedregal & Ozcaglar-Toulouse, 2011). Price, however, can also be perceived as a benefit when consumers interpret a higher price as a sign of better product credentials (Lichtenstein et al., 1993; Völckner, 2008); higher prices of sustainable options are often considered a sign of higher sustainability benefits (Auger et al., 2003).

Using this dual role of price theory, we can predict the effect of TCCs on consumers' relative preference for sustainable options, compared to a conventional alternative. TCCs, through the explicit display of hidden costs in both categories (sustainable and conventional) and the resulting true costs, create a price framing that draws consumers' attention to the products' sustainability-related attributes. As hidden costs are generally lower for sustainable options compared to conventional ones, displaying this information at the point of purchase should visually materialize the lower negative environmental and social impact of sustainable products, thus reinforcing the signal of sustainability benefit (Schäufele & Hamm, 2017). Therefore, adding hidden (and resulting true) costs to the retail prices should increase the relative preference for the sustainable product:

H1: The relative preference for the sustainable product (compared with the conventional alternative) is higher with than without a TCC (i.e., when hidden [and resulting true] costs of both products are shown in addition to the regular retail prices alone).

The mechanism underlying this positive main effect relates to the communication impact of prices: True costs should make consumers better understand prices (Rossi & Chintagunta, 2016), a perception called price transparency (Ferguson and Ellen 2013). A TCC should thus increase price transparency, which then also enables consumers to judge whether they consider the sales prices to be justified. This judgment relates to perceived price fairness, defined as the "consumer's subjective sense of a price as right, just, or legitimate versus wrong, unjust, or illegitimate" (Campbell, 2007, 261). Since the additional product information communicated via true costs contains an explanation for the higher sales prices of sustainable products, the price difference between sustainable and conventional product is likely to be seen as fairer as well (Bürgin & Wilken, 2022; Ingenbleek, 2015). Hence,

H2: The effect specified in H1 is mediated by increased levels of (a) price transparency and (b) price fairness.

In addition, we postulate that the effect of TCCs will depend on the level of hidden costs. They are generally lower for sustainable products, so that their communication through TCCs is the basis for the consumer to understand the higher price of the sustainable option and identify a benefit in it. (If the hidden costs were the same in both product categories, they could not be interpreted as an explanation for the higher price of the sustainable product.) The greater the difference in hidden costs between the two product categories (sustainable and conventional), the greater the potential for explanation by a TCC. Thus,

H3: The effect specified in H1 is moderated by the hidden cost difference between the sustainable and conventional product (the effect of a TCC becomes larger the larger the hidden cost difference).

The last hypothesis concerns the price difference between sustainable and conventional product (which could be called "sustainability premium"). If this is low, the "need" to explain the price difference via true costs is reduced. Conversely, with increased price differences, the effect of a TCC should become bigger. In sum,

H4: The effect specified in H1 is moderated by the price difference between the sustainable and conventional product (the effect of a TCC becomes larger the larger the price difference).

3 Empirical studies

3.1 Study 1: a market characterized by a relatively high green gap among consumers

3.1.1 Procedure, measures, and sample

Sample We recruited 453¹ British participants (59% female; average age: 42 years) through Prolific. Consistent with our assumption on the green gap level in the sample, purchase frequency of organic food was quite low (only 15% indicated buying such food at least a few times per year), although the average attitude toward organic food and perceived knowledge in that category was higher (4.57 vs. 3.89). "Organic" was used to operationalize "sustainable" products: Although overlapping yet different concepts (Stagl, 2002), organic products, just as sustainable products in general, also have lower hidden costs than conventional ones, a circumstance that applied to

¹ Among the 602 originally recruited (control, 200; TCC1, 201; TCC2, 201), 25% did not pass the following check: "How were the prices of the products displayed? Please tick the correct answer. (1) I saw just the regular selling prices for all products. (2) I saw the regular selling prices and so-called hidden costs for all products. (3) I saw regular selling prices, hidden costs, and the resulting true costs for all products." We excluded all participants who did not tick the correct box, given their random allocation to one of the conditions.

the real TCC (Penny, 2020) that we used, for reasons of face validity, as inspiration for the study design presented below.

Design After participants read the welcome page describing the study purpose, we randomly assigned them to one of three conditions of TCC (between-subject factor). In each condition, participants were exposed to a pair of identical options (a conventional and an organic option from the same product category) and were asked to express their relative preference for the organic variant. In the control condition (n=187), participants saw the two options only with their respective retail price. In the first treatment condition (TCC1, n = 142), participants saw products displayed with their retail price and, underneath, a green box containing some information on true costs: the retail price plus the hidden costs. In the second treatment condition (TCC2, n=125), the green box only contained the hidden costs, such that the true costs were essentially missing.² In both TCC conditions, participants received background information explaining the principle of true costs and were told that they only had to pay the retail price which is lower than the true costs.³ They could also discretionally click on a button that would open a new page providing detailed information about the true costs' composition in each of the six product categories (Penny, 2020). In all three conditions, participants performed this preference statement for six product categories in randomized order (apples, bananas, cheese, milk, beef, and potatoes). The product categories differed in terms of hidden costs (either 33% lower for the organic variant or equal for both products) and in terms of the relative price difference ("sustainability premium," 30%, 60%, or 90%). Both were within-subject factors that corresponded in magnitude to the price and hidden cost constellations observable in practice at the time of data collection. Figure 1 shows an example of the product category "cheese" (hidden costs = 33% lower for the organic variant; price difference = 90%) in all three experimental groups. The other five choice sets were analogous in design.

Measurement During the choice tasks, participants indicated their relative preference for the organic variant [PREFORG] (7-point Likert scale). After the six choices, participants completed a questionnaire. The first part measured price transparency (Matzler et al., 2006) and fairness of the price difference (Bolton et al., 2010), our hypothesized mediators. We added direct measures of the dual role of price (from Bornemann & Homburg, 2011, plus self-developed items: perceived price level of supermarket and perceived benefit of organic variant and sustainability-related impact of consumption). All items used 7-point Likert scales. These items were complemented by manipulation check items. The second part contained measures pertaining to the *evaluation of the supermarket* (green perception (Wang et al., 2017), trust in the true cost computation methodology [self-developed item],

² Based on our conceptualization, we expected a weaker effect than or even no difference from the control condition, so TCC2 served as some measure to check for the importance of true costs as an external reference price.

³ See the explanation in the "Introduction" section: *All* products—conventional *and* sustainable—have such hidden costs that are *not* reflected in the retail price.



and reactance (Dillard & Shen, 2005)). Hereby, green perception served as a potential mediator (additional explanation for the main effect), while the other two represented control variables. The third part included control variables, which can be described as scenario-independent *consumption-related* measures (attitude toward and knowledge about organic food (Posavac et al., 2014), purchase frequency of organic food (Hoppe et al., 2013), price knowledge and price consciousness [one self-developed item in each case], price-quality schema (Lichtenstein et al., 1993), deal proneness (Eisenbeiss et al., 2015), and social desirability (Strahan & Gerbasi,

Coefficients	Posterior mean	SD	95% credible interval	<i>p</i> value
TCC1	.003	.096	[184; .197]	.973
TCC1 × hidden cost difference _{33%}	.088	.034	[.023; .153]	.009
TCC1 × price difference _{60%}	.053	.050	[047; .149]	.293
TCC1 × price difference _{90%}	.022	.042	[060; .105]	.625
TCC2	.111	.101	[082; .310]	.274
TCC2×hidden cost difference _{33%}	009	.035	[079; .825]	.825
TCC2 × price difference _{60%}	054	.053	[156; .051]	.309
TCC2 × price difference _{90%}	.081	.045	[006; .170]	.071
Hidden cost difference33%	036	.026	[086; .013]	.157
Price difference _{60%}	.618	.038	[.544; .694]	<.001
Price difference _{90%}	005	.031	[066; .055]	.893
Constant	2.887	.071	[2.750; 3.027]	<.001

 Table 1
 BANOVA results in study 1 (base model to test H1, H3, and H4)

1972)). The last part contained questions about demographics (age, gender, education, and income levels).

3.1.2 Results

Reliability of all scales was good (the lowest being $\alpha = 0.81$ for deal proneness), except for sustainability-related impact of consumption ($\alpha = 0.58$); for this scale, we used its two items separately. Next, we used F-tests (metric scales) or Kruskal–Wallis tests (ordinal scales) to check for equal distribution of the control variables across conditions (tests of balance). All of them led to ps > 0.1, such that no covariates entered the subsequent analyses.

As the study design combined between-subject (condition, price transparency, price fairness) with within-subject factors (hidden cost difference, price difference) and to account for remaining unobserved heterogeneity, we ran a hierarchical Bayes ANOVA (BANOVA) model (Wedel & Dong, 2020), using the BANOVA R package (Dong & Wedel, 2017) and the Stan Gibbs sampler. For the main BANOVA, we ran the algorithm with 100,000 draws (half for burn-in, half as sample) and thinning steps of 10, leaving 5000 draws for posterior parameter inference. We ran two chains to assess convergence, using Heidelberg and Welch's convergence diagnostic. All convergence tests were passed. As is common in BANOVA, we chose conjugate diffuse priors (see Dong & Wedel, 2017).

To test the hypotheses, we refer to the posterior mean of the BANOVA regression coefficients and the Bayesian p value. Table 1 shows the coefficients' posterior means, standard deviations, 95% credible intervals, and Bayesian p values. Significant results (p < 0.05) are in bold.

Regarding H1, we found insufficient evidence for a direct effect of both TCC conditions on the preference for the sustainable products. Before we could test for mediation meaningfully, we proceed with H3 and H4. Regarding H3, showing full

true costs below the price tag (TCC1) improved the relative preference for the sustainable product when the hidden costs were lower than for the conventional product ($b_{\text{TCC1}\times\text{HC}}=0.088$, p=0.009). Showing only hidden costs (TCC2), however, did not interact with a hidden cost advantage of 33% for the sustainable product ($b_{\text{TCC2}\times\text{HC}}=-0.009$, p=0.825). This provides evidence of H3 for TCC1 (but not for TCC2). For H4, we did not find evidence for an interaction of TCCs with the price difference levels.

A robustness test confirms this finding of a TCC effect under the condition of a hidden cost "advantage" for the sustainable product: When including a control effect for reading the additional information page, the posterior mean of the coefficient remained significant ($b_{\text{TCC1}\times\text{HC}}=0.087$, p=0.040).

To test the assumed mechanism behind the TCC effect (H2) in the constellation that emerged as significant (TCC1×HC), we conducted Bayesian mediation analysis. Given the high computational demands, we ran the models on just 10,000 samples each, hence using 500 draws for posterior inference. Still, the convergence tests were passed. We reduced the mediation tests to include only significant variables from the base BANOVA model and therefore dropped the price difference variable. These analyses did not find any significant effect through perceived price transparency (all ps > 0.07), but price fairness did mediate the effects of TCC1×HC ($b_{TCCXHC}=0.079$, p < 0.001).⁴ These results are supporting H2b (for TCC1).

One alternative explanation for a TCC effect could come from an improved green perception of the retailer. In this scenario, respondents would perceive TCCs as a retailer's credible signal of commitment to sustainability goals and hence more likely act in a sustainable manner themselves (Wang et al., 2017). Such an explanation is independent of price perceptions. We tested this possibility by including retailer green perception as an additional mediator in a second robustness check. All posterior means for indirect effects through green perceptions remained insignificant (all ps > 0.14), while the previous results, insignificant indirect effects through price transparency (all ps > 0.11), and significant indirect effects through price fairness (all ps < 0.01) were maintained, underpinning the previous result regarding the role of price fairness.

Overall, study 1 confirms that TCCs improve relative preferences for the sustainable product when full true cost prices are shown to consumers (condition 1) *and* when hidden costs are advantageous for the sustainable product. This effect may be explained by an improved price fairness perception.

⁴ This model showed additional significant mediations through price fairness: $b_{\text{TCP1}} = .087$, p < .001; $b_{\text{TCC2}} = .038$, p < .001; $b_{\text{TCC2} \times \text{HC}} = .081$, p < .001).

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Coefficients	Posterior mean	SD	95% credible interval	p value
TCC	.026	.075	[122; .173]	.728
TCC × hidden cost difference _{33%}	.076	.030	[.018; .136]	.013
TCC \times price difference _{60%}	.036	.042	[045; .118]	.398
TCC \times price difference _{90%}	003	.042	[085; .078]	.952
Hidden cost difference _{33%}	.271	.029	[.213; .329]	<.001
Price difference _{60%}	.466	.041	[.384; .548]	<.001
Price difference _{90%}	.229	.042	[.148; .311]	<.001
Constant	3.887	.076	[3.738; 4.036]	<.001

 Table 2 BANOVA results in study 2 (base model to test H1, H3, and H4)

3.2 Study 2: market characterized by a smaller green gap among consumers

3.2.1 Procedure, measures, and sample

Study 2's design (procedure; measures) was the same as study 1's, with three exceptions: (1) the TCC manipulation used only two conditions: control and TCC1; (2) we adjusted the prices to the market-specific levels in Germany (maintaining the hidden cost and price difference levels, which again reflected the figures observable in practice), and they were expressed in \notin , not \pounds ; and (3) everyone saw the page with detailed information regarding the calculation of true costs.⁵

The sample originally included German 386 participants, and 5% did not pass the manipulation check, leaving N=365 respondents for the analyses (control, 183; TCC, 182). The sample was 49% female and aged between 18 and 71 years (average: 31 years). Purchase frequency of organic food was much higher than in study 1 (36% indicated buying such food at least a few times per year), while the average attitude toward organic food and perceived knowledge in that category were slightly higher (5.15 resp. 4.30), in line with our assumption of a smaller green gap level in this market.

3.2.2 Results

Reliability of all scales was again good; the lowest was $\alpha = 0.79$ for deal proneness, and thus we considered the items of (1) perceived benefit of organic variant and (2) sustainability-related impact of consumption separately (otherwise, $\alpha = 0.44$ and 0.60). In the tests of balance, we used only trust in the methodology (control, 4.25;

⁵ Under the assumption of a lower green gap (study 2) and the fact that already at higher green gap levels half of all subjects were interested enough to click on the button in question (study 1), study 2 showed the detailed information to all respondents. As everyone was also able to continue the survey as quickly as they wished, mirroring the situation in retail practice (at the point of purchase, people are free to decide whether they want to deal with the background information in detail), this change does not represent a significant difference compared to study 1.

TCC, 4.63; p < 0.01) and knowledge about organic food (4.48 vs. 4.12; p < 0.01) as control variables.

Table 2 shows the coefficients' posterior means, standard deviations, 95% credible intervals, and Bayesian p values for study 2. Significant results (p < 0.05) are in bold.

The results mimicked those of study 1: We did not find a direct TCC effect on the relative preference for the sustainable product (H1). However, we did find evidence for an interaction effect (H3): showing true prices improves preferences for the sustainable products when the hidden costs were relatively lower in the sustainable product ($b_{\text{TCC}\times\text{HC}}$ =0.076, p=0.013). We again did not find evidence for an interaction of TCC with price difference (H4). In sum, and just as study 1, study 2 confirmed H3, but neither H1 nor H4.

A robustness model confirmed these results: when including measures for the respondents' trust in the true cost method, as well as their self-assessed knowledge on organic products as two control variables, the posterior mean of the TCC interaction with a hidden cost "advantage" remains significant and positive $(b_{\text{TCC}\times\text{HC}}=0.077, p=0.010)$.

Bayesian mediation analyses again confirmed significant posterior means for indirect effects through price fairness ($b_{\text{TCC}}=0.083$, p<0.001; $b_{\text{TCC}\times\text{HC}}=0.075$, p<0.001), but not through price transparency (all ps>0.306). These results indicate that price fairness mediates the TCC effect on the relative preference for the sustainable product.⁶

4 General discussion

Our central research question was: Do TCCs encourage sustainable purchasing decisions? More specifically: Does the presentation of true costs at the point of purchase nudge consumers toward sustainable product options? Given the empirical results, the answer to this question is not a yes, but also not an unconditional no: In certain cases, TCCs can lead to a higher preference for the sustainable product variant. For

⁶ When considering green perceptions of the retailer as additional, non-price-related mediator, we find a second indirect effect (b_{TCC} =.042, p < .044; $b_{\text{TCC}\times\text{HC}}$ =.048, p < .016).

TCCs to be effective, hidden costs for the sustainable products must be lower than those for the conventional alternatives. Interestingly, under this condition, TCCs have an effect in markets characterized by a larger (study 1) and a smaller (study 2) green gap. In both studies, we find that increased perceived price fairness explains the effect of TCCs, as measured by the relative preference for the sustainable compared to the conventional product. This result may apply to more general communication initiatives aiming at increasing the level of price fairness for consumers: Companies like Everlane have successfully provided a transparent breakdown of their costs in their communications to raise consumer awareness of social and ethical implications of their consumption (Dholakia, 2023). In addition, we see that the price difference between the two products plays a significant role in forming this preference judgment, independent of other factors included in the model and especially independent of TCC. Interestingly, however, this main effect differs between study 1 (significant only at a price difference of 60%) and study 2 (significant at both price difference levels).

Since these effects occur at a low absolute preference level for the organic variant, the average consumer still would not *choose* the more sustainable product variant; preference merely moves in that direction (study 1). This is also the case in study 2, where, however, the average relative preference for the sustainable product is higher (albeit below the midpoint of the scale).

In summary, TCCs work when the hidden costs for sustainable products are lower than those for conventional alternatives. While this does not mean that all consumers would switch to the sustainable product under this condition, it does mean that the average relative preference for the sustainable product increases and so does the (individual) purchase probability as well as the market share. Table 3 recapitulates the main drivers of a TCC's effectiveness and provides key implications for firms and public policy makers that directly arise from our results. The positive effect is explained by consumers' increased perceived fairness of price difference (and possibly also by their green perception of the supermarket running the TCC [study 2 but not study 1], a non-price factor that emerged from the literature that could have offered a competing explanation). Thus, in line with Bürgin and Wilken (2022), pricing can communicate benefits to consumers (Bertini & Wathieu, 2008). This finding suggests that, for the purpose of estimating price potential, greater attention should generally be paid to the benefit communication perspective.

However, both studies also show that a much more effective lever to encourage consumers to consume more sustainably is to make the prices of sustainable products affordable compared with conventional variants. Put simply, consumers need to be able to afford sustainable products. Similar to our study context, Bürgin and Wilken (2022) also found that a price tactic (in their case, partitioned pricing) makes no difference if the sustainable price premium is too large. In this sense, our study is another indication of the strength of the green gap phenomenon as well as reasoning surrounding it.

Table 3 Managerial implications of successfully manag	ing TCCs	
Main findings	Managerial implications	Examples
TCC effectiveness increases as the hidden cost differ- ence between sustainable and conventional products increases.	Brands should focus on products that significantly con- tribute to decrease social and environmental impacts. This strategy will not work for moderate sustainabil- ity improvements.	The retailers Penny and Rewe particularly insist on com- paring products with high differences in hidden costs.
	Policy makers should develop rules to oblige manu- facturers to disclose hidden costs in markets where hidden costs of unsustainable options are high (e.g., air travel, food).	The 2023 summit of the United Nations Food and Agriculture Organization (UNFAO) recommends a true cost accounting approach to influence national sustainability policies.
The lower the price difference between sustainable and conventional products ("sustainable premium"), the higher the relative preference for sustainable product	Brands that develop sustainable products should develop strategies to maintain prices as close as pos- sible to conventional options.	The sustainable brand Veja decided to cut advertising investments to lower price gaps with conventional competitors.
options.	Policy makers should implement stronger rules that oblige manufacturers to integrate hidden costs in products' final price to lower the gap between sus- tainable and unsustainable options.	An increasing number of countries implement Extended Producer Responsibility Systems (EPR) to tax unsus- tainable options or incentivize sustainable initiatives.
When significant, the effect of TCCs is mediated by price fairness.	Sustainable brands should use TCCs as a good way of convincing consumers of the fairness of their price.	The brand Everlane provides a transparent cost break- down to increase price fairness perceptions.
	Policy makers should develop initiatives to raise aware- ness of the true costs so that the price of sustainable products is perceived as fair by the population.	The United Nations have developed guidelines for consumer protection and education on sustainable consumption.

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Data availability The data is available on request from the first author.

Declarations

Ethics approval The study setup was submitted to the ESCP's European Research Committee and approved on April 06, 2022 [decision letter available from the authors upon request].

Consent to participate The participation in this study was voluntary. Participants were recruited through the panel provider Prolific. Before conducting the study, we informed participants that we were interested in their grocery shopping behavior. We further assured that all data would be treated anonymously.

Competing interests The authors declare no competing interests.

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