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Worse is worse and better doesn't matter?

The effects of favorable and unfavorable environmental information on consumers' willingness to pay

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Abstract

Increasing consumers' willingness to pay (WTP) for environmentally friendly products is a key challenge for sustainable development in market economies. Still, how consumers react to favorable and unfavorable environmental information of different quantitative extents is largely unknown. This research therefore uses prospect theory and competing theoretical foundations to derive pertinent hypotheses and test them by using a multi-level structural equation model. The analysis draws on a survey-based experiment conducted among a representative sample of the German population. Results confirm key assertions of prospect theory. The negative effect caused by unfavorable product carbon footprint information on WTP is stronger than the positive effect caused by respective favorable information. Besides this negativity bias, consumers tend to generally reward or punish deviations of a product's environmental performance from industry average instead of consistently accounting for the size of these deviations. From a sustainable development perspective, the observed patterns highlight a problematic contrast between the need for substantial environmental improvements and limited market incentives for companies. Consequently, political intervention is needed to introduce negative labeling, raise consumers' reference points, set minimum industry standards, and subsidize companies for radical improvements.

KEYWORDS
consumer behavior, industrial ecology, negativity bias, product carbon footprint information, prospect theory, willingness to pay (WTP)

1 | INTRODUCTION

Increasing consumers' willingness to pay (WTP) for environmentally friendly products is crucial to the achievement of the 12th sustainable development goal on sustainable production and consumption and also of sustainable development in general (Sala & Castellani, 2019). However, the translation of environmental information into WTP is anything but straightforward (e.g., O'Rourke & Ringer, 2016; Thøgersen et al., 2010). In order to design effective consumer information and to assess whether market incentives are sufficient to improve the environmental performance of products, a deeper understanding of the impact of environmental information on purchase behavior is needed that goes beyond the mere

qualitative link between the two. In pursuit of this goal, we investigate *how the marginal effect of positive (or negative) environmental information on WTP increases or decreases with progressively higher (or lower) levels of a product's environmental performance.*

To identify the shape of the reaction function of WTP for a given product with respect to its environmental performance, we build on prospect theory and contrast its assumptions to competing theoretical foundations including disappointment theory, adaptation level theory, and social judgement theory. The analysis is conducted using environmental information related to CO_2 emissions, as CO_2 is the most significant contributor to climate change, one of today's most pressing environmental issues (e.g., Rockström et al., 2009; Steffen et al., 2015). Moreover, climate stability is a public good (Finus & Rübbelke, 2013), not offering private benefits. This ensures that the effects observed can be ascribed to the impact of a product's environmental performance. Besides, with product carbon footprints (PCFs) a tool has been developed in the field of industrial ecology which allows consumers to judge climate change-related impacts of products (e.g., Draucker et al., 2011; Lenzen, 2014). Drawing on Alvarez et al. (2018), the PCF can be defined as an indicator measuring the direct and indirect green-house gas emissions caused by a specific product along its entire life cycle. Unlike most environmental labels, PCFs provide quantitative and not only qualitative environmental information.

The present article contributes to the discussion on how information on environmental product performance influences WTP: First, for the first time prospect theory is applied in the context of industrial ecology, linking PCF information to WTP. Second, using PCF information, as opposed to qualitative environmental labels, allows analyzing WTP for varying degrees of positive and negative environmental performances. In so doing, this analysis goes beyond general recommendations for companies to avoid negative environmental performances, but highlights that for many companies (those offering products with very low or above average levels of environmental performance) markets provide hardly any incentive to improve environmental product performance. This stresses the importance of governmental intervention for environmental consumption such as negative environmental labeling, raising consumers' environmental reference points, minimum environmental industry standards, and subsidies for radical environmental improvements.

2 | THEORETICAL BACKGROUND AND HYPOTHESES

One of the topics most in need of additional research in sustainable consumption is the translation of sustainability information into respective consumption behaviors (e.g., Thøgersen et al., 2010; Vergragt et al., 2014). Scholars from various fields such as business, consumer, and sustainability research have investigated the influence of a product's environmental performance on purchase behavior. Multiple studies find that positive environmental information can stimulate purchase behavior in specific contexts, for instance, food (e.g., Brunk & de Boer, 2020; De Jonge et al., 2015; van Dam, & van Trijp, 2016) and consumer electronics (Moosmayer, 2012). In general, previous studies suggest that while consumers do prefer to buy more environmentally friendly products, they need to trade-off a product's higher environmental performance against its potentially higher price (e.g., Brécard et al., 2009; Vanclay et al., 2011).

Other authors focus on the means of communicating environmental product performance and analyze the effects of communicating quantitative LCA and PCF information. Molina-Murillo and Smith (2009), for instance, show that disclosing LCA information of personal care products can positively influence consumers' purchase intentions as well as the credibility consumers ascribe to environmental product performance. In contrast, Hartikainen et al. (2014) indicate that consumers attach low importance to PCF information in the food context. Consequently, O'Rourke and Ringer (2016) as well as Hartikainen et al. (2014) identify a need for further research on how the quantitative information provided by industrial ecology research influences consumer decisions. In conclusion, it still remains unclear how the reaction function of consumers' WTP is shaped with respect to a product's quantified environmental performance.

Many studies implicitly assume a linear relationship between environmental product performance and WTP (e.g., Ha-Brookshire & Norum, 2011; Loureiro & Lotade, 2005; Zander & Hamm, 2010). Empirical findings from experimental research, in contrast, give reason to expect nonlinear effects (e.g., Grankvist et al., 2004; Moosmayer, 2012; van Dam & De Jonge, 2015). One such effect is the negativity bias which refers to attributing greater weight to negative than to positive stimuli (Rozin & Royzman, 2001; Sen & Bhattacharya, 2001). While many sustainability labels present positive sustainability information, previous research suggests that combined positive and negative labeling would be more effective to foster sustainable purchase behavior (e.g., Grankvist et al., 2004; van Dam & De Jonge, 2015). Multiple theoretical explanations for negativity biases exist based on, for example, category diagnosticity theory, adaptation-level theory, social judgement theory, or prospect theory (Skowronski & Carlston, 1989; van Dam & De Jonge, 2015). Negativity biases have been found in many different settings including environmental consumption (e.g., Grankvist et al., 2004; Moosmayer, 2012; van Dam & De Jonge, 2015). An overview of pertinent literature on nonlinear effects of environmental information on consumer behavior is summarized in Table 1.

Table 1 shows that little attention has yet been paid to the explanation of nonlinearities in environmental consumption. Remarkably, none of the studies uses indicators from the industrial ecology discourse and, except for O'Rourke and Ringer (2016), all test the influence of qualitative product-related environmental information. Only three studies explicitly build their research design on theoretical ground, with two of them (Grankvist et al., 2004; van Dam & De Jonge, 2015) referring to prospect theory. Moreover, apart from Moosmayer (2012), all presented studies examine dependent variables other than WTP, such as attitudes, preferences, and purchase intentions. However, investigating WTP accounts for a consumer's price consciousness which is of great importance given the fact that environmentally friendly products are usually more expensive than

TABLE 1 Nonlinear effects of environmental information on consumer behavior

Author(s)	Theory base	Data collection	Data analysis	Key findings (focus: environmental information)	Limitation(s)	Further Research
O'Rourke and Ringer (2016)	None	Online field observation of product page views ($N = 41{,}398$) Fast moving consumer goods	**DV**: Purchase intention **IV**: Quantitative environmental-, social-, and health-related sustainability information about products and companies (interval scaled ratings without explicit reference point and related to indicators from industrial ecology)	- Positive influence of sustainability information on purchase intention among users interested in sustainability - Positive influence of environmental ratings only for pet food - Changes in sustainability scores at the low end of the ratings do not influence purchase intention, whereas changes at the high end strongly positively and negatively influence purchase intention	- Rš generally below 0.1 - Actual purchases not measured - Data collected retrospectively - 'Brick-and-mortar' shopping not considered	- Usage of sustainability information from industrial ecology research - Design of sustainability information - Controlled experiments - More reliable, statistically powerful hypothesis testing
Van Dam and De Jonge (2015)	Prospect theory; Regulatory focus theory	Three experiments among Dutch students ($N = 81; 170; 177$) Computer hardware; foods	**DV**: Attitude toward product; preference for product **IV**: Qualitative environmental label (positive, neutral or negative compared to industry average/positive or negative without explicit reference point); price **Mod**: Regulatory focus; environmental concern **Med**: Personal sustainable norms **ED**: Between-subjects; within-subjects	- Support for negativity bias only if positively labeled products offered at price premium - Effect of positive (negative) labeling enhanced by promotion (prevention) focus - Strong positive relation between environmental concern and preference for positively labeled product - Effect of negative labeling mediated by personal sustainable norms - Effect of environmental concern on preference for positively labeled product fully mediated by personal sustainable norms	- None mentioned	- Moderating effect of environmental concern on relationship between type of labeling and purchase behavior
Moosmayer (2012)	Category diagnosticity theory	Survey-based experiment among German students ($N = 315$) Consumer electronics	**DV**: Price response (based willingness to pay and price expectations) **IV**: Qualitative environmental information on corporate performance based on newspaper excerpt (positive or negative without explicit reference point) (social information of sportswear also tested) **ED**: Between-subjects	- Effect of product-related environmental information on price response - Support for negativity bias - For negative environmental information, some respondents reported a willingness to pay of EUR 0 (boycotting)	- Quoting absolute prices might be difficult and unrealistic - Constructed product value does not account for hygiene factors - Evaluating price responses before and after informational stimulus could lead to modified price responses - Social desirability bias	- Further validation of new approach measuring individual negativity bias (price response quotient) - Consideration of confounding information - Individual roots and consequences of negativity bias

(Continues)

TABLE 1 (Continued)

Author(s)	Theory base	Data collection	Data analysis	Key findings (focus: environmental information)	Limitation(s)	Further Research
Mohr & Webb (2005)	Stakeholder theory; Shareholder theory	Survey-based experiment among random sample of US-American adults ($N = 194$) Sportswear	**DV**: Evaluation of company; purchase intent **IV**: Qualitative environmental and philanthropic corporate social responsibility (CSR) information (positive or negative compared to industry); price; socially responsible consumer behavior; support for environmental and philanthropic CSR (attitude) **ED**: Between-subjects	- Positive influence of CSR information on evaluation of company and purchase intent - Support for negativity bias - CSR information influences purchase intent more strongly than price - Price influences purchase intent slightly stronger in case of negative CSR information - Effect of environmental CSR information on evaluation of company (and purchase intent) stronger for highly socially responsible (highly supportive) consumers	- Effect of CSR information on respondents might be inflated due to hypothetical shopping situation and, specifically, presentation of informational stimulus immediately before evaluating company and purchase intent - Sample not population representative	- Replication study as field experiment
Grankvist et al. (2004)	Prospect theory; Self-discrepancy theory	Incentivized experiment among Swedish students ($N = 40$) Foods and non-foods	**DV**: Preference for product **IV**: Qualitative environmental label (positive, neutral or negative compared to average product); environmental concern **ED**: Between-subjects	- Respondents with weak or no environmental concern unaffected by either kind of label - Support for negativity bias for respondents with intermediate environmental concern - Respondents with strong environmental concern equally affected by positive and negative label	- Only proxy (environmental concern) used as measure of self-guides	- Stricter theory testing - Effects of other non-environmental types of information - Linkage between promotion and prevention focus, and personal and social norms

their conventional equivalents (e.g., Brécard et al., 2009; Vanclay et al., 2011). Finally, none of the previous studies uses population representative samples.

The present study addresses this multitude of research gaps by examining nonlinear effects in consumers' WTP reaction functions with respect to a product's quantitative environmental performance information derived from industrial ecology, namely PCF information. By analyzing what monetary incentives consumers provide in certain situations, depending on the current levels of environmental product performance offered by a company, it is possible to go beyond the general recommendation of previous research that companies should avoid negative environmental performances (e.g., Moosmayer, 2012). Such analysis is of crucial importance to more accurately assess whether market incentives are sufficient to foster sustainable consumption or whether political interventions are needed, and which interventions are promising in a specific industry given the current environmental performance standard of products.

According to prospect theory, it can be expected that consumers do not evaluate the absolute level of a product's environmental performance, but rather its deviations from a reference point. Options which positively deviate are perceived as gains, negative deviations are perceived as losses (Tversky & Kahneman, 1991). Within the framework of prospect theory, the negativity bias has been introduced as loss aversion (Kahneman et al., 1991; Tversky & Kahneman, 1991), assuming that decision-makers prefer avoiding a loss over achieving a gain of the same nominal amount. In environmental consumption, prospect theory has so far only been applied in contexts where qualitative labels were used to explain the negativity bias. Based on prospect theory, van Dam and De Jonge (2015) for instance show that qualitative negative labeling of environmental product performance has a stronger effect on consumer attitudes and preferences than positive labeling. Similar expectations can also be derived for instance from category diagnosticity theory (Moosmayer, 2012), adaptation-level theory (Helson, 1964), or social judgment theory (Cooksey, 1996; Sherif & Sherif, 1967). Against the background of these earlier empirical insights and the theoretical background of negativity bias, we formulate hypothesis 1 as follows:

H1: *Negative (unfavorable) deviations of a product's environmental performance from a given reference point have a stronger effect on WTP than quantitatively corresponding positive (favorable) deviations.*

Complementing earlier research based on prospect theory, regulatory focus theory suggests that the negativity bias in environmental consumption may be further explained by differences in consumers' regulatory focus (Codini et al., 2018; Zou & Chan, 2019). According to regulatory focus theory (Higgins, 1997; Higgins et al., 1994), the effect of favorable and unfavorable information depends on an individual's motivational goal, the so-called regulatory focus. Based on the principle of regulatory fit, positive consumer response to positive environmental information should be the larger the stronger a consumer's promotion focus is, while a negative consumer response to negative environmental information should be the larger the stronger a consumer's prevention focus is. In the context of qualitative environmental labeling, van Dam and De Jonge (2015) already found that the effect of positive and negative labeling is enhanced by regulatory fit. This raises the expectation that the regulatory focus of individuals will influence the shape of the curve describing their WTP in dependence of positive and negative environmental information. However, the moderating effect of regulatory focus has not yet been investigated in the context of quantitative environmental information. We present the following hypotheses to address this research gap:

H2a: *The effect on WTP of positive (favorable) deviations of a product's environmental performance from a given reference point on WTP is enhanced by a consumer's promotion focus.*

H2b: *The effect on WTP of negative (unfavorable) deviations of a product's environmental performance from a given reference point is enhanced by a consumer's prevention focus.*

Beyond the negativity bias, other forms of nonlinearity of consumers' WTP reaction functions may occur. Prospect theory, for instance, posits an S-shaped utility function, which takes a value of zero at the reference point, rises above zero with increasing gains, and falls below zero with increasing losses. Its slope, initially higher for losses than for gains due to the above-mentioned loss aversion, in both cases flattens for increasing absolute distances from the reference point (Kahneman & Tversky, 1979; Kahneman et al., 1991). Whereas prospect theory originally models utility as a function of change in monetary wealth, its implication of a decreasing effect of departures from a reference point has been generalized to other domains such as consumer satisfaction and purchase intentions (Mittal et al., 1998). Grankvist et al. (2004) transfer the reference dependence and loss aversion assumptions of prospect theory to the study of positive and negative qualitative labels on a product's environmental performance, but explicitly leave aside the assumption of diminishing sensitivity. Building on this third core assumption of prospect theory, one can expect an S-shaped reaction of consumers' WTP to a product's environmental performance information (Figure 1a).

Contrasting with prospect theory, disappointment theory (Loomes & Sugden, 1986) offers a justification for an inversely S-shaped pattern of consumers' WTP reaction functions (Figure 1b). Disappointment theory assumes that negative deviations from a reference point cause disappointment and positive deviations cause elation. Unlike prospect theory, the effects of disappointment and elation are hypothesized to grow progressively with the amount of deviation from expectations, inducing the inverse S-shape of the utility function. Similar assumptions can be found in adaptation-level theory and social judgement theory, which postulate that very strong deviations from a reference point are perceived as even more extreme than

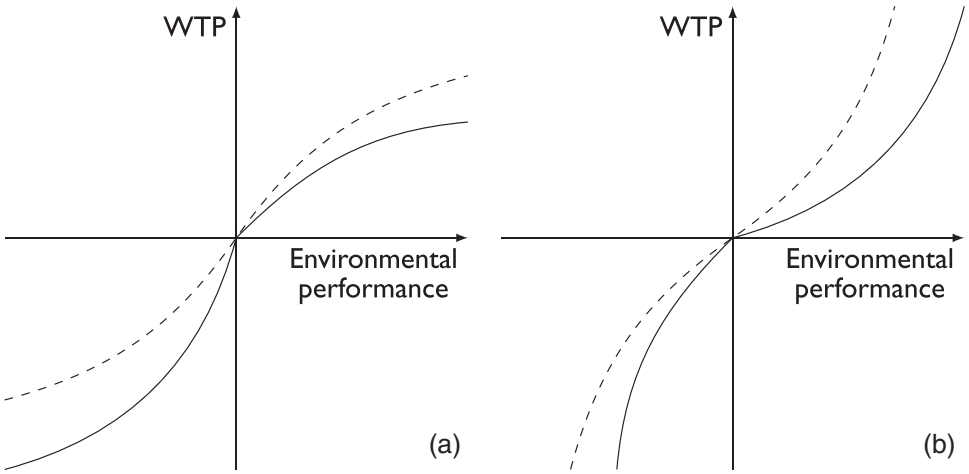

FIGURE 1 Alternative hypothesized shapes of the willingness-to-pay reaction function with (a—prospect theory) declining or (b—disappointment theory) increasing effects of deviating environmental performance and with (solid lines) or without (dashed lines) negativity bias

they objectively are (Skowronski & Carston, 1989). In accordance with these theories, O'Rourke and Ringer (2016) find that a piecewise linear function of purchase intention for products with high health-related sustainability ratings increases progressively with the health score. In contrast, the response to environmental sustainability ratings appears irregular, with alternating slopes for above-average environmental scores, indicating a need for clarification. In the context of conventional consumer behavior, Homburg et al. (2005) show that disappointment theory can explain consumers' perceived utility in response to product quality, with WTP following an inverse S-shape. Consequently, the question arises whether this finding can be transferred to environmental consumption.

Neither prospect theory nor the competing theoretical explanations have yet been applied to the question of how WTP reacts to quantitative variations in a product's environmental performance. We therefore set up the following alternative hypotheses:

H3a: *Deviations of a product's environmental performance from a given reference point have a continually declining concordant effect on WTP.*
H3b: *Deviations of a product's environmental performance from a given reference point have a continually increasing concordant effect on WTP.*

3 | METHOD

3.1 | Sample and experimental design

Our analysis builds on a survey-based experiment drawing on a population representative sample of 458 consumers from Germany.[1] Consequently, we pick up the need for experimental research (O'Rourke & Ringer, 2016) and particularly for controlled and population-based experiments (Harms & Linton, 2016).

Respondents were presented with an online questionnaire (Supporting Information S2), in the course of which they were confronted with three subsequent, hypothetical purchase decisions (Supporting Information S3). In each instance, the participants were asked to state their WTP for a pack of batteries. Environmental performance in terms of CO_2 emissions relative to the industry average was stated for the batteries on offer, and invariant prices of five unavailable packs of functionally equivalent batteries were indicated to reduce the response variance attributable purely to inhomogeneous market knowledge. The industry average of CO_2 emissions served as a reference point, as suggested by earlier literature (e.g., van Dam & De Jonge, 2015). The purchase scenarios dealt with batteries for three reasons. First, batteries are low involvement products purchased by almost all consumers occasionally. Second, the battery market does not advertise environmental product benefits, so the potential influence of consumers' prior knowledge about environmentally friendly batteries could be ruled out. Also, product categories with established sustainable markets, such as coffee, have already been in the center of earlier research (e.g., Basu & Hicks, 2008; Loureiro & Lotade, 2005). Third, choosing a utilitarian product enabled us to plausibly focus on environmental information and price as purchase-relevant product attributes. Non-functional characteristics mainly serving hedonic motives, such as design, were expected to be of only minor importance. Two pre-tests ($N = 30$; $N = 141$), confirmed that the scenarios were comprehensible and perceived as sufficiently plausible.

[1] Quota targets for gender, age, and formal education are based on micro-census data for the adult population in Germany (Statistisches Bundesamt, 2017). Quota targets and actual sampling frequencies are shown in Supporting Information S1.

The environmental performance stimulus was varied for each purchase decision. For one of the three occasions, a relative performance of 100% of the industry average CO_2 emissions was fixed. For each of the other two occasions, relative performance was randomly chosen from a range of 0.2 (i.e., one fifth or 20% of the industry average CO_2 emissions) and 5 (i.e., the fivefold or 500% of the industry average CO_2 emissions), reflecting the landmark goal of resource efficiency increase by a "factor five" (von Weizsäcker et al., 2009). Values below (above) the industry average CO_2 emissions represent favorable (unfavorable) environmental performance. The sequence of the three scenarios was randomized as well as controlled for to neutralize order effects.

Two question blocks with distraction tasks were interspersed between the purchase decisions to mitigate anchoring effects between successive WTP reports and to control respondents' involvement with the questionnaire[2]. A final question block, placed after the last purchase situation, elicited consumers' price consciousness, regulatory focus and concern about climate change (CACC), and measured the respondents' tendency to provide socially desirable answers. All questions were mandatory so there is no item non-response.

3.2 | Measurements

As the dependent variable, respondents entered their WTP as a euro amount in each purchase occasion. Despite its known limitations (e.g., Breidert et al., 2006), this direct approach of WTP elicitation is used in many related studies (e.g., Ha-Brookshire & Norum, 2011; Harms & Linton, 2016; Homburg et al., 2005). It is the method of choice for the present research, as the latter requires repeated measurements from a large, population representative sample (e.g., Breidert et al., 2006) and focuses on the shape, rather than on the precise location, of the WTP reaction function. For this purpose, the open-ended question method has proven to be suitable (Miller et al., 2011). To mitigate the potential bias of stated WTP, we explicitly control for individual social desirability tendency.

The independent variable of interest is the environmental performance of the product offered, operationalized by the product's PCF in the form of CO_2 emissions relative to the industry average. This relative measure enters on a reversed base-five logarithmic scale, with zero representing industry average and negative (positive) numbers representing unfavorable (favorable) environmental performance, normed to −1 (+1) for a five-fold (one-fifth) PCF.[3]

Respondents' regulatory focus was measured by van Dam and De Jonge's (2015) 2 × 5-item scale on promotion and prevention focus.[4] As a control variable, we further include respondents' CaCC as suggested by Metag et al. (2017), because environmental attitudes are acknowledged to impact environmentally relevant purchase decisions (e.g., Brécard et al., 2009; Harms & Linton, 2016). Due to its generally recognized influence on sustainable purchasing behavior (e.g., van Loo et al., 2015; Verain et al., 2012), we also control for respondents' price consciousness. Price consciousness was operationalized by a three-item scale (Wakefield & Inman, 2003). The items on regulatory focus, CaCC, price consciousness, social desirability (Kemper et al., 2012), and markers for common method variance (Podsakoff et al., 2003; Podsakoff et al., 2012) were measured on five-point rating scales ranging from "completely agree" to "completely disagree." We assessed the internal consistency of all scales with a confirmatory factor analysis (CFA; e.g., Hair et al., 2010; Kline, 2015), at the same time controlling for common method bias in general and social desirability bias in particular (Figure 2).[5]

The CFA model, estimated with Mplus 8 (Muthén & Muthén, 2017), fits the data well (χš/df = 664.1 / 344 = 1.93, CFI = 0.911, RMSEA = 0.045, p(RMSEA < 0.05) = 0.947, SRMR = 0.057; e.g., Hair et al., 2010; Kline, 2015; Supporting Information S4). The constructs for promotion focus, prevention focus, CaCC, and price consciousness are measured with respective congeneric reliabilities of 0.652, 0.633, 0.848, and 0.630. The method factor accounts for less than 7% of the respective scale items' variance on average, indicating absence of any substantial method bias.[6]

3.3 | Model and analysis

To estimate intersubjectively varying, potentially nonlinear reaction functions based on three individual WTP measurements, we resort to the two-level, repeated measurements structural equation model (e.g., Du Toit & Du Toit, 2008; Heck & Thomas, 2015) shown in Figure 3. The within-subjects level explains the variation of WTP between measurements, that is, the three purchase occasions, for each individual. The between-subjects level captures the variation between different respondents. On that level, promotion and prevention focus, CaCC, price consciousness and social desirability are measured by the same (sub-)model as used for the CFA (Supporting Information S5).

At the within-subjects level, WTP y_{ij} is regressed on the relative environmental performance x_{ij}, as well as on the purchase occasion dummy control variables z_{ij}. The measure of performance x_{ij} is presented as the negative logarithm to base five of the relative CO_2 emission factor. It enters

[2] From the raw sample of 531, all cases where respondents gave wrong answers to control questions were discarded.

[3] A logarithmic scale was chosen so as to represent matching relative changes of CO_2 emissions by identical intervals. The choice of base five was motivated by the guiding factor five (Von Weizsäcker et al., 2009), which translates to a unit interval on that scale. Likewise, the sign reversal (so that positive numbers represent better-than-average performance) was introduced for ease of interpretation.

[4] One item was dropped from the prevention focus scale due to lack of reliability.

[5] Common method variance is captured by a latent method factor loading on all observed indicators including non-substantive marker variables. Social desirability is conceptualized as Paulhus's (2002) gamma factor measured by three items each for two polar sub-scales, overstatement of positive traits, and understatement of negative traits (Kemper et al., 2012).

[6] The social desirability scale attains a congeneric reliability of 0.577, which is net of the 0.139 share of unspecific common method variance also reflected in the scale and controlled for.

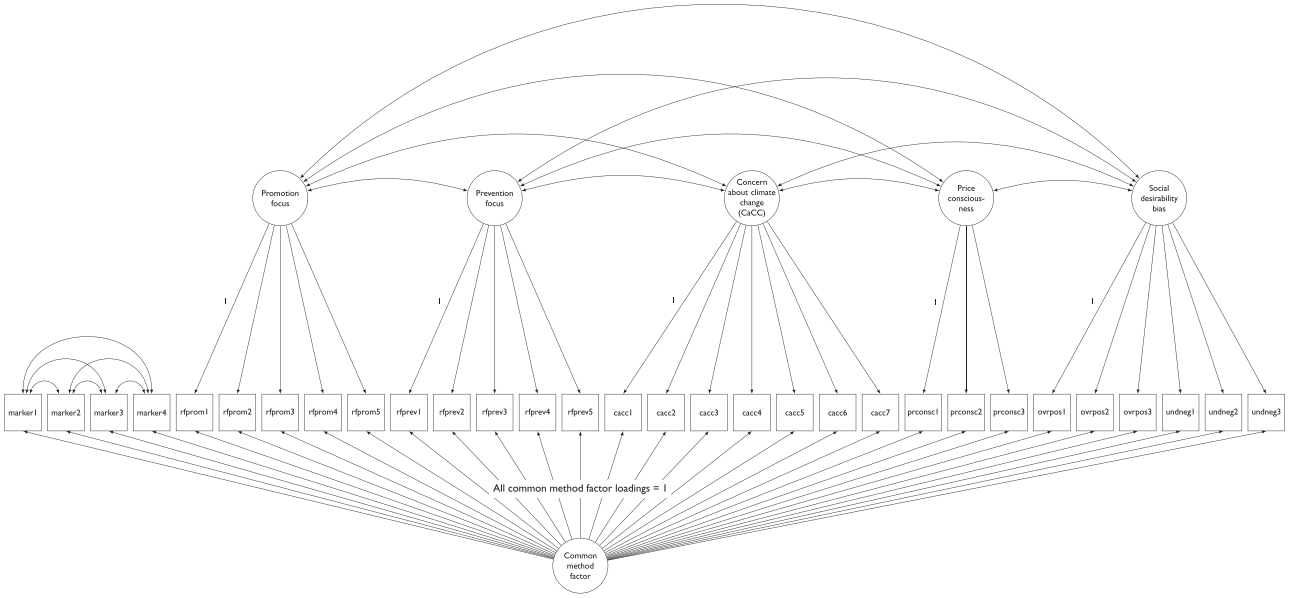

FIGURE 2 Confirmatory factor analysis model

the regression via a piecewise power function composed of a term for environmental performance surplus $f^{+}(x_{ij})$ and another for environmental performance deficit $f^{-}(x_{ij})$, both in comparison to the industry average (within-subjects part of Figure 3). At the between-subjects level, the random intercept a_j, that is, the WTP for a product with industry average environmental performance, and the random slopes b_j^{+} and b_j^{-}, that is, the WTP surplus and deficit coefficients, of the resultant individual WTP reaction function are modeled as latent dependent variables (Preacher et al., 2016; Snijders & Bosker, 2012). They are regressed on the latent and manifest control variables (between-subjects part of Figure 3).

The environmental performance surplus and deficit terms are parameterized by the real-valued exponents η^{+} and η^{-}, respectively, which allow to independently adapt the curvatures as shown in Figure 4. An exponent equal to one would thus give rise to a linear effect, exponents less than one to declining effects as suggested by prospect theory (H3a), and exponents greater than one to increasing effects[7] as suggested in H3b. The special case of a zero exponent would imply a constant offset depending only on the sign of the deviation from the reference point.

The piecewise definition of the WTP reaction function permits to differentiate the respective surplus and deficit coefficients, b_j^{+} and b_j^{-}. Specifically, we consider the following model variants, which constitute a nested sequence in the sense that each subsequent model generalizes its predecessor:

- Model (1): η^{+} and η^{-} fixed to unity, so that b_j^{+} and b_j^{-} are the slopes of a piecewise linear WTP reaction function to the left and right of the reference point of the environmental performance variable (this is the boundary case separating H3a from H3b);
- Model (2): η^{+} and η^{-} constrained to assuming a common value, so that the shapes of the reaction function to the left and right of the reference point are given by identical exponents (either above or below unity, thus supporting either H3a or H3b);
- Model (3): η^{+} and η^{-} optimized independently so as to permit different curvatures on both sides of the reference point (the two values could fall on different sides of unity, thus contradicting both hypotheses).

For given values of η^{+} and η^{-}, maximum likelihood estimates and Satorra–Bentler corrected robust standard errors were computed with Mplus 8 (Muthén & Muthén, 2017). The endogenous estimates for η^{+} and η^{-} in models (2) and (3) were obtained by maximizing the resulting profile-likelihood function over the permissible parameter space.

4 | RESULTS

All models are shown in Table 2. Based on robust likelihood-ratio tests (Satorra & Bentler, 2001, 2010), in terms of fit the linear model (1) significantly falls behind both nonlinear models (2), with $\eta^{+} = \eta^{-} = 0.25$ ($-2\Delta LL = 33.60$, scaled $\chi^2 = 29.25$, df = 1, $p < 0.001$), and (3), with $\eta^{+} = 0.04$ and $\eta^{-} = 0.28$ ($-2\Delta LL = 39.82$, scaled $\chi^2 = 34.66$, df = 2, $p < 0.001$). Any potential models with parameter values η^{+} and η^{-} greater than one would fit even worse than the linear model (1), since the profile-likelihood function is monotonically decreasing in both parameters in that range.

[7] This includes special cases of, for instance, quadratic or cubic functions with exponents equal to two or three, respectively.

TABLE 2 Parameter estimates (and standard errors) for alternative analysis models

Model	(1)	(2)	(3)
Shape parameters of WTP reaction function			
Exponent of environmental performance surplus	1.00	0.25	0.04
Exponent of environmental performance deficit	1.00	0.25	0.28
Fixed main effects on WTP			
Intercept	2.62***	2.61***	2.60***
	(0.17)	(0.17)	(0.17)
Environmental performance surplus	0.20	0.15	0.12
	(0.20)	(0.14)	(0.12)
Environmental performance deficit	0.84*	0.43*	0.43*
	(0.33)	(0.21)	(0.21)
Promotion focus	0.26*	0.22	0.20
	(0.13)	(0.13)	(0.13)
Prevention focus	0.07	0.10	0.11
	(0.14)	(0.14)	(0.14)
Concern about climate change	0.17**	0.17*	0.16*
	(0.06)	(0.07)	(0.07)
Price consciousness	−0.48***	−0.48***	−0.47***
	(0.13)	(0.13)	(0.12)
Social desirability bias	−0.17	−0.14	−0.14
	(0.22)	(0.23)	(0.22)
Female	0.19	0.22*	0.22*
	(0.11)	(0.11)	(0.11)
18–29 years old	0.09	0.08	0.07
	(0.18)	(0.19)	(0.19)
30–39 years old	0.21	0.22	0.22
	(0.20)	(0.20)	(0.20)
50–59 years old	0.13	0.14	0.15
	(0.20)	(0.20)	(0.19)
60 years old and above	0.06	0.08	0.09
	(0.16)	(0.16)	(0.16)
No school-leaving qualification	0.01	0.02	0.03
	(0.21)	(0.21)	(0.21)
Secondary general school qualification	0.14	0.12	0.10
	(0.13)	(0.13)	(0.13)
University entrance qualification	0.15	0.17	0.18
	(0.17)	(0.17)	(0.17)
University degree	−0.01	−0.03	−0.03
	(0.16)	(0.16)	(0.16)
Purchase occasion 2	−0.02	−0.01	−0.01
	(0.04)	(0.04)	(0.04)
Purchase occasion 3	0.06	0.07	0.07
	(0.05)	(0.05)	(0.05)

(Continues)

TABLE 2 (Continued)

Model	(1)	(2)	(3)
Interaction effects on WTP environmental performance surplus × …			
Promotion focus	−0.14	0.00	0.03
	(0.17)	(0.14)	(0.12)
Prevention focus	−0.42*	−0.32*	−0.27*
	(0.20)	(0.16)	(0.13)
Concern about climate change	0.22**	0.16**	0.15**
	(0.08)	(0.06)	(0.05)
Price consciousness	0.23	0.11	0.07
	(0.14)	(0.10)	(0.08)
Social desirability bias	−0.19	−0.11	−0.09
	(0.30)	(0.24)	(0.20)
Female	−0.04	−0.05	−0.03
	(0.15)	(0.11)	(0.09)
18–29 years old	0.12	0.15	0.14
	(0.23)	(0.17)	(0.14)
30–39 years old	−0.06	−0.04	−0.03
	(0.24)	(0.18)	(0.14)
50–59 years old	0.08	0.00	−0.01
	(0.27)	(0.18)	(0.14)
60 years old and above	−0.05	−0.05	−0.04
	(0.21)	(0.15)	(0.12)
No school-leaving qualification	0.54	0.32	0.26
	(0.30)	(0.21)	(0.18)
Secondary general school qualification	0.10	0.15	0.15
	(0.19)	(0.14)	(0.11)
University entrance qualification	0.39	0.21	0.17
	(0.21)	(0.15)	(0.12)
University degree	0.54*	0.35*	0.28*
	(0.23)	(0.16)	(0.13)
Environmental performance deficit × …			
Promotion focus	0.56*	0.27	0.24
	(0.26)	(0.16)	(0.15)
Prevention focus	−0.25	−0.20	−0.19
	(0.25)	(0.17)	(0.17)
Concern about climate change	0.31**	0.20*	0.19*
	(0.11)	(0.08)	(0.08)
Price consciousness	−0.83***	−0.51**	−0.50**
	(0.23)	(0.16)	(0.15)
Social desirability bias	−0.66	−0.38	−0.37
	(0.44)	(0.30)	(0.30)
Female	−0.02	0.06	0.06
	(0.20)	(0.13)	(0.13)

(Continues)

TABLE 2 (Continued)

Model	(1)	(2)	(3)
18–29 years old	−0.18	−0.03	−0.02
	(0.35)	(0.22)	(0.23)
30–39 years old	−0.36	−0.16	−0.16
	(0.30)	(0.19)	(0.19)
50–59 years old	−0.28	−0.12	−0.11
	(0.35)	(0.23)	(0.23)
60 years old and above	−0.09	0.08	0.08
	(0.28)	(0.18)	(0.19)
No school-leaving qualification	−0.11	0.01	0.01
	(0.30)	(0.22)	(0.23)
Secondary general school qualification	0.00	0.03	0.03
	(0.23)	(0.15)	(0.15)
University entrance qualification	0.49	0.38	0.41
	(0.34)	(0.23)	(0.23)
University degree	0.48	0.22	0.23
	(0.32)	(0.20)	(0.20)
Fixed effects of social desirability bias on …			
Promotion focus	0.19	0.19	0.19
	(0.12)	(0.12)	(0.12)
Prevention focus	−0.55**	−0.55**	−0.55**
	(0.17)	(0.17)	(0.17)
Concern about climate change	0.32	0.32	0.32
	(0.18)	(0.18)	(0.18)
Price consciousness	−0.23	−0.23	−0.23
	(0.17)	(0.17)	(0.17)
Covariances			
Promotion focus with prevention focus	0.12*	0.12*	0.12*
	(0.06)	(0.06)	(0.06)
Promotion focus with concern about climate change	0.02	0.02	0.02
	(0.03)	(0.03)	(0.03)
Promotion focus with price consciousness	0.10*	0.10*	0.10*
	(0.04)	(0.04)	(0.04)
Prevention focus with concern about climate change	0.06	0.06	0.06
	(0.03)	(0.03)	(0.03)
Prevention focus with price consciousness	0.04	0.04	0.04
	(0.04)	(0.04)	(0.04)
Concern about climate change with price consciousness	0.04	0.04	0.04
	(0.04)	(0.04)	(0.04)
Random effects on WTP Residual variances			
Between-subject random intercept	0.86***	0.89***	0.99***
	(0.10)	(0.13)	(0.15)
Random slope environmental performance surplus	0.12	0.30	0.46
	(0.24)	(0.26)	(0.24)

(Continues)

TABLE 2 (Continued)

Model	(1)	(2)	(3)
Random slope environmental performance deficit	1.09**	0.83*	1.17**
	(0.37)	(0.32)	(0.42)
Within-subject residual	0.40***	0.28**	0.17
	(0.05)	(0.09)	(0.10)
Covariances			
Intercept and slope environmental performance surplus	0.07	0.02	−0.10
	(0.12)	(0.13)	(0.13)
Intercept and slope environmental performance deficit	0.03	0.08	0.20
	(0.18)	(0.16)	(0.19)
Slopes environmental performance surplus and environmental performance deficit	0.33	0.14	−0.01
	(0.23)	(0.16)	(0.17)
Model fit			
Natural logarithm of likelihood (LL)	−19635.79	−19618.99	−19615.88
Akaike information criterion (AIC)	39619.58	39587.98	39583.76
Bayesian information criterion (BIC)	40528.81	40502.44	40503.45
Likelihood-ratio test versus model 2			
−2ΔLL	33.60***		
Scaled χ^2; df	29.25; 1		
Likelihood-ratio tests versus model 3			
−2ΔLL	39.82***	6.22*	
Scaled χ^2; df	34.66; 2	5.32; 1	
Hypothesis H1 (supported)			
Fixed main effects on WTP			
Environmental performance surplus		0.15	0.12
		(0.14)	(0.12)
Environmental performance deficit		0.43*	0.43*
		(0.21)	(0.21)
Likelihood-ratio test for equality of fixed main and interaction effects of surplus and deficit			
−2ΔLL		28.51*	
Scaled χ^2; df		29.19; 15	
Hypotheses H2a (not supported) and H2b (not supported)			
Interaction effects on WTP			
Environmental performance surplus × promotion focus		0.00	0.03
		(0.14)	(0.12)
Environmental performance deficit × prevention focus		−0.20	−0.19
		(0.17)	(0.17)
Hypotheses H3a (supported) and H3b (not supported)			
Shape parameters of WTP reaction function			
Exponent of environmental performance surplus			0.04
Exponent of environmental performance deficit			0.28
Likelihood-ratio test for $\eta+=1$			
−2ΔLL			21.31***
Scaled χ^2; df			18.41; 1
Likelihood-ratio test for $\eta-=1$			
−2ΔLL			20.32***
Scaled χ^2; df			17.54; 1

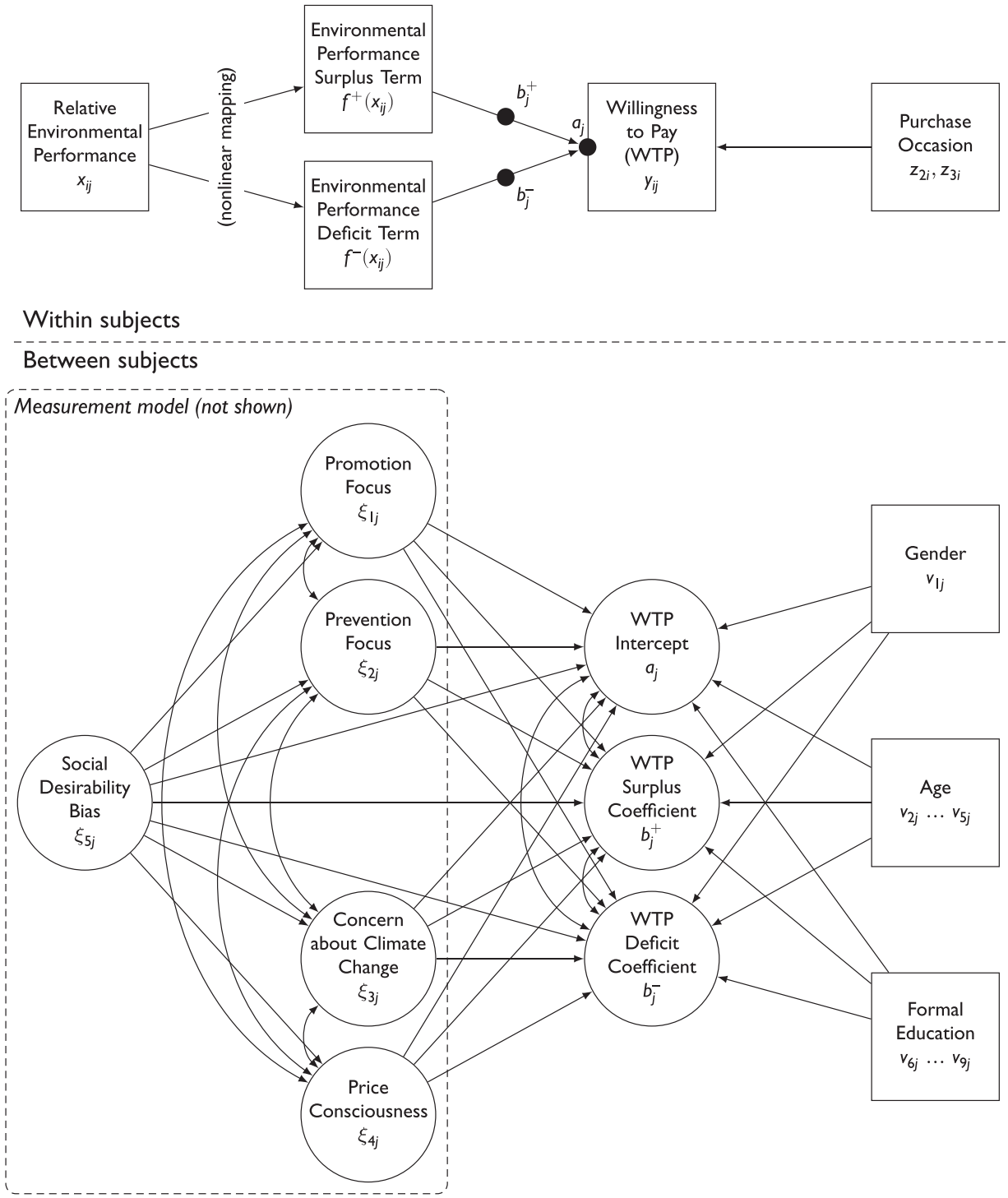

FIGURE 3 Path diagram of two-level repeated measurements structural equation model (random intercept and slopes shown as solid circles on within-subjects level)

Based on these results, hypothesis H3a, which implies exponent values between zero and one, can be confirmed, whereas H3b, corresponding to exponent values greater than one, is refuted.[8] Figure 5 shows the differential WTP reaction functions for a reference subject (i.e., with average scores on all scales) under models (2) and (3), clearly illustrating the S-shape hypothesized by prospect theory. Between models (2) and (3), the latter fits significantly better ($-2\Delta LL = 6.22$, scaled $\chi^2 = 5.32$, df = 1, $p = 0.021$). The curvature of the positive branch of the WTP function is found

[8] Individual robust likelihood-ratio tests for each of the exponents, shown in Table 2, also reject their respective equality to one.

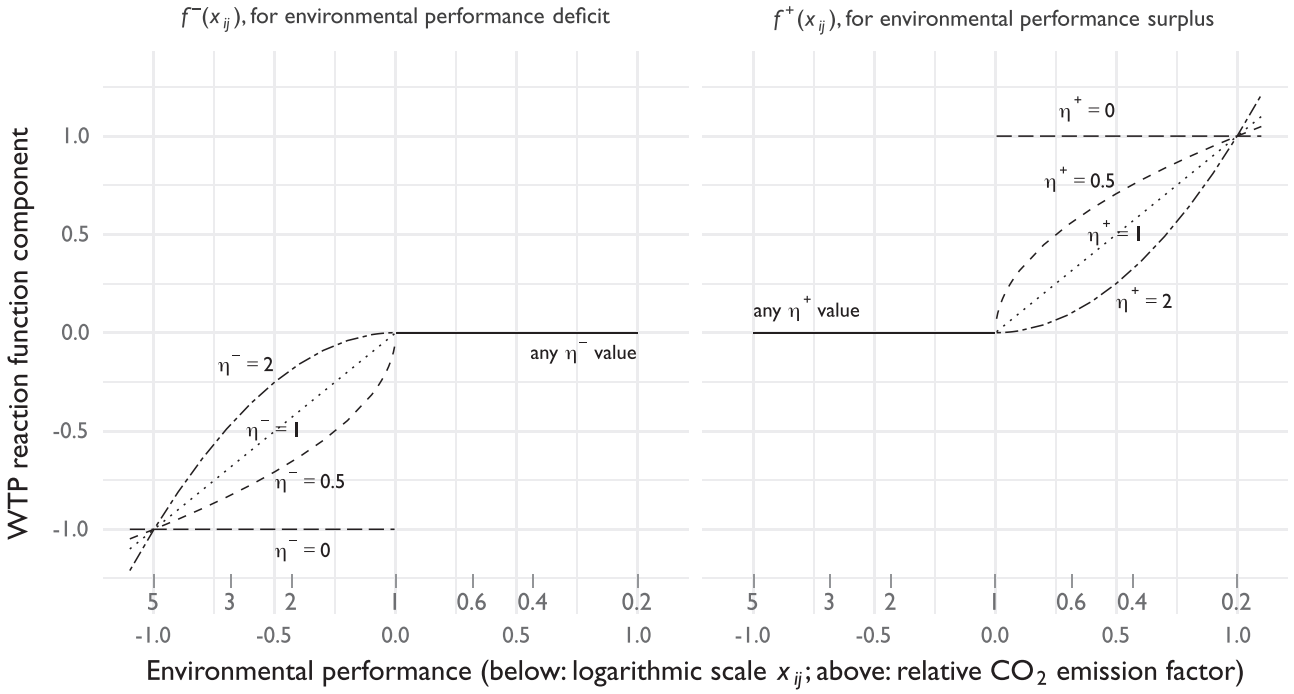

FIGURE 4 Positive and negative components of willingness-to-pay reaction function for different parameterizations (exponents η^+ and η^- of power function)

to be particularly strong (with an exponent close to zero), so that the premium consumers are willing to pay for products with above-standard environmental performance is largely independent of the strength of the performance surplus.

For an examination of H1, we turn to model (2), which yields parameter estimates very close to those of model (3) (with matching statistical significance) but permits a direct comparison of corresponding negative and positive slope parameters. In model (2), the null hypothesis of equality of corresponding pairs of fixed main and interaction effects of environmental performance surplus and deficit can be rejected ($-2\Delta LL = 28.51$, scaled $\chi^2 = 29.19$, df = 15, $p = 0.015$). WTP is significantly reduced by environmental performance deficits, whereas the price premium accepted for a performance surplus of the same size is consistently lower and not even statistically significant ($0.43^* > 0.15$) for a reference individual. As the significant interaction effects of environmental performance with CaCC ($0.20^* > 0.16^{**}$) show, both reactions are positively moderated by a consumer's CACC, with the relative bias diminishing, but not disappearing for high CaCC values. This finding is illustrated by the floodlight analysis (Spiller et al., 2013) shown in Figure 6, which displays the conditional point estimates and confidence intervals of the environmental performance surplus and deficit effects on WTP for varying CaCC scores, given average scores on the other scales.

As can be seen by the respective interaction effects of promotion and prevention focus with environmental performance surplus and deficit in Table 2, neither of the effects of regulatory focus hypothesized by H2a and H2b can be confirmed. The only significant effect in model 3 is a negative moderation of the WTP premium for environmental performance surpluses by prevention focus (-0.27^*).

Our analysis also controls for price consciousness, which has a significant main effect on WTP (-0.47^{***}) and a significant interaction with environmental performance deficit (-0.50^{**}), whereas its interaction with environmental performance surplus is insignificant (0.07). The interplay of these effects implies that price-conscious consumers' WTP is uniformly lower than that of the average consumer for products which meet or exceed the industry average, but less or not at all so for products falling short. Hence, the WTP reaction to negative environmental performance is essentially eliminated by price consciousness. With the exception of a gender main effect (women's WTP is higher), no other control variables show significant effects.[9] To rule out context or fatigue effects, we controlled for the impact of different measurement occasions, which proved insignificant ($-2\Delta LL = 3.076$, scaled $\chi^2 = 2.89$, df = 2, $p = 0.236$). A summary of all hypothesis tests can be found at the end of Table 2.

[9] Although the interaction of having a university degree with environmental performance surplus is also shown as significant, an omnibus test of the impact of education yields no significant result ($-2\Delta LL = 5.56$, scaled $\chi^2 = 5.43$, df = 4, $p = 0.246$).

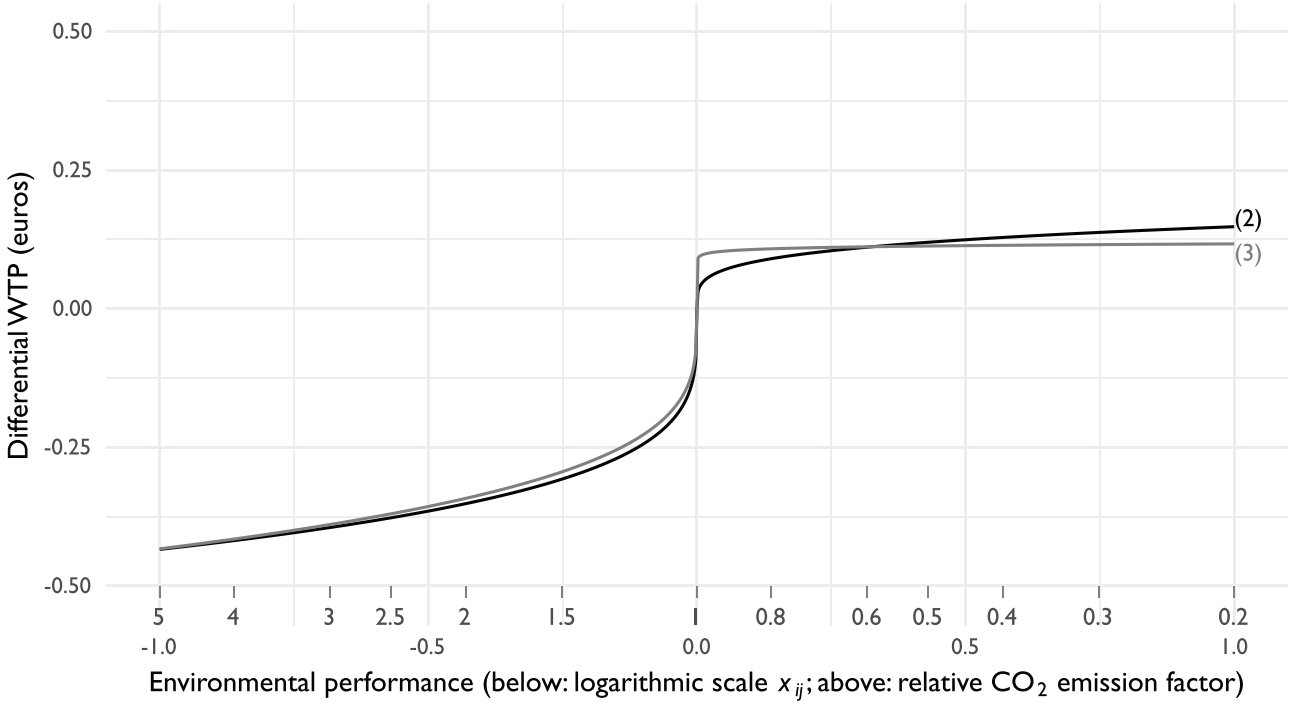

FIGURE 5 Differential willingness-to-pay reaction function for a reference subject under model (2)[10]

5 | DISCUSSION

This study is the first to apply prospect theory to the question of how consumers' WTP reacts to quantitative variations in PCF information. It confirms key assumptions of prospect theory in the context of industrial ecology.

First, environmental consumption behavior is subject to a negativity bias. Our results thus confirm H1a, which expected that negative deviations of a product's environmental performance from a given reference point have a stronger effect on WTP than quantitatively corresponding positive deviations. Additionally, we find that the negativity bias is reversed for highly price-conscious consumers, who react to environmental performance surpluses, whereas their WTP reaction to corresponding deficits is reduced or even neutralized. Compared to previous research on negativity biases in environmental consumption, the present study is also unique in its quantitative operationalization of the independent (environmental information) and the dependent variable (WTP). This approach allows quantifying the magnitude of the negativity bias for specific sizes of negative and positive deviations. Figure 5 for example highlights that a negative deviation by a factor of five creates a WTP decrease of roughly 0.43 € for a reference consumer, while a corresponding positive deviation (i.e., a decrease of CO_2 emissions by factor five) stimulates a WTP increase of only circa 0.12 €. Additionally, an earlier explanation for the negativity bias suggested by Moosmayer (2012) can be backed by our data. Moosmayer (2012) argues that some consumers boycott products which are labeled with negative environmental information. In fact, in 6.3 % of relevant cases, participants reported a WTP of zero for products with below-average environmental performance.

Second, we confirm regulatory focus as a moderating variable for the WTP reaction to a product's environmental performance deficit. However, we cannot support H2a (and H2b), which expected that the effect on WTP of positive (negative) deviations of a product's environmental performance from a given reference point on WTP is enhanced by a consumer's promotion (prevention) focus.

Third, our findings not only show that positive industrial ecology indicators can stimulate purchase behavior (Hartikainen et al., 2014; Vanclay et al., 2011), but also how different quantitative levels of PCF information influence WTP. One key finding is that WTP does not change uniformly with better environmental performance (Figure 6), but exhibits a diminishing sensitivity to environmental information for progressive deviations from a given reference point. Hence, H3a, which expected that deviations of a product's environmental performance from a given reference point have a continually declining concordant effect on WTP, can be confirmed, whereas H3b, which expected a continually increasing effect, is rejected. For positive deviations even a nearly constant WTP surplus can be observed. Companies are therefore incentivized to just slightly exceed the industry average. For companies offering products which already outperform the industry average, hardly any incentives to further improve

[10] The graph shown in figure 5 represents the estimated differential WTP reaction function for a male respondent in the age range of 40–49 years, with a middle school diploma, average promotion and prevention foci, average CaCC, average price consciousness, and average social desirability bias. The vertical axis' scale is relative to an intercept (2.61***) with significant random variation between subjects (0.99***) not attributable to the control variables

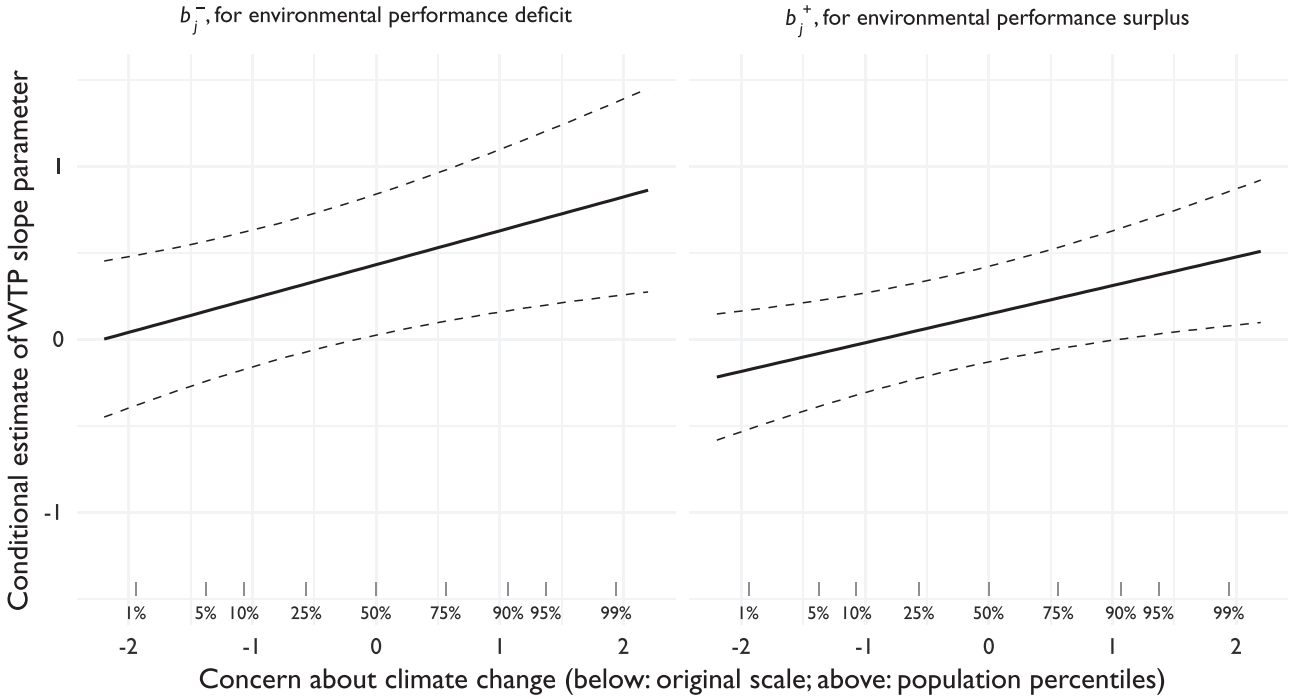

FIGURE 6 Floodlight analysis of willingness-to-pay surplus and deficit coefficients for varying values of concern about climate change (point estimates and 95% confidence intervals)

environmental product performance exist. Likewise, no substantial incentives for stepwise improvements exist for companies which offer products with environmental performances substantially below industry average. Furthermore, the present analysis reveals that the WTP of consumers with low CaCC is mostly unchanged by quantitative variations in PCF information. Our results hence offer an explanation for O'Rourke and Ringer's (2016) observation that many consumers are unaffected by sustainability-related information, and similar findings on the low influence of PCF information on purchase behavior (Hartikainen et al., 2014; Hornibrook, May & Fearne, 2015). Overall, our study highlights that, for many companies, consumers' WTP creates only very limited incentives to improve environmental product performance.

Interpreting our findings from a theoretical lens, the negativity bias is not only in accordance with prospect theory, but also with previous research (e.g., Moosmayer, 2012; van Dam & De Jonge, 2015), and with competing theoretical explanations, such as diagnosticity theory (Moosmayer, 2012), adaptation-level theory (Helson, 1964), social judgment theory (Sherif & Sherif, 1967), or correspondent inference theory (Jones & McGillis, 1976). However, building on and going beyond earlier work, we use prospect theory to examine and confirm its assumptions of reference dependence (shared with adaptation-level theory and social judgement theory) and diminishing sensitivity in the context of consumers' WTP response to quantitative variation in PCF information. The latter finding is not only in opposition to empirical studies supporting disappointment theory (Homburg et al., 2005; O'Rourke & Ringer, 2016) but also to further theories implying increasing sensitivity as a result of an extremity bias, such as adaptation-level theory and social judgement theory. O'Rourke and Ringer (2016), for instance, show that for products with above-average health-related sustainability ratings small improvements in the ratings trigger progressively increasing effects on purchase intentions. The discrepancy to our findings might be explicable by the fact that health benefits deal primarily with private gains, whereas CO_2 reductions measured in the present study reflect public gains. Moreover, instead of mere purchase intentions, we used WTP as independent variable.

6 | CONCLUSIONS AND LIMITATIONS

Given the crucial importance of sustainable consumption for sustainable development (Sala & Castellani, 2019) and our finding that consumers' WTP does not provide substantial incentives to improve environmental product performance for many companies, interventions from policymakers and companies are indispensable.

First, our study informs policymakers about the importance of providing consumers not only positive but also negative environmental product information. Taking advantage of the negativity bias, a mandatory negative labeling system could push environmentally harmful products out of the market. Apart from the European Union's energy labeling scheme of electrical appliances (Heinzle & Wüstenhagen, 2012; Ölander & Thøgersen,

2014), practical examples of negative labeling are still rare. An important caveat to their further use, however, results from our finding that the effectiveness of negative labeling might not extend to price-conscious consumers.

Second, in light of the reference dependence of consumers' WTP reactions, political measures aiming at raising consumers' reference points for a product's environmental performance might be worthwhile. Reference points could, for instance, be influenced by setting the labeling scale (Heinzle & Wüstenhagen, 2012; Ölander & Thøgersen, 2014).

Third, the S-shape of the WTP reaction function reveals that companies are not substantially rewarded by consumers' WTP for the first steps toward improving highly environmentally harmful products as well as for performing far better than the industry average. For products targeting price-conscious consumers, it may not even pay to catch up with the industry average. From a sustainability science perspective, this is alarming because earlier research on planetary boundaries (e.g., Rockström et al., 2009; Whiteman et al., 2012) or resource productivity (von Weizsäcker et al., 2009) has shown that sustainable development requires not only marginal but rather breakthrough advances. Consequently, political interventions such as mandatory minimum standards as well as subsidies for companies' radical improvements in terms of environmental product performance are needed.

Fourth, below-average performing companies are well advised to improve their products' environmental performance up to or even slightly above the industry average. Generally, the quantification of the negativity bias in this study helps marketers to better assess the magnitude of potential consequences of improvements in product's environmental performance. Thereby, the procedure used in this research to quantify the negativity bias may be transferred to contexts of particular interests by specific companies to guide their pro-environmental product and pricing strategies. Moreover, marketers can be guided by the fact that even price-conscious consumers may reward above-average environmental performance, whereas they do not penalize below-average performance.

This research comes along with some limitations and opportunities for further research. First, the dependent variable reflects the WTP stated in a survey-based experiment rather than revealed in real purchase decisions. Although we are aware of the potential problems associated with a direct elicitation of WTP (Auger & Devinney, 2007; Breidert et al., 2006), this approach better allows to avoid anchoring and framing effects and is appropriate for capturing the general functional form of WTP. Further research could replicate our findings using real choice experiments. Second, we tested only one possible mechanism of communicating environmental product performance to consumers, by presenting the relative amount of CO_2 emissions caused. Further research should investigate the effects of different kinds of communicating such information, for instance as absolute figures.

Apart from addressing these limitations, future research could test whether and how the results change when different types of products and sustainability information are used and, hence, further product attributes and sustainability benefits gain importance for consumers' WTP (e.g., O'Rourke & Ringer, 2016). Based on Brunk and de Boer (2020), future studies should also test how the provision of positive and negative information on different environmental aspects of the same product influences WTP and how this depends on the sequence of information provision. In this vein, the focus should be expanded to aspects of environmental information which contribute not only to public but also to private gains, such as health benefits. Similarly, subsequent research could follow up on the role of regulatory focus and the possible impact of further moderators such as environmental attitudes with a potential effect on the nonlinearity of the WTP reaction function (cf., Husted et al., 2014).

In conclusion, our results provide partial support for the claim that "worse is worse and better doesn't matter." We confirm that negative deviations from a reference point have a stronger effect than positive deviations. Although we do not find that "better doesn't matter," we do maintain that "how much better does not matter," because companies are not incentivized to substantially improve the environmental performance of their products based on consumers' WTP.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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REFERENCES

Akerlof, G. A. (1970). The market for "Lemons": Quality uncertainty and the market mechanism. *The Quarterly Journal of Economics*, *84*(3), 488–500.
Alvarez, S., Tobarra, M.-A., & Zafrilla, J.-E. (2018). Corporate and product carbon footprint under compound hybrid analysis: Application to a Spanish timber company. *Journal of Industrial Ecology*, *49*(12), 88.

Auger, P., & Devinney, T. M. (2007). Do what consumers say matter? The misalignment of preferences with unconstrained ethical intentions. *Journal of Business Ethics*, *76*(4), 361–383.
Basu, A. K., & Hicks, R. L. (2008). Label performance and the willingness to pay for Fair Trade coffee: A cross-national perspective. *International Journal of Consumer Studies*, *32*(5), 470–478.
Brécard, D., Hlaimi, B., Lucas, S., Perraudeau, Y., & Salladarré, F. (2009). Determinants of demand for green products: An application to eco-label demand for fish in Europe. *Ecological Economics*, *69*(1), 115–125.
Breidert, C., Hahsler, M., & Reutterer, T. (2006). A review of methods for measuring willingness-to-pay. *Innovative Marketing*, *2*(4), 8–32.
Brunk, K. H., & de Boer, C. (2020). How do consumers reconcile positive and negative CSR-related information to form an ethical brand perception? A mixed method inquiry. *Journal of Business Ethics*, *161*(2), 443–458. https://doi.org/10.1007/s10551-018-3973-4
Codini, A. P., Miniero G., & Bonera, M. (2018). Why not promote promotion for green consumption? *European Business Review*, *30*(5), 554–70.
Cooksey, R. W. (1996). The methodology of social judgement theory. *Thinking and Reasoning*, *2*(2-3), 141–74.
De Jonge, J., van der Lans, I. A., & van Trijp H. C. M. (2015). Different shades of grey: Compromise products to encourage animal friendly consumption. *Food Quality and Preference*, *45*, 87–99.
Draucker, L., Kaufman, S., ter Kuile, R., & Meinrenken, C. (2011). Moving forward on product carbon footprint standards. *Journal of Industrial Ecology*, *15*(2), 169–171.
Du Toit, S. H. C., & Du Toit, M. (2008). Multilevel structural equation modeling. In J. de Leeuw & E. Meijer (Eds.), *Handbook of multilevel analysis* (pp. 435–478). Springer.
Finus, M., & Rübbelke, D. T. (2013). Public good provision and ancillary benefits: The case of climate agreements. *Environmental and Resource Economics*, *56*(2), 211–226.
Grankvist, G., Dahlstrand, U., & Biel, A. (2004). The impact of environmental labelling on consumer preference: Negative vs. positive labels. *Journal of Consumer Policy*, *27*, 213–230.
Ha-Brookshire, J. E., & Norum, P. S. (2011). Willingness to pay for socially responsible products: Case of cotton apparel. *Journal of Consumer Marketing*, *28*(5), 344–353.
Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis* (7th ed.). Pearson.
Harms, R., & Linton, J. D. (2016). Willingness to pay for eco-certified refurbished products: The effects of environmental attitudes and knowledge. *Journal of Industrial Ecology*, *20*(4), 893–904.
Hartikainen, H., Roininen, T., Katajajuuri, J. M., & Pulkkinen, H. (2014). Finnish consumer perceptions of carbon footprints and carbon labelling of food products. *Journal of Cleaner Production*, *73*, 285–293.
Heck, R. H., & Thomas, S. L. (2015). *An introduction to multilevel modeling techniques: MLM and SEM approaches using Mplus*. Routledge.
Heinzle, S. L., & Wüstenhagen, R. (2012). Dynamic adjustment of eco-labeling schemes and consumer choice – The revision of the EU energy label as a missed opportunity? *Business Strategy and the Environment*, *21*(1), 60–70.
Helson, H. (1964). *Adaptation-level theory*. Harper.
Higgins, E. T. (1997). Beyond pleasure and pain. *American Psychologist*, *52*(12), 1280–1300.
Higgins, E. T., Roney, C. J. R., Crowe, E., & Hymes, C. (1994). Ideal versus ought predilections for approach and avoidance – Distinct self-regulatory systems. *Journal of Personality and Social Psychology*, *66*(2), 276–286.
Homburg, C., Koschate, N., & Hoyer, W. D. (2005). Do satisfied customers really pay more? A study of the relationship between customer satisfaction and WTP. *Journal of Marketing*, *69*, 84–96.
Hornibrook, S., May C., & Fearne, A. (2015). Sustainable development and the consumer: Exploring the role of carbon labelling in retail supply chains. *Business Strategy and the Environment*, *24*(4), 266–76.
Husted, B. W., Russo M. V., Meza C. E. B., & Tilleman, S. G. (2014). An exploratory study of environmental attitudes and the willingness to pay for environmental certification in Mexico. *Journal of Business Research*, *67*(5), 891–99.
Jones, E. E., & MeGillis, D. (1976). Correspondent inferences and the attribution cube: A comparative reappraisal. In J. Harvey, W. Ickes, & R. Kidd (Eds.), *New directions in attribution research* (pp. 390–420). Erlbaum.
Kahneman, D., Knetsch, J. L., & Thaler, R. H. (1991). Anomalies: The endowment effect, loss aversion, and status quo bias. *Journal of Economic Perspectives*, *5*(1), 193–206.
Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, *47*(2), 263–291.
Kemper, C. J., Beierlein, C., Bensch, D., Kovaleva, A., & Rammstedt, B. (2012). *Social desirability gamma (short scale SD-G)*. https://www.gesis.org/fileadmin/kurzskalen/working_papers/KSE_G_Workingpaper.pdf
Kline, R. B. (2015). *Principles and practice of structural equation modeling* (4th ed.). Guilford Press.
Lenzen, M. (2014). An outlook into a possible future of footprint research. *Journal of Industrial Ecology*, *18*(1), 4–6.
Loomes, G., & Sugden, R. (1986). Disappointment and dynamic consistency in choice under uncertainty. *The Review of Economic Studies*, *53*(2), 271–282.
Loureiro, M. L., & Lotade, J. (2005). Do fair trade and eco-labels in coffee wake up the consumer conscience? *Ecological Economics*, *53*(1), 129–138.
Metag, J., Füchslin, T., & Schäfer, M. S. (2017). Global warming's five Germanys: A typology of Germans' views on climate change and patterns of media use and information. *Public Understanding of Science*, *26*(4), 434–451.
Miller, K. M., Hofstetter, R., Krohmer, H., & Zhang, Z. J. (2011). How should consumers' willingness to pay be measured? An empirical comparison of state-of-the-art approaches. *Journal of Marketing Research*, *48*(1), 172–184.
Mittal, V., Ross, W. T., Jr, & Baldasare, P. M. (1998). The asymmetric impact of negative and positive attribute-level performance on overall satisfaction and repurchase intentions. *The Journal of Marketing*, *62*(1), 33–47.
Mohr, L. A., & Webb, D. J. (2005). The effects of corporate social responsibility and price on consumer responses. *Journal of Consumer Affairs*, *39*(1), 121–147. https://doi.org/10.1111/j.1745-6606.2005.00006.x
Molina-Murillo, S. A., & Smith, T. M. (2009). Exploring the use and impact of LCA-based information in corporate communications. *The International Journal of Life Cycle Assessment*, *14*(2), 184–194.
Moosmayer, D. C. (2012). Negativity bias in consumer price response to ethical information. *Business Ethics: A European Review*, *21*(2), 198–208.
Muthén, B. O., & Muthén, L. K. (2017). *Mplus: Statistical analysis with latent variables: User's guide* (8th ed.). Muthén and Muthén.
O'Rourke, D., & Ringer, A. (2016). The impact of sustainability information on consumer decision making. *Journal of Industrial Ecology*, *20*(4), 882–892.

Ölander, F., & Thøgersen, J. (2014). Informing versus nudging in environmental policy. *Journal of Consumer Policy*, *37*, 341–356.
Paulhus, D. L. (2002). Socially desirable responding: The evolution of a construct. In H. I. Braun, D. N. Jackson, & D. E. Wiley. (Eds.), *The role of constructs in psychological and educational measurement* (pp. 51–73). Erlbaum.
Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879–903.
Podsakoff, P. M., MacKenzie, S. B., & Podsakoff, N. P. (2012). Sources of method bias in social science research and recommendations on how to control it. *Annual Review of Psychology*, *63*(1), 539–569.
Preacher, K. J., Zhang, Z., & Zyphur, M. J. (2016). Multilevel structural equation models for assessing moderation within and across levels of analysis. *Psychological Methods*, *21*(2), 189–205.
Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F. S., III, Lambin, E. F., Lenton, T. M., Scheffer, M., Folke, C., Schellnhuber, H. J., Nykvist, B., de Wit, C. A., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P. K., Costanza, R., Svedin, U., … Foley, J. A. (2009). A safe operating space for humanity. *Nature*, *461*, 472–475.
Rozin, P., & Royzman, E. B. (2001). Negativity bias, negativity dominance, and contagion. *Personality and Social Psychology Review*, *5*(4), 296–320.
Sala, S., & Castellani, V. (2019). The consumer footprint: Monitoring sustainable development goal 12 with process-based life cycle assessment. *Journal of Cleaner Production*, *240*, 118050.
Satorra, A., & Bentler, P. M. (2001). A scaled difference chi-square test statistic for moment structure analysis. *Psychometrika*, *66*(4), 507–514.
Satorra, A., & Bentler, P. M. (2010). Ensuring positiveness of the scaled difference chi-square test statistic. *Psychometrika*, *75*(2), 243–248.
Sen, S., & Bhattacharya, C. B. (2001). Does doing good always lead to doing better? Consumer reactions to corporate social responsibility. *Journal of Marketing Research*, *38*(2), 225–43.
Sherif, M., & Sherif, C. W. (1967). Attitudes as the individual's own categories: The social judgment approach to attitude change. In C. W. Sherif & M. Sherif (Eds.), *Attitude, ego involvement, and change* (pp. 105–139). Wiley.
Skowronski, J. J., & Carlston, D. E. (1989). Negativity and extremity biases in impression formation: A review of explanations. *Psychological Bulletin*, *105*(1), 131–142.
Snijders, T. A. B., & Bosker, R. J. (2012). *Multilevel analysis: An introduction to basic and advanced multilevel modeling* (2nd ed.). Sage.
Spiller, S. A., Fitzsimons, G. J., Lynch, J. G., Jr, & McClelland, G. H. (2013). Spotlights, floodlights, and the magic number zero: Simple effects tests in moderated regression. *Journal of Marketing Research*, *50*, 277–288.
Statistisches Bundesamt. (2017). *Statistisches Jahrbuch 2017*. Statistisches Bundesamt.
Steffen, W., Richardson, K., Rockström, J., Cornell, S. E., Fetzer, I., Bennett, E. M., Biggs, R., Carpenter, S. R., de Vries, W., de Wit, C. A., Folke, C., Gerten, D., Heinke, J., Mace, G. M., Persson, L. M., Ramanathan, V., Reyers, B., & Sörlin, S. (2015). Planetary boundaries: Guiding human development on a changing planet. *Science*, *347*(6223), 1259855.
Thøgersen, J., Haugaard, P., & Olesen, A. (2010). Consumer responses to ecolabels. *European Journal of Marketing*, *44*(11/12), 1787–1810.
Tversky, A., & Kahneman, D. (1991). Loss aversion in riskless choice: A reference-dependent model. *The Quarterly Journal of Economics*, *106*(4), 1039–1061.
Vanclay, J. K., Shortiss, J., Aulsebrook, S., Gillespie, A. M., Howell, B. C., Johanni, R., Maher, M. J., Mitchell, K. M., Stewart, M. D., & Yates, J. (2011). Customer response to carbon labelling of groceries. *Journal of Consumer Policy*, *34*(1), 153–160.
van Dam, Y. K., & De Jonge, J. (2015). The positive side of negative labelling. *Journal of Consumer Policy*, *38*(1), 19–38.
van Dam, Y. K., & van Trijp J. C. M. (2016). Interventions to encourage sustainable consumption. *APSRACT: Applied Studies in Agribusiness and Commerce*, *10*, 51–58.
van Loo, E. J., Caputo, V., Nayga, R. M., Jr, Seo, H. S., Zhang, B., & Verbeke, W. (2015). Sustainability labels on coffee: Consumer preferences, willingness-to-pay and visual attention to attributes. *Ecological Economics*, *118*, 215—225.
Verain, M. C., Bartels, J., Dagevos, H., Sijtsema, S. J., Onwezen, M. C., & Antonides, G. (2012). Segments of sustainable food consumers: A literature review. *International Journal of Consumer Studies*, *36*(2), 123—132.
Vergragt, P., Akenji, L., & Dewick, P. (2014). Sustainable production, consumption, and livelihoods: Global and regional research perspectives. *Journal of Cleaner Production*, *63*, 1—12.
von Weizsäcker, E., Hargroves, K., Smith, M., Desha, C., & Stasinopoulos, P. (2009). *Factor five: Transforming the global economy through 80% increase in resource productivity*. Earthscan.
Wakefield, K. L., & Inman, J. J. (2003). Situational price sensitivity: The role of consumption occasion, social context and income. *Journal of Retailing*, *79*(4), 199—212.
Whiteman, G., Walker, B., & Perego, P. (2012). Planetary boundaries: Ecological foundations for corporate sustainability. *Journal of Management Studies*, *50*(2), 307–336.
Zander, K., & Hamm, U. (2010). Consumer preferences for additional ethical attributes of organic food. *Food Quality and Preference*, *21*(5), 495–503.
Zou, L. W., & Chan, R. Y. K. (2019). Why and when do consumers perform green behaviors? An examination of regulatory focus and ethical ideology. *Journal of Business Research*, *94*, 113–127.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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