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The importance of product lifetime labelling for purchase decisions: Strategic implications for corporate sustainability based on a conjoint analysis in Germany

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#### **RESEARCH ARTICLE**



# The importance of product lifetime labelling for purchase decisions: Strategic implications for corporate sustainability based on a conjoint analysis in Germany

Kathleen Jacobs<sup>1,2</sup> 💿 📔 Jacob Hörisch<sup>3</sup> 💿

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<sup>1</sup>Institute for Food and Resource Economics, University of Bonn, Bonn, Germany

<sup>2</sup>Bonn Alliance for Sustainability Research. Bonn, Germany

<sup>3</sup>Centre for Sustainability Management, Leuphana University Lüneburg, Lüneburg, Germany

#### Correspondence

Jacob Hörisch. Centre for Sustainability Management, Leuphana University Lüneburg, Universitätsallee 1, 21335 Lüneburg, Germany. Email: hoerisch@leuphana.de

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#### Abstract

This article studies the influence of product lifetime labelling on purchase decisions. Based on consumer theory of Lancaster, experimental survey data are collected from a population representative sample of 499 German consumers, using choice-based conjoint analysis. Hierarchical Bayes utility modelling suggests a substantial positive effect of product lifetime labelling on purchase decisions. However, the effect is not linear but decreasing with higher levels of product lifetime. The relative importance of the product lifetime label is found to be higher than that of the product's energy consumption or brand. Additionally, we show that the introduction of product lifetime labelling renders the positive influence of existing brands on purchase decisions less impactful. Therefore, strategic implications for companies differ substantially, depending on companies' current brand-building. Besides implications for business strategy, the study informs marketers and policymakers about the potential of product lifetime labelling to stimulate the supply of, and demand for, more durable products.

#### KEYWORDS

choice-based conjoint analysis, labelling, product lifetime, purchase decision, sustainable consumption

#### INTRODUCTION 1

Many aspects of environmental consumption and their strategic implications for businesses have so far experienced ample attention. Research has, for example, highlighted that different types of environmental product information, such as environmental labelling, can influence consumers' perception of product quality (e.g., Ertz et al., 2017; Gleim & Lawson, 2014) as well as their willingness to pay (WTP) (e.g., Heinzle & Wüstenhagen, 2012; Petersen et al., 2021). However, consumers' attitudes and purchase intentions towards environmentally friendly products do not automatically lead to actual environmentally friendly purchase behaviour, as shown in numerous studies on

the 'attitude behaviour' and 'intention behaviour' gap (e.g., Caruana et al., 2016; Jacobs et al., 2018). In addition to these aspects, the emerging discourse on sufficiency stresses the central importance of reducing current levels of consumption in developed economies in order to mitigate the adverse socioecological effects thereof (e.g., Freudenreich & Schaltegger, 2020; Iyer & Muncy, 2009; Sheth et al., 2011).

To reduce consumption without decreasing the well-being of consumers, extending product lifetimes is a crucial leverage point, which has still received relatively little attention in research (e.g., Bakker et al., 2014; Cooper, 2005; Van Nes & Cramer, 2005). Product lifetime refers to the period from acquisition to disposal of a

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product and is determined both by the consumer's willingness to keep the product in use and by the product's functional durability (Cox et al., 2013). While product longevity has so far played a subordinate role in environmental consumption research, it is now coming more to the fore due to the emerging discourse on a circular economy-a key approach towards a more sustainable economic paradigm (Murray et al., 2017). Circular business models focus, inter alia, on slowing down product life cycles through durable product design or a higher degree of repairability (e.g., Bocken et al., 2016; Bracquene et al., 2021; Testa et al., 2020). In order to make product lifetime more transparent for consumers and to strengthen the demand for longlasting products, the possibility of a product lifetime label has recently been discussed at a political level (e.g., European Commission, 2020; Montalvo et al., 2016).

Still, little is known on what influence the introduction of product lifetime labelling would exert on purchase decisions and what incentives for producing long-lasting products such labelling would create for companies. The recent systematic literature review by Bangsa and Schlegelmilch (2020) on the influence of products' sustainability attributes on purchase decisions highlights the scarcity of research in this field. Hence, earlier studies have identified a need for research on the influence of product lifetime labelling on purchase decisions and respective strategic implications for companies (e.g., Cox et al., 2013; Wilhelm, 2012). To address this research need, the present article investigates (i) what influence product lifetime labelling exerts on purchase decisions and (ii) how such labelling affects the importance ascribed to further purchase-relevant criteria and creates implications for corporate sustainability strategies.

Using a choice-based conjoint (CBC) analysis, we address these research questions in the context of electrical appliances as such appliances are purchased by nearly all households in developed and emerging economies and as their production has a major impact on the environment (Hsu et al., 2019; Kiddee et al., 2013). Surprisingly, the systematic literature review by Bangsa and Schlegelmilch (2020) reveals that despite the high relevance of electrical appliances for environmental sustainability, this product type accounts for only a small share (7.5%) of all studies on sustainable consumer choices, while most studies are conducted on food or apparel products. As a consequence, the product lifetime label tested in this study is defined as a mandatory label indicating the expected number of years an electrical appliance will function without restriction. It is framed as being issued by an independent, third-party institute using a standardised test procedure.

Our results show that higher levels of product lifetime positively influence purchase decisions. However, this positive effect of product lifetime labelling is not linear but decreasing with higher levels of product lifetime. We show that the influence such information has is comparably relevant to the price of products and that consumers consider such information even more relevant than information on energy consumption or brands. Last, our results reveal that providing information on product lifetime renders the influence of further purchaserelevant product attributes on purchase decisions, such as the brand, less important.

The remainder of this article is structured as follows. The next section briefly introduces the theoretical framework of this study, based on which hypotheses are developed in section 3. Section 4 provides details on the sample as well as the methods used to address the hypotheses. The results of the empirical analysis are presented in Section 5. The last section discusses the results and draws conclusions for business practitioners, policymakers and researchers and summarises the limitations of this study.

#### LITERATURE REVIEW AND 2 THEORETICAL FRAMEWORK

While much research has been done on sustainability-related product attributes such as organic production and energy consumption (e.g., Sammer & Wüstenhagen, 2006; Testa et al., 2019; Torres-Ruiz et al., 2018), the attribute of product lifetime has experienced less attention. Still, in the research field of business strategy and the environment, there is increasing agreement on the fundamental importance of extending product lifetimes, particularly for products with strong adverse environmental effects in production (e.g., Denac et al., 2018; Sarigöllü et al., 2021; Van Nes & Cramer, 2005). However, empirical evidence suggests that the lifetime of products has not increased but decreased in the last decades. For example, research in the context of electrical appliances shows that the average product lifetime of some appliance categories fell substantially between 2004 and 2013, mainly due to technical failure (Hennies æ Stamminger, 2016; Prakash et al., 2016).

Based on this observation and the huge unused environmental potential associated with longer product lifetimes, extending product lifetimes has also increasingly become an important political goal. One of the key measures in this respect is the introduction of mandatory product lifetime labelling, as increasingly discussed, for example, by the European Commission (2020; see also Montalvo et al., 2016). Indeed, research has repeatedly shown that consumers have an unmet need for better information on the lifetime of products (e.g., Cooper, 2004; Cooper & Christer, 2016; Cox et al., 2013). The labelling of product lifetime is particularly relevant as product lifetime is a so-called experience attribute that can only be evaluated by consumers after purchase (Darby & Karni, 1973; Nelson, 1970). If no reliable information on a product's expected lifetime is provided, information asymmetries between consumers and the company arise. These information asymmetries may lead to an adverse selection mechanism that pushes high-quality products out of the market (Akerlof, 1970). Such asymmetries can be reduced by providing consumers with more solid information, for instance, through labelling (e.g., Heinzle & Wüstenhagen, 2012; Hornibrook et al., 2015; Sammer & Wüstenhagen, 2006). Consequently, a label indicating the expected lifetime of a product could considerably reduce consumers' information gap on durability as well as their perceived risk of buying a supposedly long-lasting product that turns out to be short-lived. As labelling enables product differentiation (Schumacher, 2010), a product lifetime label can help consumers to distinguish between products

with different lifetimes, thereby activating previously hidden preferences for longer product lifetimes. Still, empirical research on how consumers react to product lifetime information is rare, with only one known exception of an academic study, that is, the student-sample study conducted by Wilhelm (2012; see also the recent systematic literature review by Bangsa & Schlegelmilch, 2020).

Consumer theory of Lancaster (1966) provides a useful basis for addressing this research need as it allows simultaneously analysing the effects of multiple different attributes of products. Lancaster-(1966) summarises his theory in three assumptions. First, he assumes that it is not the good as such which provides the consumer with utility, but the attributes of the respective good. Such attributes may include, among others, a product's price, brand or energy consumption. Second, Lancaster (1966) argues that, in general, goods possess not only one but multiple attributes, and many attributes are shared by more than one good. Third, he assumes that a combination of goods may possess attributes and may provide utility different from the attributes the respective goods provide separately. Particularly building on the first two assumptions, Lancaster (1966) postulates that consumer preferences are not directed to a product itself, but to its attributes. The theory is therefore well suited to examining decision-making processes in multi-attribute choice contexts (Nocella et al., 2012). Various consumer studies, including those on sustainable purchase behaviour, have already applied the Lancastrian framework (e.g., Krause & Battenfeld, 2019; Lebeau et al., 2012; Scott, 2002). It thus provides a sound basis for measuring consumer preferences for product lifetime as a specific case of a product attribute and comparing the relative influence of product lifetime information with that of other attributes.

Table 1 summarises the extant literature on product lifetime in the context of environmental consumption and highlights that research on other aspects of environmental consumption (left column) by far outweighs the research on how consumers react to product lifetime information (right column), despite the importance of product lifetime information for circular economy and sufficiency strategies (middle column).

### 3 | DEVELOPMENT OF HYPOTHESES

Despite the high relevance of product lifetime labelling for reducing information asymmetries and the environmental burdens of overconsumption, research on consumers' reactions to product lifetime information provided via labelling is rare. As a consequence, also the implications for business strategy, which would come along with a possible introduction of such labelling, as discussed by the European Commission (2020), remain unknown. Based on an experimental survey answered by US American students, Wilhelm (2012) finds that mandatory consumer information about the number of years a mobile phone is designed to function properly significantly affects consumer preferences. We argue that due to the long-run benefits (i.e., saving money and time) longer product lifetimes offer to consumers (Grigsby, 2004; Van Nes & Cramer, 2005), this initial insight by **TABLE 1** Summary of extant literature on product lifetime in the context of environmental consumption

Exemplary aspects frequently dealt with in environmental consumption literature	Need for research on product lifetime, especially consumers' reaction to product lifetime information (selection)	Research on consumers' reaction to product lifetime information
<ul> <li>Energy labels (e.g., Heinzle &amp; Wüstenhagen, 2012; Sammer &amp; Wüstenhagen, 2006)</li> <li>Organic labels (e.g., Testa et al., 2019; Torres-Ruiz et al., 2018)</li> <li>Packaging (e.g., Bartl, 2014; Marken &amp; Hörisch, 2020)</li> <li>Water usage and treatment (e.g., Moosmayer, 2012)</li> <li>Ways of communicating environmental information (e.g., Ertz et al., 2017)</li> </ul>	<ul> <li>Cooper, 2004</li> <li>Cooper &amp; Christer, 2016</li> <li>Cox et al., 2013</li> <li>Denac et al., 2018</li> <li>Echegaray, 2016</li> <li>Jensen et al., 2021</li> <li>Sarigöllü et al., 2021</li> <li>Van Nes &amp; Cramer, 2005</li> <li>Wilhelm, 2012</li> </ul>	• Wilhelm, 2012

Wilhelm (2012) can most likely be generalised. Therefore, building on Lancaster's (1966) assumption that products possess multiple attributes which are relevant for shaping consumer preferences, we hypothesise that product lifetime is one such attribute. Accordingly, we formulate our first hypothesis as follows:

**Hypothesis 1.** Higher levels of product lifetime positively influence purchase decisions.

As noted above, consumer theory of Lancaster (1966) assumes that products are characterised by multiple attributes. Hence, consumers may sometimes be forced to make trade-offs between different product attributes. The research by Sammer Wüstenhagen (2006), for example, suggests for the context of energy labelling, that consumers perceive trade-offs between the attributes of energy efficiency and price, which are both found to be highly purchase relevant. Sammer and Wüstenhagen (2006) as well as Sonnenberg, Erasmus, and Schreuder (2014) reveal that the utility consumers derive from the energy efficiency of washing machines increases linearly with an improvement in the energy efficiency class. Thus, independent from the actual level of energy efficiency, the importance of the attribute energy efficiency remains constant, even for very high levels of energy efficiency. However, in contrast to a high-energy efficiency, a very long product lifetime may also have disadvantages for consumers. Previous research suggests that consumers

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may be afraid of missing progress on certain product features such as design, performance or energy efficiency if they commit to longer product lifetimes (e.g., Cooper, 2004; Cox et al., 2013). In the area of mobile phones, Wilhelm's (2012) study indicates a decreasing positive effect of product lifetime information on consumer preferences. Although consumer electronics are more exposed to fashion and innovation cycles (Cox et al., 2013), the aforementioned consumer concerns may also apply to further product categories, less affected by short innovation cycles. Based on this rationale, we set our second hypothesis as follows, expecting a non-linear effect of product lifetime on purchase decisions:

Hypothesis 2. The positive influence a longer product lifetime exerts on purchase decisions decreases with very high levels of product lifetime.

In its second key assumption, consumer theory of Lancaster (1966, p. 134) postulates that 'a good will possess more than one characteristic'. Regarding the attribute (aka characteristic) of product lifetime, consumers can hardly estimate a product's durability at the time of purchase. Research by Testa et al. (2020) suggests that only consumers with high levels of personal predisposition to seeking information will undertake sufficient effort to actively search such information. In addition. Hiller and Woodall (2019) show that even explicitly ethical consumers frequently follow a pragmatist perspective and as a result do not always have the ambition to seek for and purchase the 'best' product. Consequently, in the absence of product lifetime labelling, most consumers will either focus on other product attributes or orient themselves towards the rather intuitive or emotional quality signals (cf. Zollo, 2021) conveyed, for example, by brands, although these are often insufficient (e.g., Cox et al., 2013; Erdem & Swait, 1998). Brand is also named as one of the most purchase-relevant attributes of electrical home appliances (e.g., Artinger et al., 2018; Sammer & Wüstenhagen, 2006). Previous studies on sustainability labelling, however, indicate that labels can partially take over the trust-building role of brands (e.g., Heinzle & Wüstenhagen, 2012; Jaffry et al., 2004). For example, Schumacher-(2010) indicates that eco-labelling can replace less binding marketing strategies, set up to differentiate environmentally friendly products, such as voluntary communication campaigns on a product's sustainability performance. The third hypothesis transfers this logic as follows:

Hypothesis 3. The introduction of a product lifetime label renders the positive purchase influence of existing brands less impactful.

As 'a good will possess more than one characteristic' (Lancaster, 1966, p. 134), consumers may perceive trade-offs between different attributes of the respective good, increasing the complexity of purchase decisions (cf. Hiller & Woodall, 2019). Earlier studies demonstrate, for example, that while most consumers prefer environmentally friendly products, they frequently face a trade-off between

higher environmental performance and potentially lower prices (e.g., Brécard et al., 2009; Vanclay et al., 2011). Consequently, previous research has also assessed the relative importance of different product attributes, including attributes related to the environment. When asking Swiss consumers for the most important attribute when buying a washing machine, Sammer and Wüstenhagen (2006) found price to be the most important criterion. Many consumers also named the equipment of the machine as well as its level of energy consumption as purchase-relevant criteria, while, for instance, brand was assessed as less relevant. Based on a conjoint analysis, Codini et al.-(2012) revealed that Italian consumers ascribe their highest relative importance to a washing machine's price, followed by energy consumption, spin dryer speed and brand. Heinzle and Wüstenhagen-(2012) conducted a conjoint analysis among German consumers in the context of television purchases. They also identified price to be the most relevant product attribute, followed by the television's energy label, equipment version and brand. Likewise, in their recent systematic literature review on the influence of products' sustainability attributes on purchase decisions, Bangsa and Schlegelmilch (2020) show that in most studies, price is more relevant than environmental product attributes (see, e.g., Ghvanidze et al., 2017; Heinzle & Wüstenhagen, 2012; Sonnenberg, Erasmus, & Schreuder, 2014).

In contrast to the findings of Sammer and Wüstenhagen (2006), Codini et al. (2012) as well as Heinzle and Wüstenhagen (2012), the conjoint study by Sonnenberg, Erasmus, and Schreuder (2014) shows that consumers attach greater importance to the brand of a washing machine than to its energy rating, when facing trade-offs. Likewise, Bangsa and Schlegelmilch (2020) find that some studies related to clothing ascribe brand (Sonnenberg, Jacobs, & Momberg, 2014), or functionality (Momberg et al., 2012), a higher relative importance than environmental attributes. However, following the context-specific studies of Sammer and Wüstenhagen (2006), Codini et al. (2012) as well as Heinzle and Wüstenhagen (2012), it can be assumed that the energy consumption of an electrical appliance is more important to consumers than these other attributes.

Synthesising this previous research, we hypothesise that price is generally the most purchase-relevant product attribute of electrical appliances, followed by energy consumption, equipment version and brand. Due to the scarcity of research on product lifetime labelling, it is difficult to include this attribute in such ranking of relative importances. While Wilhelm (2012) reveals that product lifetime information influences purchase decisions, it can be expected that alike other environmental attributes (e.g., energy consumption), it is of lower relative importance than the price. Additionally, compared to energy consumption, the public and political debate on product lifetime is relatively new. Sirieix et al. (2013) find that consumers attach comparatively lower importance to sustainability-related aspects they are not (yet) familiar with. Thus, consumers might be unfamiliar with product lifetime labels, which suggests that product lifetime is of lower relative importance than energy consumption. Finally, the above summarised research by Sammer and Wüstenhagen (2006), Codini et al. (2012) as well as Heinzle and Wüstenhagen (2012) suggests that the influences the equipment version and especially the brand exert on purchase

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decisions are lower than the influence of environmental attributes. Hence, in Hypothesis 4, we expect the relative importance of different product attribute to be as follows:

**Hypothesis 4.** The price has the highest relative influence on purchase decisions, followed by energy consumption, product lifetime, equipment version and brand.

#### 4 | METHODS

#### 4.1 | Data collection and sample characteristics

Data were gathered through an experimental online survey administered to German consumers, who were recruited via an online panel. A representative sample of the German population was drawn to enable population-based conclusions. This also took into account the demand for samples that better reflect the general population, as outlined in Wilhelm's (2012) study, which itself is based on a student sample. Quota sampling was used with quota targets for gender, age and highest educational achievement, derived from micro-census data of the German adult population (Destatis, 2018); 571 questionnaires were completed during a 7-day survey period in May 2019. After the deletion of speeders, that is, respondents who finished the survey in an unrealistically short period of time (<50% than the median response time),<sup>1</sup> a total of 499 usable questionnaires remained for subsequent analyses.

In order to verify population representativeness of the final sample, chi-squared tests were performed to confirm the marginal distributions of the final sample for homogeneity with those of the German adult population. An overview of the input and output factors of all chi-squared tests is given in Table 2. No statistically significant differences are found between the sample's and the population's composition in terms of gender, age and highest educational achievement.

#### 4.2 | Choice-based conjoint analysis

A computer-assisted CBC questionnaire was designed involving a series of choice tasks on purchasing electrical home appliances. This context was selected because such appliances are highly relevant for environmental sustainability and are purchased by nearly all house-holds (Hsu et al., 2019; Kiddee et al., 2013), but have still received only scant attention in previous literature (for a systematic overview, see Bangsa & Schlegelmilch, 2020). Specifically, washing machines were chosen as the object of purchase. This choice was based on the following reasons. First, washing machines are typical utilitarian products, primarily purchased for their functional properties, as opposed to properties such as design (Cox et al., 2013; Mugge &

TABLE 2 Socio-demographic composition of the sample compared to the German adult population

		Sample			Chi-squared test		
	German population <sup>a,b</sup>	Observed		Expected			
Contra dama secondata alterna da statta	%	n	n 400	n 100	2	JC	
Socio-demographic characteristic	100.0	100.0	499	499	χ-	ar	p value
Gender							
Female	50.7	50.7	253	253	0.000	1	.996
Male	49.3	49.3	246	246			
Age							
15–29 years old	19.5	19.4	97	97	4.072	4	.396
30-39 years old	14.8	12.0	60	74			
40-49 years old	15.5	15.2	76	78			
50–59 years old	18.8	18.8	94	94			
60 years and older	31.4	34.5	172	157			
Highest educational achievement							
No school-leaving qualification	7.8	6.6	33	39	1.056	4	.901
Secondary modern school qualification	33.8	33.9	169	168			
Secondary school certificate	26.5	27.3	136	132			
University entrance qualification	14.4	14.8	74	72			
University degree	17.6	17.4	87	88			

Abbreviation: df, degrees of freedom.

<sup>a</sup>Figures based on micro-census data projected to year 2017 (Destatis, 2018).

<sup>b</sup>Adult population of Germany aged 15 years and above.

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Schoormans, 2012). They are thus a suitable basis to start investigating the possible effects of product lifetime labelling. Second, the production of large electrical home appliances is very resource intensive. Long-lasting washing machines therefore have a substantial positive effect on the environment, even if future improvements in energy and water efficiency will be achieved (Oeko-Institut, 2018). Third, lifetime tests for washing machines already exist in practice (Miele, 2019; Stiftung Warentest, 2021), which would allow introducing a thirdparty certified product lifetime labelling, as discussed by the European Commission (2020).

To be able to test the possible effects of introducing a product lifetime label on the influence of existing product attributes, and thus to test Hypothesis 3, two consecutive CBC exercises were designed, which allows the comparison of consumer preferences before and after the introduction of the label. Both CBC exercises involved a series of seven and respectively nine choice tasks on purchasing a washing machine. In each choice task, respondents chose one out of three washing machines that differed with regard to a number of attributes, including the product lifetime label in the second CBC exercise. Consumers could also indicate not to buy any of the presented alternatives (none option), which made the choice tasks appear more realistic (Parker & Schrift, 2011).

The washing machine profiles were equipped with the attributes most important to consumers (Rao, 2014). To test Hypotheses 1 and 2 and respectively Hypothesis 3, it was necessary to consider the product lifetime label and respectively the brand. Following recommendations towards a small number of attributes (e.g., Green & Srinivasan, 1990; Rao, 2014), three more characteristics were chosen: energy consumption, equipment version and price. This allows testing Hypothesis 4, dealing with the relative influence of these attributes. The choice of attributes largely corresponds to previous conjoint studies on washing machines (e.g., Codini et al., 2012; Sammer & Wüstenhagen, 2006; Sonnenberg, Erasmus, & Schreuder, 2014).

Not more than five levels per attribute were specified to ensure precision in utility estimation (e.g., Green & Srinivasan, 1990; Orme, 2002). The levels were defined so as to broadly cover the product spectrum available on the German market based on an analysis of online retailers prior to data collection. Similar to Codini et al. (2012) as well as Sammer and Wüstenhagen (2006), the selected brands represent high reputation brands (Miele), medium reputation brands (Siemens) and low reputation brands (Beko) in the washing machine segment. Besides, a 'new brand' was added to comparatively measure the product lifetime label's impact on existing brands. The minimum level of energy consumption was chosen to be slightly lower than the actual industry minimum to account for possible future advances in energy efficiency. Two levels of equipment version seemed sufficient as consumers can principally choose between standard wash programmes and functionalities as well as extra features. The price levels cover the prices at which washing machines are predominantly sold in Germany (€200 to €800) and two even higher prices. The latter served to realistically reflect washing machines with particularly attractive attribute-level combinations including, for instance, a long product lifetime. The product lifetime label, defined as a mandatory

label<sup>2</sup> indicating the expected number of years a washing machine will function without restriction, spans five levels. The lowest level (5 years) represents the minimum actual life of washing machines often reported in Germany (Hennies & Stamminger, 2016; Prakash et al., 2016). The highest level (25 years) was set above the maximum lifetime of 20 years currently tested on the German market (Miele, 2019), as washing machines have lasted even longer in the past (Hennies & Stamminger, 2016; Prakash et al., 2016). An overview of the final set of attributes and their levels is given in Table 3.

For each CBC exercise, the introduction text and one exemplary choice task are shown in Appendix S1. The choice tasks were generated according to a controlled random experimental design using the balanced overlap method (Chrzan & Orme, 2000). For each CBC exercise, it was thus ensured that each respondent's questionnaire version was marked by balanced overlap (modest degree of repetitions of attribute levels within choice tasks), level balance (approximately the same number of occurrences of each level belonging to one attribute) and near orthogonality (near proportionality of each joint occurrence of any two levels of different attributes to the product of their marginal frequencies). These properties serve the statistical efficiency of the experimental design in measuring main and interaction effects of utilities (e.g., Rao, 2014; Sawtooth Software, 2017). We also randomised the order in which attributes appeared in the choice tasks once per respondent to control for order effects across respondents (Sawtooth Software, 2019). Furthermore, seemingly unrealistic combinations of attribute levels, for example, the premium brand Miele with a low price or with a low product lifetime, were deliberately kept in the experimental design. According to pertinent literature, prohibitions of attribute-level combinations should generally be avoided as they can lead to inefficient experimental designs. Instead, respondents should be encouraged to respond as if all products were actually available (Orme, 2002), which was the strategy chosen for this study (Appendix S1).

In order to be able to generate a population representative sample, socio-demographic characteristics were surveyed. To test whether the data are severely affected by social desirability issues, Kemper et al.'s (2012) three-item scales on overstating positive traits and understating negative traits were used. A confirmatory factor analysis reveals that factor loadings (item 1 = 0.774, 0.840; item 2 = 0.679, 0.647; and item 3 = 0.581, 0.535) and reliabilities ( $\alpha = 0.716$ , 0.698;  $\omega$  = 0.727, 0.709; and AVE = 0.478, 0.453) of both scales only partly meet the common standards to support substantive measurement ( $\geq 0.7$  for factor loadings;  $\geq 0.7$  for  $\alpha$  and  $\omega$ ; and  $\geq 0.5$  for AVE; e.g., Fornell & Larcker, 1981; Nunnally & Bernstein, 1994). These results hint at the absence of a noteworthy social desirability bias in the collected data (Appendix S2). All survey questions, including the ones on socio-demographic characteristics and social desirability, were mandatory so that there is no item non-response.<sup>3</sup> The CBCrelated data collection and analysis procedures were carried out using Sawtooth Software's Lighthouse Studio (version 9.7.0). All other calculations were performed with the statistical software R (version 3.6.2; R Core Team, 2019).

**TABLE 3** Attributes and attribute levels of washing machines in the choice tasks

	Attribute level				
Attribute	First choice-based conjoint exercise	Second choice- based conjoint exercise			
Brand	Miele	Miele			
	Siemens	Siemens			
	Beko	Beko			
	New brand	New brand			
Energy consumption <sup>a</sup>	80 kWh/year	80 kWh/year			
	120 kWh/year	120 kWh/year			
	160 kWh/year	160 kWh/year			
	200 kWh/year	200 kWh/year			
Equipment version	Standard <sup>b</sup> with extras <sup>c</sup>	Standard <sup>b</sup> with extras <sup>c</sup>			
	Standard <sup>b</sup>	Standard <sup>b</sup>			
Price	€200	€200			
	€500	€500			
	€800	€800			
	€1100	€1100			
	€1400	€1400			
Product lifetime		25 years			
label <sup>a</sup>		20 years			
		15 years			
		10 years			
		5 years			
Fixed attributes					
Туре	Front loader				
Load capacity	7 kg				
Energy efficiency class (European Union energy label)	A+++ <sup>d</sup>				
Maximum spin speed	1400 rotations per minute				

<sup>a</sup>Energy consumption and expected product lifetime tested on the basis of an average use and 220 washes per year.

<sup>b</sup>Standard: wash programmes: for example, hot, coloured, mixed, delicates, easy care, wool, eco and quick; functions: for example, start time delay, remaining time display and consumption adjustment to load. <sup>c</sup>Extras: wash programmes: for example, sports, shirts, allergy, baby clothes, bedding, jeans and animal hair; functions: for example, smartphone control, consumption display and automatic detergent dosing. <sup>d</sup>The data were collected before the introduction of the new energy efficiency labelling scheme in 2021, which ranges from A to G. Therefore, the current labelling from A+++ to D at the time of data collection was used.

#### 5 | ANALYSIS AND RESULTS

This CBC study provides choice data from 7984 hypothetical purchase decisions. Each of the 499 respondents answered 16 choice tasks in two CBC exercises. In the first CBC exercise, a total of 10,479 washing machines were presented, while in the second CBC exercise, a total of 13,473 washing machines were shown. In both cases, the washing machines displayed covered all theoretically possible attribute-level combinations, which amount to 160 in the first and 800 in the second CBC exercise. Table 4 shows the average utilities of each attribute level for both CBC models based on hierarchical Bayes estimation. Hierarchical Bayes utility modelling is considered the state-of-the-art approach in analysing CBC data, since it accounts for heterogeneity in respondents' preferences by estimating individual-level utilities (e.g., Huber & Train, 2001; Orme & Chrzan, 2017; Rossi & Allenby, 2003). The reported average root like-lihood values (0.627 and 0.677) are around two times higher than the one of the chance model (0.333), indicating a good fit of both CBC models (Orme, 2013).

As shown in Table 4, the utilities of all dummy-coded attributes (brand, energy consumption, equipment version and product lifetime label) are derived from piecewise linear part-worth functions (Rao, 2014). For the purpose of the subsequent WTP analysis, price was coded linearly (see, e.g., Orme, 2013; Sammer & Wüstenhagen, 2006). In general, all presented part-worth estimates appear plausible in terms of the order of preference and in terms of the sign of the price coefficient. With one exception, all part-worth increases from one level to the next more preferred one are found to be significant.<sup>4</sup> The negative utility coefficient of price is also significantly different from zero. It can, therefore, be summarised that all tested attributes significantly influence purchase decisions for washing machines. Thus, given the significant influence of the product lifetime label, and the increasing average utilities for higher levels of product lifetime, Hypothesis 1 can be confirmed.

The part-worths for all levels of the product lifetime label exhibit a decreasing positive effect for an increase in product lifetime. While the part-worth gain from 20 to 25 years is too small to be significant, the one from 5 to 10 years shows the largest increase within the attribute. This observation was verified by comparing the existing CBC model of the second CBC exercise with a nested model which differed only in that the label entered the estimation as a linear-coded rather than a dummy-coded attribute. A likelihood-ratio test shows that the original model exhibits a significantly better fit than the simpler model ( $-2\Delta$ LL = 294.21,  $\chi^2$  = 16.27, df = 3, *p* < .001). A decreasing positive effect of the product lifetime label on purchase decisions thus fits the data better than a corresponding linear effect, which confirms Hypothesis 2.

The arbitrariness in utilities' scaling can be eliminated by expressing them in monetary units. The resulting relative WTP measures enable the comparison of attribute levels' effects on purchase decisions across attributes and even across CBC exercises. WTP defines how much monetary value a consumer ascribes to a change from one attribute level to another (e.g., Hensher et al., 2015; Orme, 2013). According to standard CBC practice (e.g., Orme, 2013; Sammer & Wüstenhagen, 2006), a consumer's WTP for one level compared to a reference level within the same attribute was calculated by dividing the part-worth difference between both levels by Business Strategy and the Environment

#### TABLE 4 Hierarchical Bayes utility modelling results of both choice-based conjoint exercises

	Model of the first choice-based conjoint exercise (n = 499) $$		oint exercise	Model of the second choice-based conjoint exercises $(n = 499)$		
Attribute level	Average utility <sup>a,b</sup>	(SD)	p value <sup>c</sup>	Average utility <sup>a,b</sup>	(SD)	p value <sup>c</sup>
Brand						
High reputation brand (Miele)	34.32	(44.73)	***	27.67	(43.52)	***
Medium reputation brand (Siemens)	17.04	(18.97)	***	10.39	(15.77)	***
New brand	-24.03	(22.64)	*	-13.97	(23.96)	***
Low reputation brand (Beko)	-27.33	(32.48)	n/a	-24.10	(28.16)	n/a
Energy consumption						
80 kWh/year	40.00	(33.85)	***	30.92	(28.33)	***
120 kWh/year	16.26	(12.65)	***	11.55	(12.30)	***
160 kWh/year	-11.54	(13.47)	***	-4.88	(13.67)	***
200 kWh/year	-44.73	(31.60)	n/a	-37.59	(28.37)	n/a
Equipment version						
Standard with extras	14.63	(16.33)	***	9.26	(12.95)	***
Standard	-14.63	(16.33)	n/a	-9.26	(12.95)	n/a
Price						
(Linear slope)	-14.68	(8.84)	***	-13.26	(8.69)	***
Product lifetime label						
25 years				45.88	(47.45)	
20 years				44.17	(22.82)	***
15 years				17.89	(16.42)	***
10 years				-11.20	(28.57)	***
5 years				-96.75	(45.82)	n/a
None option	5.25	(96.81)		19.08	(101.95)	
Average <sup>a</sup> root likelihood	0.627	(0.15)		0.677	(0.14)	

<sup>a</sup>Averaged across all respondents.

<sup>b</sup>Based on hierarchical Bayes estimation (Markov chain Monte Carlo algorithm, 50,000 iterations prior and 50,000 iterations after convergence), utility estimates averaged per respondent to generate point estimates for each attribute level (e.g., Howell, 2009; Orme & Chrzan, 2017; Sawtooth Software, 2019) with standard deviations given in parentheses; dummy-coded attributes: scaled as zero-centred differences; price: linear slope based on price levels divided by 100, that is, a €1 price increase equals a 0.1468 utility decrease for the first choice-based conjoint exercise. <sup>c</sup>Dummy-coded attributes: utility increases from one level to the next more preferred level based on paired *t* tests; price: whether different from zero

<sup>+</sup>p ≤ .10.

\*p ≤ .05.

 $p \le .01.$ \*\*\* $p \le .001.$ 

the absolute value of the average utility coefficient of price. Table 5 presents the average WTP for each attribute level as well as the changes for brand, energy consumption and equipment version from the first and to the second CBC exercise. In addition, the results of Table 5 are visualised in Figure 1.

In Table 5 and Figure 1, significant losses of WTP are evident for all existing brands, holding all other product attributes equal. Given the introduction of a product lifetime label, consumers are on average willing to pay only  $\in$ 314 more for a high reputation brand (reduced from  $\in$ 397), only  $\in$ 184 more for a medium reputation brand (reduced from  $\in$ 280) and  $\in$ 76 less for a low reputation brand (discount increased from  $\in$ 23). In other words, the positive impact of high and

medium reputation brands on purchasing washing machines relative to the new brand has decreased, while the negative impact of the low reputation brand has increased. The influence of all existing brands on purchase behaviour has thus become less favourable. Given that the positive utilities of existing brands have decreased in the second CBC exercise, which includes information on product lifetimes, we can conclude that the introduction of a product lifetime label renders the positive purchase influence of existing high and medium reputation brands less impactful and thus support Hypothesis 3. Besides, the shape of the piecewise linear WTP function for the product lifetime label (Figure 1) further underpins the decreasing positive effect of the label on purchase decisions. A strong increase of WTP from 5 to 10

based on t test.

TABLE 5 Change in willingness to pay from the first to the second choice-based conjoint exercise

	First choice-based conjoint $(n = 499)$	exercise	Second choice-based conjoint exercise ( $n = 499$ )		Change in willingness to pay		
Attribute level	Average willingness to pay <sup>a</sup> (€)	(SD)	Average willingness to pay <sup>a</sup> (€)	(SD)	€	%	p value <sup>b</sup>
Brand							
High reputation brand (Miele)	397.36	(419.98)	314.09	(489.10)	-83.27	-21.0	***
Medium reputation brand (Siemens)	279.66	(236.79)	183.76	(253.48)	-95.90	-34.3	***
New brand <sup>c</sup>	0.00		0.00				
Low reputation brand (Beko)	-22.51	(211.60)	-76.42	(163.84)	-53.91	-239.5	***
Energy consumption							
80 kWh/year	577.04	(432.60)	516.82	(416.54)	-60.23	-10.4	**
120 kWh/year	415.35	(255.26)	370.66	(286.70)	-44.69	-10.8	**
160 kWh/year	226.03	(219.83)	246.78	(195.52)	20.76	9.2	+
200 kWh/year <sup>c</sup>	0.00		0.00				
Equipment version							
Standard with extras	199.25	(222.42)	139.63	(195.37)	-59.62	-29.9	***
Standard <sup>c</sup>	0.00		0.00				
Product lifetime label							
25 years			1075.80	(685.15)			
20 years			1062.89	(504.19)			
15 years			864.65	(407.88)			
10 years			645.28	(214.60)			
5 years <sup>c</sup>			0.00				

<sup>a</sup>Averaged across all respondents with standard deviations given in parentheses. <sup>b</sup>Based on paired *t* tests.

<sup>c</sup>Reference level.

<sup>+</sup>p ≤ .10.

\*p ≤ .05.

\*\*p ≤ .01.

\*\*\*p ≤ .001.

years (€645) is followed by two weaker increases (additional €219 up to 15 years and €198 up to 20 years).

Finally, Table 6 provides an overview of the average relative importance of each product attribute for both CBC exercises. The results emphasise the comparatively strong influence the product life-time label exerts on purchase decisions. If no information via a product lifetime label is provided, price is the single most important attribute for consumers. In contrast, if such information is provided, both the product lifetime label and the price show nearly equally high relative importance values. The product lifetime label (33.7%) and price (32.8%) are more important than energy consumption (15.2%) and brand (13.6%). Equipment version (4.7%) appears to play only a minor role when purchasing washing machines. Thus, Hypothesis 4 cannot be confirmed, which expected product lifetime to exert a comparatively smaller influence. Table 7 summarises the evaluation of the hypotheses.

To gain additional insights into potential consumer segments, we also conducted a cluster analysis. We used the relative importances of brand, energy consumption, equipment version, price and product lifetime label-all measured on the basis of the second CBC exercise-as cluster variables. Table 8 provides the results of the cluster analysis including the socio-demographic composition of each cluster. Four distinct consumer segments could be identified in terms of their preferences for the five product attributes. Furthermore, the results show how large the different consumer segments are and how they differ in terms of gender, age and highest educational achievement. It can be seen, among other aspects, that product lifetime is among the two most important attributes in all segments. Interestingly, the largest segment (cluster 3; 51.7%) considers price to be by far the most relevant, followed by product lifetime, while the second largest segment (cluster 4; 26.5%) considers product lifetime by far to be the most relevant, followed by price. The socio-demographic composition of both segments indicates, for instance, that respondents of the product lifetime-led segment (cluster 4) are younger than the ones of the price-led segment (cluster 3). The remaining two segments of roughly equal size find energy consumption (cluster 1) or brand (cluster 2)

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**FIGURE 1** Visualisation of the change in willingness to pay from the first to the second choice-based conjoint exercise

Second choice-based conjoint exercise

<sup>a</sup> Average willingness to pay compared to the reference level (see table 5); reference levels: New brand, Standard, 200 kWh/year, 5 years <sup>b</sup> kWh = kilowatt hours

particularly relevant in addition to product lifetime and also differ in terms of their age structure (where cluster 1 is much younger than cluster 2).

### 6 | DISCUSSION AND CONCLUSIONS

#### 6.1 | Discussion against previous literature

Overall, our study demonstrates the applicability of consumer theory of Lancaster (1966) in the context of product lifetime information. Thereby, the results confirm key assumptions of Lancaster's (1966) consumer theory, as we show that it is indeed the configuration of different product attributes which shapes consumer preferences. Furthermore, we reveal that the Lancastrian framework is, despite its maturity, not outdated but able to integrate newly emerging relevant product attributes such as product lifetime.

Specifically, in line with Hypothesis 1, the present article shows that mandatory product lifetime labelling positively affects purchase decisions for electrical home appliances. The finding is thus in line with Sircome et al. (2016) but in opposition to Artinger et al. (2018), who could not prove such an effect. This may be explained by the concept of consumer trust, which is essential for effective sustainability labelling (e.g., Issock et al., 2018; Nuttavuthisit &

Relative importances of attributes for both choice-TABLE 6 based conjoint exercises

	Average relative importance <sup>a</sup>			
Attribute	First choice-based conjoint exercise (n = 499)	Second choice-based conjoint exercise (n = 499)		
Brand	21.2%	13.6%		
Energy consumption	23.9%	15.2%		
Equipment version	8.1%	4.7%		
Price	46.9%	32.8%		
Product lifetime label		33.7%		
Total	100.0%	100.0%		

<sup>a</sup>Averaged across all respondents; relative importances computed by expressing the respective range of utilities for each attribute as a percentage of the corresponding total over all attributes within each individual (Orme & Chrzan, 2017).

**TABLE 7** Overview of the evaluation of the hypotheses

Hypothesis	Result
Hypothesis 1: Higher levels of product lifetime positively influence purchase decisions.	Confirmed
Hypothesis 2: The positive influence a longer product lifetime exerts on purchase decisions decreases with very high levels of product lifetime.	Confirmed
Hypothesis 3: The introduction of a product lifetime label renders the positive purchase influence of existing brands less impactful.	Confirmed
Hypothesis 4: The price has the highest relative influence on purchase decisions, followed by energy consumption, product lifetime, equipment version and brand.	Not confirmed

Thøgersen, 2017). While the label tested in this study is framed as being issued by an independent, third-party institute using a standardised test procedure (Appendix S1), the label tested by Artinger et al. (2018) represents a non-binding estimate of the manufacturer. Previous research indicates that consumer trust in sustainability labels is substantially higher when the label is issued by manufacturer- and retailer-independent institutions than by the companies themselves (e.g., Ertz et al., 2017; Gertz, 2005; Horne, 2009).

By confirming Hypothesis 2, we find support for the indication of Wilhelm (2012) on a potential decreasing positive effect of product lifetime information. While Wilhelm (2012) studied the example of mobile phones using a student sample, we can confirm this observation for the context of electrical home appliances using a population representative sample. An extension of a washing machine's lifetime from 5 to 10 years would be rewarded with an additional WTP of €645, or €129 for each additional year. Between 10 and 20 years, the increase in WTP is almost linear with an additional WTP of about €40

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Cluster analysis results including the socio-demographic TABLE 8 composition of the clusters

	Cluster (n = 499) <sup>a</sup>			
	1	2	3	4
Cluster size	10.4%	11.4%	51.7%	26.5%
Cluster variable	% 100.0	% 100.0	% 100.0	% 100.0
Relative importance 'brand'	11.6	39.2	9.0	12.3
Relative importance 'energy consumption'	34.4	13.7	13.3	12.0
Relative importance 'equipment version'	4.5	5.3	4.2	5.5
Relative importance 'price'	13.3	16.0	47.4	22.6
Relative importance 'product lifetime label'	36.3	26.0	26.1	47.6
Socio-demographic characteristic	% 100.0	% 100.0	% 100.0	% 100.0
Gender				
Female	48.1	45.6	50.8	53.8
Male	51.9	54.4	49.2	46.2
Age				
15–29 years old	36.5	1.8	13.6	31.8
30-39 years old	11.5	14.0	12.8	09.9
40-49 years old	17.3	14.0	14.7	15.9
50–59 years old	09.6	14.0	24.0	14.4
60 years and older	25.0	56.1	34.9	28.0
Highest educational achievement				
No school-leaving qualification	11.5	3.5	5.8	7.6
Secondary modern school qualification	25.0	26.3	39.1	30.3
Secondary school certificate	25.0	33.3	25.6	28.8
University entrance qualification	19.2	08.8	12.8	19.7
University degree	19.2	28.1	16.7	13.6

<sup>a</sup>Cluster analysis based on each respondent's relative importances for the washing machine attributes measured in the second choice-based conjoint exercise; method: k-means clustering; number of clusters chosen by plotting the within-group sum of squares by the number of clusters extracted (elbow criterion).

for each additional year, even between the high product lifetimes of 15 and 20 years. However, companies would hardly be rewarded for manufacturing washing machines with a lifetime of more than 20 years. Potential reasons for the missing incentive to produce products with very long lifetimes include that consumers might have concerns about missing future product updates (e.g., Cooper, 2004; Cox et al., 2013) even with highly utilitarian products. In addition, in the long run, consumers might anticipate changes in their living environment that potentially mismatch very long product lifetimes

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(e.g., change in family size, change of residence and end of own life). Last, the non-linear labelling effect could also be explained by the negativity bias, which has already been found in settings of sustainability labelling (e.g., Moosmayer, 2012; Petersen et al., 2021; Van Dam & De Jonge, 2015). It refers to the psychological tendency of assigning more weight to negative than to positive stimuli compared to a reference point (Rozin & Royzman, 2001). Consumers' expectation regarding the lifetime of a washing machine, which is on average around 10 years (Appendix S3), can be taken as a reference point. In line with the concept of the negativity bias, the absolute changes in WTP are stronger for losses from 10 to 5 years than for gains from 10 to 15 years (Table 5).

The present article also reveals that introducing a product lifetime label renders the positive purchase influence of existing high and medium reputation brands less impactful, as expected in Hypothesis 3. This may point to a weakening of the information asymmetry between consumers and manufacturers regarding a product's durability. The importance consumers ascribe to quality signals sent by existing brands (e.g., Cox et al., 2013; Erdem & Swait, 1998) may decrease due to the provision of transparent product lifetime information. As implied by research on sustainability labelling (e.g., Larceneux et al., 2012: Mondelaers et al., 2009), this could lead to a loss in the brands' trust-building function.

Last, regarding the relative importance of different product attributes for purchase decisions, we expected price to be most relevant, followed by energy consumption, product lifetime, equipment version and brand (Hypothesis 4). In contrast to this hypothesis, we found that price and product lifetime exert the strongest influences, followed by energy consumption, brand and equipment version. The order of the relative importances with regard to price, energy consumption and brand is thus in line with the findings presented by Heinzle and Wüstenhagen (2012), Codini et al. (2012) as well as Sammer and Wüstenhagen (2006), and confirms further research from other contexts, which highlighted the high relative importance of price in environmental consumption (see, e.g., Bangsa & Schlegelmilch, 2020). In contrast to these findings, our results indicate a lower relative importance of the equipment version. Going beyond the aforementioned studies, our analysis additionally included product lifetime as an important attribute of electrical appliances. The results thus show that the products' lifetime is indeed more important than we expected, being of higher importance than energy consumption. Different potential reasons exist for this unexpected finding: First, the product lifetime label represents a new product attribute for consumers. Consequently, it might attract more attention from consumers than already existing types of product information (e.g., on energy consumption). While our findings thus realistically reflect the situation directly after the potential introduction of a product lifetime label, it might be that the relative impact of product lifetime labelling decreases in the years following its introduction. Second, and alternatively to the above, one could argue that, unlike other sustainabilityrelated aspects which are currently not communicated via labelling, the issue of product lifetime is not entirely new to consumers as it is observable in retrospect. Every consumer has therefore certain

experiences with product lifetimes. Thus, the argument by Sirieix et al. (2013) that consumers are reluctant to react to sustainability information on new sustainability aspects they are not familiar with might not be applicable to the issue of product lifetime labelling. A third potential explanation for the strong relative influence of product lifetime information, which is not related to the novelty aspect of product lifetime labelling but likely to also be valid in the long run, is that longer product lifetimes offer consumers an opportunity to save time (Grigsby, 2004). Thus, longer product lifetimes can offer two types of private benefits (financial gains and time savings), whereas other environmental attributes such as energy consumption only offer financial gains. Furthermore, the financial gains coming along with longer lifetimes of washing machines (savings due to reduced annual investment costs) are likely to be higher than the financial gains coming along with lower levels of energy consumption (savings due to reduced annual energy costs), which might be particularly relevant for rational, profit-maximising consumers and not only to environmentally oriented consumers.

All in all, this research confirms that product lifetime is a very influential attribute for environmental consumption research, even though it has experienced only scant attention in previous studies. Our study thus extends earlier analyses on environmentally friendly purchase behaviour, which have, for instance, focused on energy consumption (e.g., Heinzle & Wüstenhagen, 2012; Sammer & Wüstenhagen, 2006), organic food (e.g., Testa et al., 2019; Torres-Ruiz et al., 2018), packaging (e.g., Bartl, 2014; Marken & Hörisch, 2020), water usage and treatment (e.g., Moosmayer, 2012) or on ways of communicating environmental information (e.g., Ertz et al., 2017) and thus left aside other relevant environmental aspects.

#### **Practical implications** 6.2

The findings of this study can inform business strategists, marketers as well as policymakers. With regard to implications for businesses, our results reveal that incentives exist for companies to improve product lifetimes and communicate respective improvements voluntarily, as long as no mandatory labelling scheme exists. If such labelling was introduced, manufacturers would face even stronger incentives to produce long-lasting products. Product lifetime labelling could thus stimulate the supply of, and demand for, more durable electrical home appliances.

Still, not all companies face the same incentives with regard to disclosing product lifetimes. Currently, many consumers interested in long product lifetimes seem to use brands as a proxy for product lifetime. Thus, companies with well-known and reputable brands will most likely not benefit, but suffer from the introduction of product lifetime labelling, at least if the trust their brands create signals longer product lifetimes than their products actually deliver. In contrast, companies intending to enter the market might favour such introduction, if they are able to create products with long lifetimes. The current absence of product lifetime labelling creates market entry barriers for new businesses, which aim to specialise in products with long

lifetimes, as their brands are not (yet) able to signal high levels of product lifetime. Thus, market entry barriers for new, more sustainable brands in the area of electrical home appliances may be reduced. Apart from possible labelling costs, new businesses would have to invest less in the development of their brand images in terms of guality, given the existence of a mandatory product lifetime label.

On a more general level, our results advise companies to develop business models for longer product lifetimes, including repair and upgrade services as well as other forms of ownership such as leasing (e.g., Ertz et al., 2019; Wilhelm, 2012). Such business models may provide companies with various opportunities for differentiation in the context of product lifetime.

With regard to marketing products with long lifetimes, our results can assist marketers to estimate the rise in consumers' WTP if product lifetime is increased by a certain magnitude. While it may be profitable to produce longer lasting products (particularly under a product lifetime labelling scheme), due to the decreasing effect of longer product lifetimes on WTP, manufacturers of products with already very long lifetimes need to be aware that further increasing product lifetime may not be rewarded. In contrast, manufacturers of less durable products are well advised to improve their products' lifetime to realise considerable gains in WTP. To realise such gains, our results provide initial indication that marketers could communicate aspects such as saving time (cf. Grigsby, 2004).

Last, our results inform policymakers about the effectiveness of mandatory product lifetime labelling of electrical home appliances, as discussed, for example, by the European Commission (2020). Previous introductions of similar labels, such as the European Union's energy labelling scheme for electrical appliances, have triggered innovations towards more energy-efficient products over time (Heinzle & Wüstenhagen, 2012). Our analysis indicates that similar effects could be expected from introducing product lifetime labelling. The provision of information on the expected product lifetime changes purchase decisions by activating previously hidden consumer preferences for a highly purchase-relevant product attribute. Given consumer receptiveness to product lifetime information, the introduction of such labelling is likely to generate positive environmental effects.

#### 6.3 Limitations and future research

This study encompasses the following limitations, which should be addressed in future research. First, even though the indirect WTP measurement based on CBC analysis as done in this study is more realistic than a direct measurement approach (Breidert et al., 2006), respondents tend to exaggerate their purchase intent in experimental settings without real financial transactions (Nagle & Holden, 2002). Future CBC studies should consider, for instance, market simulations to generate even more realistic WTP measures (Orme, 2013). In addition, we recommend adaptive CBC surveys as they increase respondents' perceived realism and the engaging nature of the surveys and thus tend to delve deeper into each respondent's decision-making structure than traditional CBC analyses (Sawtooth Software, 2021). Likewise, replication studies with real choice experiments could help to validate our results.

Second, our study aims to reflect the immediate effects of introducing product lifetime labelling. Future research could investigate in how far the influence of product lifetime labelling might change in the years following the introduction.

Third, this research reveals a high importance of the product lifetime attribute in purchase decisions, but can only speculate on the personal motivations behind this importance. Future research should therefore investigate consumer motivations behind buying longlasting products.

Fourth, while the results of the study may be transferable to many developed countries, it is conceivable that the product lifetime label may have a different impact in, for example, low-income countries or countries with a different consumer culture. Even in further developed countries, specificities with regard to per-capita income or the distribution of the income might exist, which could lead to country-specific effects. Future studies should thus generally consider the use of samples from different countries to explore potential crosscountry differences regarding the effects of product lifetime labelling (cf. Sircome et al., 2016).

Fifth, as is common in many (conjoint) studies on sustainable consumption (e.g., Heinzle & Wüstenhagen, 2012; Krause & Battenfeld, 2019; Petersen et al., 2021), we used some relevant sociodemographic variables when setting the sampling quota targets. However, we acknowledge that the quality of the sample could have been further improved, if it had been representative not only in terms of the socio-demographic characteristics but also in terms of other relevant psychographic characteristics such as political attitude. The latter should therefore also be included in the sampling of future studies.

Last, in our study, we have focused on the influence of product lifetime information at the consumer level and did not investigate potential further determinants at the retailer level, including retailer brands and warranties. Therefore, retailer-related variables demonstrate an important avenue for future research on product lifetime labelling as they might exert direct, mediating or moderating effects on purchase decisions.

In addition to overcoming these limitations, further avenues for future research exist. First, this study generally identifies product lifetime, to be a very influential attribute in the context of environmentally friendly purchase decisions. Thus, future studies which aim at capturing a broad range of environmentally relevant product attributes are informed to also include product lifetime, besides more established attributes such as energy use or packaging. Second, experimental studies comparing different types of labelling schemes (e.g., voluntary vs. mandatory), different types of information (e.g., expected product lifetime vs. repairability) and different product categories (e.g., utilitarian vs. hedonic) are recommended (cf. Artinger et al., 2018). Here, it would be particularly interesting to see how other types of product lifetime information, for example, repairability ratings (e.g., Bracquene et al., 2021) or warranties, affect the influence of the product lifetime label tested in this study on purchase decisions. Additionally, research on warranties might help to better

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differentiate the effect of product lifetime labels from that of product warrantees on not only purchase decisions but also on consumers' perceived risk and quality (cf. Cooper, 2005; Cox et al., 2013). Third, the additional segmentation analysis conducted in this study already reveals interesting insights with regard to the existence, size and socio-demographic composition of potential market segments considering especially their preferences for product lifetime. Future studies would benefit from further segmentation analyses that take into account additional consumer characteristic such as specific attitudes or values in order to, for instance, identify the market potential for long-lasting products. Fourth, a market shift towards higher levels of product lifetime could provide new opportunities for second-hand retailers (Maitre-Ekern & Dalhammar, 2016). Future studies should thus shed light on the impact of product lifetime labelling on secondary markets. Last, in order to ensure the feasibility of product lifetime labelling, further research on standardised durability tests (Stamminger et al., 2018, 2020) needs to be carried out.

Together with the analysis at hand, such future studies could help to more effectively use the vast potential longer product lifetimes bear for environmental sustainability. We thus highlight that product lifetime labelling can be an important step towards sufficiency and reducing environmentally harmful consumption patterns, while it at the same time offers strategically relevant incentives for businesses.

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#### ORCID

Kathleen Jacobs https://orcid.org/0000-0001-8837-6632 Jacob Hörisch https://orcid.org/0000-0001-5825-1652

#### ENDNOTES

- <sup>1</sup> Following common practice in survey research (e.g., Greszki et al., 2014; Steinbrecher et al., 2015), we defined speeders as respondents who answered their questionnaire more than 50% faster than the respondent who took the median response time. Therefore, all 72 questionnaires from respondents with a response time of less than 7.61 min (median: 15.22 min) were deleted from the data set.
- <sup>2</sup> The product lifetime label tested in this article is framed as a comparison label. According to Wiel and McMahon (2005), comparison labels are mandatory labels which enable consumers to compare the performance of all products of the labelled product category, whereas endorsement labels are voluntary seals of quality that are awarded according to defined criteria and thus only label the best performing products. In the field of energy labelling, Heinzle and Wüstenhagen (2012) argue that comparison labels are more widely used and have triggered innovations towards energy-efficient products. Likewise, it is assumed that mandatory labelling schemes will be more effective in the context of product lifetimes than voluntary ones (Artinger et al., 2018; Maitre-Ekern & Dalhammar, 2016).
- $^3$  Large parts of the final questionnaire were pretested among a nonrepresentative sample of German consumers (n = 316). The main

objective of the pilot study was to test the functionality of the second CBC exercise (with product lifetime label). Overall, the results revealed plausible utility estimates. Based on the pilot study, only a few minor changes have been made such as the deletion of attribute levels.

<sup>4</sup> Moreover, all potential two-way interaction effects between the attributes were tested for each of the CBC models. This was done by using the interaction search tool which is based on a modified likelihood-ratio test leveraging individual-level main-effect utilities from hierarchical Bayes estimation. Interaction effects identified with this tool are also expected to increase a model's per cent certainty measure by at least 1% (Sawtooth Software, 2019). Following this procedure, none of the potential interaction effects are found to substantially improve the CBC models.

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#### SUPPORTING INFORMATION

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