



University of Groningen

Sustainability Claims and Perceived Product Quality

Doorn, van, Jenny; Verhoef, Pieter; Risselada, Hans

Published in: Sustainability

DOI:

10.3390/su12093711

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version Publisher's PDF, also known as Version of record

Publication date: 2020

Link to publication in University of Groningen/UMCG research database

Citation for published version (APA):

Doorn, van, J., Verhoef, P., & Risselada, H. (2020). Sustainability Claims and Perceived Product Quality: The Moderating Role of Brand CSR. *Sustainability*, *12*(9), [3711]. https://doi.org/10.3390/su12093711

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: https://www.rug.nl/library/open-access/self-archiving-pure/taverneamendment.

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): http://www.rug.nl/research/portal. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

Download date: 12-10-2022





Article

Sustainability Claims and Perceived Product Quality: The Moderating Role of Brand CSR

Jenny van Doorn, Peter C. Verhoef * and Hans Risselada

Department of Marketing, Faculty of Economics and Business, University of Groningen, Paviljoen 136, P.O. Box 800, NL-9700 AV Groningen, The Netherlands; j.van.doorn@rug.nl (J.v.D.); h.risselada@rug.nl (H.R.) * Correspondence: p.c.verhoef@rug.nl; Tel.: +31-50-363-3686

Received: 29 February 2020; Accepted: 24 April 2020; Published: 3 May 2020



Abstract: In this research, we focus on the presumed negative effect of a sustainability claim on product quality. We propose that a brands' corporate social responsibility (CSR) can reduce this negative effect. We conduct an experiment to test our hypotheses for a newly introduced detergent brand with an ecolabel vs. without one for high and low brand CSR levels. The experiment was conducted among 304 participants. Our results show that the ecolabel of the detergent can indeed trigger quality concerns. These quality concerns are reduced for brands high in CSR. This suggests that a brand's sustained commitment to sustainability is important in overcoming negative effects of sustainability claims on product quality.

Keywords: sustainability; corporate social responsibility; product quality

1. Introduction

Within supermarkets, an increasing number of sustainable products can be observed (International Supermarket News 2015 [1]). Manufacturers and retailers aim to focus more on sustainability. The UK-Netherlands based multinational Unilever has for example introduced the Sustainable Living Plan to increase the number of sustainable ingredients in their brands [2]. Despite the increasing number of sustainable products and interest in sustainability among consumers, market share for sustainable products remain low (around 3% of the European Market; [3,4]. A likely explanation is that high prices of sustainable alternatives deter consumers from purchasing sustainable products and make them continue buying non-sustainable alternatives. Moreover, there is a consistent finding that environmental attitudes do frequently not translate into purchase behavior of sustainable products [5–7] Recent studies though also point to other explanations. Specifically, Van Doorn and Verhoef [8] have pointed to potential negative quality associations with sustainable food products leading to a lower willingness to pay for them. You could argue that this is no longer the case, as sustainability has gone mainstream with leading manufacturers, such as Unilever, offering sustainable products as well and emphasizing their commitment to sustainability. The question though is whether this is true.

We therefore first investigate whether the negative main effect of sustainability claims still exists and thereby aim to replicate the findings of Van Doorn and Verhoef [4]. In this study, we focus on nonfood products carrying an ecolabel as a specific sustainability claim. In the domain of food, organic claim are one of the most common sustainability claims and has been investigated frequently [5,9]. Recent research suggests that similar consumers buy organic and other products with sustainable claims (i.e., fair trade) [4]. Next, if the commitment to sustainability of leading brands could reduce the negative effect of sustainability claims on perceived product quality, we should mainly observe this for brands possessing such a high perceived commitment (i.e., Ben & Jerry's of Unilever; or Tony Chocolonely). We therefore investigate the moderating role of a brands' corporate social responsibility (CSR). Thus, the second objective of this study is to investigate if a brand's CSR can reduce the negative

Sustainability **2020**, *12*, *3711*

quality inferences of a sustainability claim. In order to achieve these two objectives, we conducted an experiment in which we manipulated the presence of an ecolabel and the CSR level of a detergent brand.

To study this is particularly important given the fact that national brands have been blamed for green washing and that these brands are blamed for only being self-interested [10–12] and only use CSR initiatives to cover a questionable environmental record. However, in this study, we claim that building a CSR reputation can actually contribute to the success and consumer acceptance of new sustainable products. The success of this new product is of course beneficial for the brand manufacturer. However, it is also beneficial for society as the consumer demand for sustainable products increases.

We continue with a discussion of the underlying theory and our hypotheses. Next, we discuss our empirical study design and the results. We end with a conclusion and research limitations.

2. Hypotheses

Newman, Gorlin, and Dhar [13] provide initial evidence that consumers may react differently to sustainable new products than to their conventional counterparts. They caution that a sustainability claim on a new product can backfire because consumers have a lay theory that firm resources are zero-sum. As a consequence, consumers may believe that resources invested in creating a sustainable product reduces the investments in quality. Consumers therefore assume that a company sacrifices quality for sustainability.

Recent research indeed shows that sustainable products may be perceived to be of lower quality compared to conventional products. Empirical results of Van Doorn and Verhoef [4] show that quality concerns of sustainable food products are indeed an issue. In different experiments they show that organic claims reduce quality associations for food products and they show that this differs between vice products and virtue products. Relative vices (also known as "wants") are products that provide immediate pleasurable experience, but contribute to negative long-term outcomes. Relative virtues are less gratifying and appealing in the short term but have less negative long-term consequences than vices and therefore are a more prudent choice [14]. The negative quality effect seems to be stronger for vice products. However, their three reported experiments provide no conclusive evidence. Lin and Chang [15] report similar effects suggesting that green or environmental friendly products are less effective, and therefore consumers' usage of these products is higher.

Also other research has pointed to negative consequences of sustainability claims. Specifically Luchs et al. [16] discuss the notion of the sustainability liability. In product categories, where strength related attributes focusing on making sure that the product gets the job done are valued, sustainability claims may lead to lower preferences for sustainable products. However, they also show that when gentleness attributes focusing on for example family safety and health are valued, sustainability enhances product preferences. This occurs because consumers associate higher product ethicality with gentleness-related attributes [17] and lower product ethicality with strength-related attributes. Thus, their research indeed suggest that sustainable claims may reduce quality associations, when these associations tend to specifically focus on the product getting the job done.

Overall, one could conclude that a negative main effect of sustainable claims on quality associations can be expected. We therefore hypothesize our main effect.

H1: A sustainability claim on a new product has a negative effect on perceived product quality.

Brand CSR

CSR is typically defined as a firm's commitment to ensure societal and stakeholder well-being through discretionary business practices and contributions of corporate resources [3]. CSR is a rather broad concept. It can be based on a diverse set of actions, such as cash donations to charity, activities for minorities and vulnerable citizens, and an environmentally friendly production policy. Existing studies suggest that there are positive though small performance returns from CSR efforts [18,19]. CSR also influences consumer attitudes and purchase behavior. Prior studies found predominantly

Sustainability **2020**, *12*, *3711* 3 of 8

positive effects of perceived CSR on consumers' brand attitudes, brand equity, and self-reported consumer share-of-wallet [8,11,20]. Thus, CSR could also be positively related to product quality. This is not the subject of our study though, as we focus on the moderating effect of brand CSR on the effect of sustainability claims on product quality. Our claim is that sustainable products can have a higher perceived quality when they are introduced by brands with a strong CSR. CSR may reduce customer uncertainty about the quality of the product. This occurs because a brand with high CSR showed sustained commitment to CSR, and therefore the zero-sum heuristic may be less salient [18]. Hence, consumers may be less likely to believe that the functionality of the product is sacrificed for sustainability. As a consequence, the negative impact of a sustainability claim on product quality is reduced. Hence, we hypothesize:

H2: Brand CSR reduces the negative effect of the sustainability claim on perceived product quality.

The two hypotheses lead to the conceptual model as displayed in Figure 1, where we thus assume a negative main effect of a sustainability claim on product quality and a moderating effect of Brand CSR on this negative main effect. We also account for the fact that brand CSR can have a direct positive effect on product quality [20].

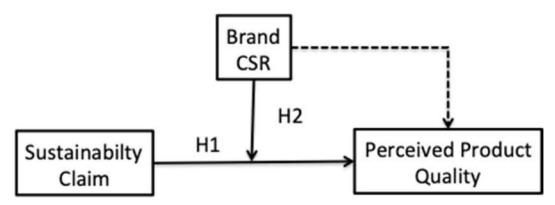


Figure 1. Conceptual Model.

3. Experimental Design

We conducted a study among 304 participants (101 males, $M_{age} = 41$ years) of a large scale European consumer panel who indicated to be the person chiefly responsible for grocery shopping in their household. We conducted a 2 (sustainability claim yes vs. no) \times 2 (CSR brand yes vs. no) online experiment of a fictitious laundry detergent brand called "Clean". We told our respondents that "Clean" launched a new formula for laundry detergent pods called "Clean X" featuring a "new and unique anti-wrinkle formula that effectively reduces wrinkles and therewith the need to iron, transforming for instance regular shirts and blouses into easy to iron shirts and blouses". We furthermore stated that "Clean X is the first laundry detergent that is therefore allowed to carry the "eaziron" logo". (see Figure 2).

We manipulated the sustainability of this new product including the EU Ecolabel on the picture of the laundry detergent pod and told our respondents that "Clean X pods carry the EU Ecolabel, signifying that they are better for the environment than their counterparts not carrying this label" (see Figure 2). We manipulated CSR brand perceptions by telling our respondents that "Clean" is "well-known for being socially responsible and acting responsibly toward the environment". We assessed the perceived quality of the new product introduction with two items ("How would you rate the ability of this new laundry detergent to reduce wrinkles in the laundry"? "How would you rate ability of this new laundry detergent to reduce the effort to iron"?) on a scale from 1 = low to 7 = high.

Sustainability **2020**, 12, 3711 4 of 8



Figure 2. Stimuli used in Experimental Study.

We first conducted a similar experiment with a student panel. In this experiment, we could only replicate the positive main effect of CSR perceptions on perceived quality and neither the main effect of the sustainability label nor its interaction with CSR perceptions. In hindsight, we can explain this because many student participants indicated themselves that they neither do their own laundry nor purchase detergents themselves nor iron. We therefore decided to conduct a second study with a more appropriate respondent base. Exact results of the first study can be requested from the first author.

Manipulation Check

We measured a brand's CSR with an adapted version of the CSR scale developed by Brown and Dacin [21]. We used three items that consumers could state their agreement on using a 7-point disagree (1) to completely agree scale (7): "[brand] is a socially responsible brand"; "[brand] is acting responsibly toward the environment", and "[brand] contributes something to society". The coefficient alpha for this scale is 0.90.

Sustainability **2020**, *12*, *3711* 5 of 8

We conducted an analysis of covariance (ANCOVA) on the measure of brand CSR as a function of the presence/absence of the sustainability claim and the CSR manipulation and their interaction. In line with what our manipulation intended, brand CSR perceptions are higher when respondents were told that Clean is well-known for being socially responsible ($M_{CSRbrand} = 5.18$, $M_{noCSRbrand} = 4.66$; F(1,300) = 16.41, p < 0.001), but also when the product carries a sustainability claim ($M_{sustainable} = 5.10$, $M_{conventional} = 4.75$; F(1,300) = 7.69, p < 0.01). The interaction effect between the two forms of manipulation was also significant (F(1,300) = 4.09, p < 0.05). Given that the presence or absence of a sustainability claim also affected CSR perceptions, we use the measured levels of brand CSR perception as a mediator [22]. We present the results with the manipulated brand CSR as a robustness check below.

4. Results

We conducted a moderated mediation analysis (PROCESS Model 74, 5000 resamples; Hayes [23] on the perceived quality of the laundry detergent as a function of perceived brand CSR (centered), the absence or presence of the EU Ecolabel (sustainability claim), and their interaction. This model incorporates CSR perceptions as a mediator between sustainability claim and quality perceptions and therewith accounts for the sustainability claim influencing both CSR perceptions and quality perceptions.

Results revealed a significant negative main effect of a sustainability claim (b = -1.61, p < 0.001), indicating in line with hypothesis 1 that the perceived quality of the innovative product is impaired when adding a sustainability label. We also find a non-hypothesized significant positive main effect of perceived brand CSR (b = 0.19, p < 0.01), supporting prior findings that CSR is positively related to brand attitudes [19]. Importantly and as expected, these main effects were qualified by a positive sustainability claim × perceived brand CSR interaction (b = 0.26, p < 0.01), indicating that a new product introduced by a CSR brand is less likely to encounter such skepticism, which is in line with hypothesis 2. Furthermore, results revealed a significant indirect effect of the sustainability claim on perceived quality via perceived brand CSR (b = 0.07; SE = 0.03, 95% CI [0.02, 0.14]).

Figure 3 shows that when perceived brand CSR is low (1 SD below the mean), the perceived quality of the innovative product is impaired when it features a sustainability label ($M_{sustainable} = 5.31$, $M_{conventional} = 5.87$). When brand CSR is high, there is no such negative effect of a sustainability label ($M_{sustainable} = 6.35$, $M_{conventional} = 6.30$).

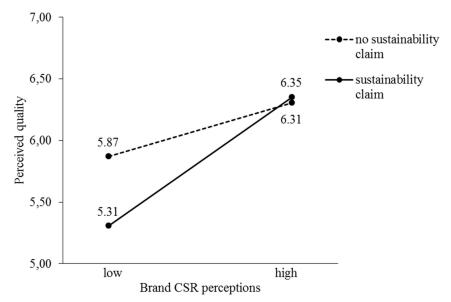


Figure 3. The effect of high (+1 SD) and low (-1 SD) brand corporate social responsibility (CSR) perceptions on perceived quality for products with and without sustainability claims.

Sustainability **2020**, *12*, *3711* 6 of 8

As a robustness check, we conducted an ANOVA on the perceived quality of the laundry detergent as a function of the manipulated brand CSR, the absence or presence of a sustainability claim, and their interaction. We report the simple means for perceived quality per cell and per manipulated variable (EKO vs. No Eko and High CSR vs. Low CSR) in Table 1. We find a significant main effect of adding the sustainability claim ($M_{\text{sustainable}} = 5.83$, $M_{\text{conventional}} = 6.07$; F(1,300) = 5.6, p < 0.05) as expected. While the main effect of manipulated brand CSR is not significant, ($M_{\text{CSRbrand}} = 5.89$, $M_{\text{noCSRbrand}} = 6.01$; F(1,300) = 1.49, p = 0.22). We do find the sustainability claim × brand CSR interaction (F(1,300) = 3.95, p < 0.05). However, this effect differs from the interaction effect with perceived brand CSR levels, as perceived quality is similar for the sustainable claim and no sustainable claim in the no CSR condition ($M_{\text{sustainable noCSRbrand}} = 5.99$, $M_{\text{conventional noCSRbrand}} = 6.01$), while the perceived quality is lower in the sustainable claim with high CSR condition than for the no claim high CSR condition ($M_{\text{sustainable CSRbrand}} = 5.66$, $M_{\text{conventional CSRbrand}} = 6.11$). This difference with the reported analysis of our model in Figure 3 occurs due to the fact that the presence of the sustainable claim also impacts perceived CSR, that subsequently also affects perceived product quality. Our process model accounts for this interaction effect.

Table 1. Robustness Check: Sample Size (N), Means and Standard Deviations for Perceived Quality per Experimental Condition (N = 302).

Condition	N	Mean	SD	Condition	N	Mean	SD
Eco Label	150	5.83	0.94	Eco Label; CSR	74	5.66	0.97
				Eco Label; No CSR	76	5.99	0.89
No Eco Label	152	6.07	0.86	No Eco Label; CSR	76	6.11	0.85
				No Eco Label; No CSR	76	6.03	0.88
				CSR	150	5.89	0.94
				No CSR	152	6.01	0.88
				Total	302	5.95	0.91

5. Discussion

While the number of sustainable products available in supermarkets increases annually and many manufacturers and retailers position sustainability as an integral part of their strategy, marketing research cautions that not all sustainable products are viewed positively by the consumer [4,15,16,18]. Our study indeed confirms this.

We show a negative main effect of sustainable claims on product quality. This confirms the findings of Van Doorn and Verhoef [4] for non-food products. The results also are in line with other studies [15]. We though note, that the studied detergent category strongly focuses on strength attributes, as the detergent needs to get the job (cleaning) done. As Luchs et al. [16] show, sustainability claims can indeed be a liability and reduce quality associations when strength attributes are important in a category. Moreover, our measurement of product quality also focused on getting the job done. We did not measure more gentle attributes. Future research could also consider this.

However, extending Van Doorn and Verhoef [4], we show that negative quality and functionality inferences of a sustainability claim are less pronounced for a brand that has a good CSR record. Making a new product sustainable constitutes a good fit with the brand's strategy, and therefore the conflict between a high quality vs. a sustainable innovation may be less of an issue, because investments in sustainability have already been made by the brand before [24]. This likely reduces consumer uncertainty about the functionality of a new sustainable product. One alternative explanation for our finding is that perceived congruency or fit. A sustainability label on a utilitarian product with a technology-related benefit may be perceived as incongruent (hence lower perceived quality). If the brand has a consistent CSR track record, this incongruency is solved (hence higher perceived quality).

Sustainability **2020**, *12*, *3711* 7 of 8

Future research could test which of these explanations hold. Furthermore, as noted CSR is a rather broad concept as it can be based on a diverse set of actions, such as cash donations to charity, activities for minorities etc. We only studied EKO labels. Future research could study if similar interactions between these actions and CSR on perceived product quality or other consumer perceptions would be found.

Our finding is important given that national brands have been accused for green washing [9]. When sustainable new product introductions are combined with strong brand CSR perceptions, then the new product has a higher perceived quality. This could lead to a stronger success for the new products, which we though do not investigate. Interestingly, our results suggest that investing in CSR is beneficial for the brand, as it may increase consumer demand for their newly introduced sustainable product, but also beneficial for society as more sustainable products are sold.

6. Research Limitations

This study has several limitations. First, this study only concerns a single non-food product category with relatively important strength-related attributes: detergents. Moreover, it is a rather utilitarian product category, where product quality is very important. There have been prior sustainable product introductions in this category (i.e., Omo Power) that might have created a stronger suspicion for the quality issues with sustainable claims. Future research could also consider hedonic (non-food) categories. Also categories where gentleness-related attributes are more important could be considered. This study also considered a single organic claim. Future research could also study other sustainable claims (i.e., fair trade). Using sales data van Doorn et al. [25] though seem to suggest that the found effects might hold across categories for several sustainability claims. The experimental data were collected in several European countries. Assessing the impact of cultural differences on sustainable product success would therefore be an interesting area of future research.

7. Conclusions

This study thus showed a negative main effect of a sustainability claim on product quality. However, we also showed that brand CSR reduces this negative main effect. Our study thus suggests that when firms introduce a new sustainable product, they should have a strong brand CSR in order to overcome negative quality inferences, even though sustainability is becoming more mainstream.

Author Contributions: J.v.D. contributed with the execution of the study, the analysis and the writing. P.C.V. contributed with being the main author of the article. H.R. was involved in co-writing and editing of the article. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

References

- 1. Interantional Supermarket News Supermarkets Focus on Organic and Sustainable Products. *International Supermarketnews*, 2015. Available online: http://www.internationalsupermarketnews.com/supermarkets-focus-on-organic-and-sustainable-products/ (accessed on 20 June 2018).
- 2. Stern, S. The outsider in a hurry to shake up his company. In *Financial Times*; Financial Times: London, UK, 2010.
- 3. Du, S.; Bhattacharya, C.B.; Sen, S. Reaping relational rewards from corporate social responsibility: The role of competitive positioning. *Int. J. Res. Mark.* **2007**, *24*, 224–241. [CrossRef]
- 4. Van Doorn, J.; Verhoef, P.C. Willingness to pay for organic products: Differences between virtue and vice foods. *Int. J. Res. Mark.* **2011**, *28*, 167–180. [CrossRef]
- 5. Van Doorn, J.; Verhoef, P.C. Drivers of and barriers to organic purchase behavior. *J. Retail.* **2015**, *91*, 436–450. [CrossRef]
- 6. Verhoef, P.C.; Van Doorn, J. Segmenting consumers according to their purchase of products with organic, fair-trade, and health labels. *J. Mark. Behav.* **2016**, *2*, 19–37. [CrossRef]

Sustainability **2020**, *12*, *3711* 8 of 8

7. Juhl, H.J.; Fenger, M.J.; Thøgersen, J. Will the consistent organic food consumer step forward? An empirical analysis. *J. Consum. Res.* **2017**, *44*, 519–535. [CrossRef]

- 8. Van Doorn, J.; Onrust, M.; Verhoef, P.C.; Bügel, M.S. The impact of corporate social responsibility on customer attitudes and retention—The moderating role of brand success indicators. *Mark. Lett.* **2017**, *28*, 607–619. [CrossRef]
- 9. Bezawada, R.; Pauwels, K. What is special about Marketing Organic Products? How Organic Assortments, Price and Promotions Drive Retailer Performance. *J. Mark.* **2013**, *1*, 31–51. [CrossRef]
- 10. Prout, J. Corporate responsibility in the global economy: A business case. *Soc. Bus. Rev.* **2006**, *1*, 184–191. [CrossRef]
- 11. Torres, A.; Bijmolt, T.H.A.; Tribó, J.A.; Verhoef, P.C. Generating global brand equity through corporate social responsibility to key stakeholders. *Int. J. Res. Mark.* **2012**, *29*, 13–24. [CrossRef]
- 12. Yoon, Y.; Gürhan-Canli, Z.; Schwarz, N. The effect of corporate social responsibility (CSR) activities on companies with bad reputations. *J. Consum. Psychol.* **2006**, *16*, 377–390. [CrossRef]
- 13. Newman, G.E.; Gorlin, M.; Dhar, R. When going green backfires: How firm intentions shape the evaluation of socially beneficial product enhancements. *J. Consum. Res.* **2014**, *41*, 823–839. [CrossRef]
- 14. Wertenbroch, K. Consumption Self-Control by Rationing Purchase Quantities of Virtue and Vice. *Mark. Sci.* **1998**, *17*, 317–337. [CrossRef]
- 15. Lin, Y.-C.; Chang, C.A. Double Standard: The Role of Environmental Consciousness in Green Product Usage. *J. Mark.* **2012**, *76*, 125–134. [CrossRef]
- 16. Luchs, M.G.; Walker Naylor RIrwin, J.R.; Raghunathan, R. The Sustainability Liability: Potential Negative Effects of Ethicality on Product Preference. *J. Mark.* **2010**, *74*, 18–31. [CrossRef]
- 17. Brough, A.R.; Wilkie JE, B.; Ma, J.; Isaac, M.S.; Gal, D. Is eco-friendly unmanly? The green-feminine stereotype and its effect on sustainable consumption. *J. Consum. Res.* **2016**, *43*, 568–580.
- 18. Margolis, J.D.; Elfenbein, H.A.; Walsh, J.P. Does it Pay to be Good ... and Does it Matter? A Meta-analysis of the Relationship between Corporate Social and Financial Performance, 2010, *SSRN*. Available online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1866371 (accessed on 20 June 2018).
- 19. Orlitzky, M.; Schmidt, F.L.; Rynes, S.L. Corporate social and financial performance: A meta-analysis. *Organ. Stud.* **2003**, 24, 403–441. [CrossRef]
- 20. Ailawadi, K.L.; Neslin, S.A.; Luan, Y.J.; Taylor, G.A. Does retailer CSR enhance behavioral loyalty? A case for benefit segmentation. *Int. J. Res. Mark.* **2014**, *31*, 156–167. [CrossRef]
- 21. Brown, T.J.; Dacin, P.A. The company and the Product: Company Associations and Corporate Consumer Product Responses. *J. Mark.* **1997**, *61*, 68–84. [CrossRef]
- 22. MacKinnon, D.P. Integration Mediators and Moderators in Research Design. *Res. on Soc. Work Prac.* **2011**, 21, 675–681. [CrossRef]
- 23. Hayes, A.F. An Index and Test of Linear Moderated Mediation. *Multivar. Behav. Res.* **2015**, *50*, 1–22. [CrossRef]
- 24. Becker-Olsen, K.L.; Cudmore, B.A.; Hill, R.P. The impact of perceived corporate social responsibility on consumer behavior. *J. Bus. Res.* **2006**, *59*, 46–53. [CrossRef]
- 25. Van Doorn, J.; Risselada, H.; Verhoef, P.C. *Does Sustainability Sell? The Impact of Sustainability Claims on the Success of National Brands' New Product Introductions*; Working Paper; University of Groningen: Groningen, The Netherlands, 2019.



© 2020 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (http://creativecommons.org/licenses/by/4.0/).