Article

The Impact of Remanufactured Products' Similarity on Purchase Intention of New Products

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Abstract: The remanufacturing industry can realize sustainability by saving resources and protecting the environment. The remanufactured products have a high similarity with the new products, and how they affect consumers' evaluation of the new products is an important issue. This paper discusses the relationship between the similarity of remanufactured products and consumers' willingness to purchase new products, with a mediating effect of perceived quality and a moderating effect of brand reputation. The empirical analysis based on 498 valid samples shows our conclusions below. First, the similarity of remanufactured products has a significant negative impact on the purchase intention of new products. Second, the perceived quality of new products plays a partial mediating role between similarity and purchase intention. Third, brand reputation negatively moderates the relationship between the similarity of remanufactured products and the perceived quality of new products. Furthermore, brand reputation also moderates the mediating effect of the similarity of remanufactured products on the purchase intention of new products through the perceived quality of new products. This paper suggests a new perspective for the research of remanufactured products and provides an important reference for the healthy and sustainable development of recycling and remanufacturing industry.

Keywords: similarity of remanufactured products; purchase intention of new products; brand reputation; perceived quality of new products

1. Introduction

The rapid development of the economy and society has brought great pressure on the environment and resources. The remanufacturing industry, which is being promoted globally, can "win-win" in saving resources and protecting the environment, to realize sustainability. The Chinese government pointed out in the relevant report that the efficiency of resource utilization should be improved comprehensively, the recycling system of waste materials should be accelerated, and the sustainable development of the ecological environment should be promoted. With the rapid development of science and technology, the reliability and durability of the products have been greatly improved, while the service life of the products has been shortened, which is far less than the actual service life. The amount of waste materials from all walks of life has increased sharply [1]. The recycling and remanufacturing industry profits from the exploitation of rich resources built into waste products, and the average profit can exceed 20% of the product's value [2]. However, China's waste products recycling and remanufacturing industry is still in the primary stage with great market potential and development space.

As an important part of the wastes recycling system, the impact of remanufactured products on the new product sales market has attracted much attention, among which the similarity between remanufactured products and new products is the core issue. Many manufacturers are reluctant to introduce remanufactured products for fear that similar remanufactured products will reduce the sales and profits from new products. The similarity of remanufactured products refers to the similarity between the remanufactured

products and the new products in terms of function, appearance, durability, and service. Remanufactured products can be regarded as vertical substitutes for new products [3]. On the one hand, remanufactured products are recycled from new products sold for the first time, which can be regarded as an extension and replacement of new products. On the other hand, remanufactured products are the recycling, refurbishment, or module upgrading of used products, and are often regarded as the vertical and low-end products with green properties of new products. Therefore, the remanufactured products are similar but different from the new products. Many companies have launched remanufactured products in recent years. Apple Inc., in the electronics industry, began to carry out the recycling and remanufacturing plan of old products in 1994. It launched the "Apple Renew" plan in 2016 and began to sell remanufactured mobile phones, tablets, smartwatches and other remanufactured products, and sold 7.86 million refurbished devices in 2018 alone. H&M, which is in the apparel industry, put forward a recycling program in 2013 and launched its "CONSCIOUS" clothing line, which focuses on recycling and remanufacturing clothing. The "Be Mindful" accessory series, launched by LV, a luxury goods company, in 2019, also belongs to the category of products recycling, remanufacturing and reselling.

In the previous literature on remanufactured products, the similarity between remanufactured products and new products is not included. Early studies focused on fields of operation, such as the design and optimization of the remanufactured production process [4], the allocation and coordination of remanufactured costs [5,6], and the cannibalization effect of remanufacturing [7]. With the advancement of the research, the later studies focus on the coordination of the remanufacturing recovery system: to explore the acquisition of the recycling source [8], incentive [9] and cooperation [10], etc. These studies assume that remanufactured products are identical to the new products. At present, studies gradually focus on the marketing issues of remanufactured products, such as risk-utility evaluation [11], green demand [12], social responsibility [13], purchase intention [14,15], and consumers' selling intention [16], etc. However, these studies assume that the remanufactured products and the new products are independent and completely different, and the similarity has not been considered. Consumer purchase intention of new products is the key to profit. The new product market might be negatively affected by similar remanufactured products, which is the most concerning problem for manufacturers when remanufactured products are launched, and also becomes a major obstacle to the healthy development of the recycling and remanufacturing industry in the waste materials recycling system. Therefore, it has become a necessary and important research issue to explore the influence of remanufactured products' similarity to the new products market, especially considering consumers' purchase intention toward new products.

This paper attempts to explore how the similarity between remanufactured products and new products affects the purchase intention of new products through empirical research. The remainder of this study is organized as follows. The second section gives an overview of the previous literature and proposes a theoretical model based on four hypotheses. The third section introduces the sample data and variables' measures. The fourth section shows the research methods and results. The fifth section presents conclusions and managerial implications, and the final section provides research limitations and future research directions.

2. Literature Review and Hypothesis

2.1. Similarity of Remanufactured Products and Purchase Intention of New Products

Purchase intention represents consumers' interest in and the possibility of purchasing a product, which is an attitude variable to measure customers' future contribution to a brand. [17]. The purchase intention of new products in this paper is relative to the remanufactured product, which is a decision made by consumers whether to buy new products or not according to the experience and market environment brought by the enterprise to launch the remanufactured product. When the similarity between the remanufactured product and the new product is higher, the more consistent their ability to meet the needs

of consumers will be, the more consumers will choose to buy the remanufactured product with a more favorable price and give up the purchase of the new product. This paper argues that the similarity of remanufactured products has a negative effect on the purchase intention of new products. The reasons are as below:

1. Remanufactured product similarity produces a substitution effect. Because remanufactured products are recycled, refurbished, or upgraded modules of used products, saving on the consumption of resources and raw materials, the cost and pricing of remanufactured products are relatively low. The low price advantage of the remanufactured product will encroach on the sales of the new product due to the price discount. The average discount factor for remanufactured products currently ranges from 10% to 40%, and its demand curve is non-linear [18]. The substitution effect shows that the decline in sales of a certain product can be attributed to consumers switching to cheaper alternatives [19]. The lower pricing of the remanufactured product attracts consumers to buy the remanufactured product rather than the new product, creating a substitution effect.

2. The similarity of remanufactured products brings about vertical differentiation effect. Remanufactured products are the recycling and reuse of sold products, with a natural green attribute [20], which is a prominent difference from new products. Remanufactured products are often understood and defined as vertically differentiated products of new products [3]. In the electronics industry, for example, according to the Global E-waste Monitor 2020 released by the UN, the total amount of e-waste generated globally in 2019 was 53.6 million metric tons, which increased by 21% in the five years alone. Proper recycling of this e-waste could be worth USD 57 billion, while only 17.4% of it is collected, recycled, and reused. Without being properly recycled, the toxic additives and heavy metals such as mercury and lead contained in electronic products can cause soil pollution, water pollution and air pollution, and even damage the coordination system of the human body. Therefore, the recycling and remanufacturing industry has prominent green properties, which can not only reduce the consumption of resources, but also greatly reduce the pollution to the environment. When there is a high similarity between the remanufactured product and the new product, the remanufactured product can attract more green consumers with environmental protection concepts, or stimulate the environmental protection awareness of consumers, so that they are more willing to buy green remanufactured products and reduce the purchase of new products.

Therefore, this research hypothesized the following:

Hypothesis 1 (H1). *Similarity of remanufactured products has a significant negative impact on purchase intention of new products.*

2.2. Perceived Quality of New Products

Perceived quality is a subjective quality perceived by consumers. It is consumers' overall judgment on the "goodness" of a product, which is based on relevant internal and external information of the enterprise, including the objective attributes and characteristics of the product, etc. [21]. Consumers rely on clues or signals to assess product quality [22]. Perceived quality of new products in this paper refers to the new product quality level evaluated by consumers according to the clues and signals provided by the remanufactured product when the enterprise launches the remanufactured product. This paper believes that the similarity of remanufactured products will negatively affect the perceived quality of new products because:

1. The similarity of remanufactured products will indicate a lower perceived quality of new products. When the remanufactured product is similar to the new product, the perceived quality of the remanufactured product can serve as the reference clue and signal for consumers to evaluate the quality of the new product. The quality of remanufactured products is usually fuzzy and uncertain. Due to fuzzy aversion and

risk aversion, consumers tend to regard the purchase of remanufactured products as a risk decision [23], and the perceived quality of remanufactured products is also evaluated at a lower level [24]. With a high similarity between the remanufactured product and the new product, the perceived quality of the remanufactured product can be regarded as a reference point, which changes the consumers' estimation of the perceived quality of the new product and produces a downward assimilation effect [25]. The assimilation effect means that the valuation of existing objects is close to the reference point, that is, consumers' perceived quality of new products is closer to the lower perceived quality of remanufactured products.

2. The similarity of remanufactured products will result in consumers' suspicion of the quality of new products. Remanufactured products are supplied from original products which are detective, returned and recycled. The higher the remanufactured product similarity is, the more similar the remanufacturing business of the manufacturer is to the new product business, the more likely the consumer will have the following suspicions about the new product quality: (1) the new product's qualified rate is not high, hence it is necessary to carry out the remanufacturing business; (2) the manufacturer will deliberately relax the quality inspection of new products, so as to provide a stable supply source for the remanufacturing business [3]. These suspicions will reduce the perceived quality level of new products to different degrees.

There is usually a direct positive relationship between perceived quality and purchase intention, which is verified from different angles by domestic and foreign literature. For example, Yan et al. [26] from the perspective of a private label, Ramesh et al. [27] from the perspective of corporate social responsibility, Rosillo-Díaz et al. [28] from the perspective of the cultural dimensions uncertainty-avoidance and collectivism, and Evgeniy et al. [29] from the perspective of electronic word of mouth have all confirmed this point of view. The higher the perceived quality level of new products, consumers will be more willing to buy them after purchase evaluation. The higher similarity of remanufactured products, the more negative the perceived quality of new products, while the lower the purchase intention of the new products, and vice versa. The following hypothesis is therefore formulated.

Hypothesis 2 (H2). *Perceived quality of new products has a mediating effect between similarity of remanufactured products and purchase intention of new products.*

2.3. Brand Reputation

The difference in perceived quality of new products caused by the similarity of different remanufactured products may be related to brand reputation. Brand reputation, a comprehensive and subjective evaluation standard, is formed by the accumulation of brand performance in the past [30], and reflects the sum of the cumulative effects of all past and present marketing activities. This paper argues that brand reputation will strengthen the influence of remanufactured product similarity on the perceived quality of new products.

From the perspective of brand reputation information integration, the assimilation effect of high brand reputation will be enlarged. An important factor that makes brand reputation influence consumers' judgment and decision-making behavior is consumers' lack of grasp of product attributes and benefits that come from product information asymmetry or incompleteness. Brand reputation can affect consumers' trust in the brand, and trust reduces uncertainty through credibility and positive expectations [31]. When the similarity between the remanufactured product and the new product is high, this will become a strong and certain negative information, which will not only bring the perceived quality level of new products down to the level consistent with remanufactured products, but may even reduce the evaluation of the brand. The influence of brand crisis information depends on consumers' degree of trust in the brand [32].

Based on the perspective of China's unique culture, the Mianzi level of new products with a high brand reputation will be pulled down. The concept of Mianzi in the Chinese

cultural value system is one of the main motivations for Chinese consumers to make purchases [33], especially for luxury goods. Many consumers tend to pursue and buy famous brand products visible to the public to show their wealth and express their social status and self-image [34]. New products with a high brand reputation can express the buyer's high Mianzi level. Even at the life cycle stage of growth and maturation, "popular" type of remanufactured products will also be understood and defined as the product of vertical low-end products, due to the drawbacks of subjective feeling or objective aspects such as appearance or function, as well as "has been used by others" [3]. Vertical low-end remanufactured products with high similarity to new products are likely to lower the Mianzi level of consumers brought by new products with high brand reputation, and further reduce consumers' perception and evaluation of the quality of new products. Furthermore, under a low brand reputation context, the negative impact of high remanufactured product similarity on the perceived quality of new products may not be strengthened since the lack of pursuit of famous brands and Mianzi. In this regard, the following hypothesis is proposed:

Hypothesis 3 (H3). *Brand reputation has a moderating effect on the relationship between the similarity of remanufactured products and the perceived quality of new products. In the case of high brand reputation, the similarity of remanufactured products has a stronger negative impact on the perceived quality of new products.*

Based on the previous analysis of Hypotheses 2 and 3, this study further concluded that brand reputation would moderate the mediating effect of perceived quality of new products, which therefore constituted the moderated mediating effect. With a lower brand reputation, there is a smaller influence of remanufactured product similarity on the perceived quality of new products, and the impact from remanufactured product similarity via perceived quality of new products on purchase intention of new products is weaker. On the contrary, with a higher brand reputation, the relationship between the similarity of remanufactured products and perceived quality of new products is stronger, then the negative effect in this transmission mechanism will increase. The aforementioned discussion leads to our fourth hypothesis as follows:

Hypothesis 4 (H4). *Brand reputation has a moderating effect on the mediating effect of perceived quality of new products. In the case of high brand reputation, the perceived quality of new products plays a stronger mediating role.*

Figure 1 is the research model of this paper. On the whole, this paper believes that similarity of remanufactured products not only has a direct negative impact on purchase intention of new products, but also has an indirect impact through the mediating effect of perceived quality of new products, and brand reputation plays a key moderating role in this process.

Figure 1. Research model.

3. Methodology

3.1. Data Collection and Sample

This research collected 200 valid questionnaires for the pre-test. The scales in the pre-test passed the reliability and validity test, with Cronbach's Alpha of all variable scales

greater than 0.7, KMO of 0.828, Sig in Bartlett's Test of Sphericity less than 0.001, and cumulative variance explained by factors of 76.615%. Subsequently, this study distributed questionnaires through online and offline channels. A total of 620 questionnaires were recovered, including 122 invalid questionnaires and 498 valid ones, with an effective recovery rate of 80.3%.

In the sample of this paper, male subjects accounted for 46.4% and female subjects for 53.6%. The subjects were aged between 18 and 45 years old, accounting for 95.4%. In terms of education level, 16.2% have a high school degree or below, 21.9% have a college degree, 36.7% have a bachelor's degree, and 25.2% have a master's degree or above. According to monthly household income, 3.4% are below 5000 yuan, 20.9% are between 5000 yuan and 10,000 yuan, 40.2% are between 10,000 yuan and 20,000 yuan, and 35.5% are above 20,000 yuan.

3.2. Measures

All the variables involved in this paper were measured by a 7-point Likert-type scale (1 means "strongly disagree", while 7 means "strongly agree"). Among them, the similarity of remanufactured products adopted the scale developed by Agrawal et al. [3], for example: the new product is similar to the remanufactured product in performance. Brand reputation used items prepared by Selnes [35], for example: "I think this brand's reputation is higher than that of other competing brands in the market". Perceived quality of new products chose the item scale developed by Agrawal et al. [3], for example: "The quality of new products will deteriorate after the remanufactured products are launched". The items of Azizan et al. [36] were chosen for purchase intention of new products' scale, for example: "After the brand launched the same type of remanufactured products, I was no longer willing to buy new products". The items of perceived quality of new products and purchase intention of new products are coded in reverse.

4. Empirical Results

4.1. Reliability and Validity

In this paper, SPSS 23.0 was used to test the reliability of the scale involving variables in the study. The test results showed that the internal consistency score of the similarity of remanufactured products was 0.804, the score of brand reputation was 0.802, the score of perceived quality of new products was 0.811, and the purchase intention of new products' was 0.794. The internal consistency scores are all greater than 0.7, indicating that each scale was with high reliability. To test the distinction between key variables, AMOS 22.0 was used in this paper to conduct a confirmatory factor analysis of key variables. According to the analysis results in Table 1, the fitting indices of the four-factor model were within the acceptable range and better than those of other comparison models (χ^2/df = 2.41, CFI = 0.982, NNFI = 0.970, IFI = 0.983, RMSEA = 0.053), which indicated that the four variables in this paper had good discriminant validity.

Table 1. Confirmatory factor analysis results.

Models	χ^2/df	CFI	NNFI	IFI	RMSEA
Five-Factor Model: SIM, REP, PQ, NWTB	2.41	0.982	0.970	0.983	0.053
Four-Factor Model: SIM, REP + PQ, NWTB	16.15	0.785	0.677	0.786	0.175
Three-Factor Model: SIM + REP, PQ, NWTB	15.70	0.791	0.687	0.793	0.172
Two-Factor Model: SIM, REP + PQ + NWTB	25.91	0.617	0.469	0.619	0.224
One-Factor Model: SIM + REP + PQ + NWTB	36.42	0.434	0.245	0.437	0.267

Note: SIM, similarity of remanufactured products; REP, brand reputation; PQ, perceived quality of new products; NWTB, purchase intention of new products.

4.2. Correlation Analysis

The results of the correlation analysis are shown in Table 2. Similarity of remanufactured products is significantly negatively correlated with perceived quality of new products (r = −0.183, $p < 0.01$), significantly negatively correlated with purchase intention of new products (r = −0.234, $p < 0.01$). Perceived quality of new products is significantly positively correlated with purchase intention of new products (r = 0.210, $p < 0.01$). The correlation coefficient between brand reputation and similarity of remanufactured products is 0.277 ($p < 0.01$), and the correlation between brand reputation and perceived quality of new products is −0.231 ($p < 0.01$), between brand reputation and purchase intention of new products is −0.222 ($p < 0.01$). The results were in line with expectations, thus the correlation analysis preliminarily validated the research hypothesis.

Table 2. The matrix of correlation.

Variable	1	2	3	4	5	6	7
1. Gender [a]	1						
2. Age [b]	0.811 **	1					
3. Income [c]	0.754 **	0.750 **	1				
4. SIM	0.035	−0.011	0.015	1			
5. PQ	0.033	0.028	0.024	−0.183 **	1		
6. REP	−0.039	−0.060	−0.030	0.277 **	−0.231 **	1	
7. NWTB	0.001	−0.020	−0.024	−0.234 **	210 **	−0.222 **	1
Mean	1.536	1.900	3.078	4.2663	3.74	4.318	3.83
Std	0.4992	0.8937	0.8343	1.43345	1.663	1.6163	1.621

Note: N = 498; ** $p < 0.05$; SIM, similarity of remanufactured products; REP, brand reputation; PQ, perceived quality of new products; NWTB, purchase intention of new products. [a] Gender: (1) Male, (2) Female; [b] Age: (1) 18–25, (2) 26–35, (3) 36–45, (4) 46 or above; [c] Income: (1) Under 5000 RMB, (2) 5000-under 10,000 RMB, (3) 10,000-UNDER 20,000 RMB, (4) 20,000 RMB or above.

4.3. Hypothesis Test

In this paper, SPSS 23.0 was used to test the model through hierarchical regression analysis. The specific results are shown in Table 3.

Table 3. Hierarchical regression analysis results.

Variable	PQ				NWTB			
	M1	M2	M3	M4	M5	M6	M7	M8
Gender	0.030	0.052	0.049	0.051	0.067	0.096	−0.061	0.087
Age	0.007	−0.015	−0.028	−0.041	−0.042	−0.07	0.043	−0.067
Income	−0.003	−0.001	0.004	0.019	−0.043	−0.04	0.042	−0.04
SIM		−0.185 ***	−0.131 **	−0.132 **		−0.237 ***		−0.206 ***
PQ							0.210 ***	0.172 ***
REP			−0.194 ***	−0.201 ***				
SIM*REP				−0.149 **				
R^2	0.001	0.035	0.070	0.092	0.002	0.058	0.046	0.087
ΔR^2	−0.005	0.027	0.060	0.081	−0.004	0.050	0.038	0.077
F	0.178	4.481	7.383	8.281	0.310	7.582	5.928	9.320

Note: N = 498; *** $p < 0.01$, ** $p < 0.05$; SIM, similarity of remanufactured products; REP, brand reputation; PQ, perceived quality of new products; NWTB, purchase intention of new products.

The main effect test was performed first. As model 6 (M6) shows in Table 3, the similarity of remanufactured products had a significant negative impact on the purchase intention of new products (β = −0.237, $p < 0.001$). Thus, H1 was supported.

Then we examined the mediating effect. It could be seen from model 2 (M2) in Table 3 that the similarity of remanufactured products had a significant negative correlation with the perceived quality of new products (β = −0.185, $p < 0.001$). Model 8 (M8) showed that when the perceived quality of new products was added, the negative effect of similarity of

remanufactured products on purchase intention of new products was -0.206 ($p < 0.001$) reduced from -0.237 ($p < 0.001$), and the influence of perceived quality of new products on purchase intention of new products was still significant, with a regression coefficient of 0.172 ($p < 0.001$). Therefore, a preliminary conclusion could be drawn that the perceived quality of new products partially mediated the relationship between the similarity of remanufactured products and the purchase intention of new products.

In addition, the Process plug-in in SPSS 23.0 was used for Bootstrapping analysis to determine the significance of the indirect effect of similarity of remanufactured products on the purchase intention of new products through the perceived quality of new products. The analysis results showed that the 95% confidence interval was (-0.0552, -0.0124), excluding 0, and the indirect effect was significant, with the effective value of -0.0318. After controlling the mediating variable of perceived quality of new products, the direct effect of r similarity of remanufactured products on purchase intention of new products was still significant. The 95% confidence interval was (-0.2921, -0.1193), without 0, as well as the effect value was -0.2057. Therefore, the perceived quality of new products had a partial mediating effect, and H2 was supported.

Furthermore, we examined the moderating effect. As could be seen from Model 4 (M4) in Table 3, the regression coefficient of "SIM*REP" was significant ($\beta = -0.149$, $p < 0.01$), indicating that brand reputation significantly moderated the relationship between the similarity of remanufactured products and perceived quality of the new products. Therefore, H3 was supported. In this paper, the moderating effect of brand reputation on the similarity of remanufactured products and perceived quality of new products was plotted (Figure 2), and a simple slope test was carried out, so that this moderating effect could be more intuitively demonstrated. Based on the mean value of brand reputation plus or minus one standard deviation, the simple slope test results showed that when brand reputation was high, the negative impact of similarity of remanufactured products on the perceived quality of new products was significant ($\beta = -0.2877$, $p < 0.001$). When brand reputation was low, the relationship between the similarity of remanufactured products and the perceived quality of the new product was not significant ($\beta = 0.0234$, $p > 0.05$). Therefore, H3 was further supported.
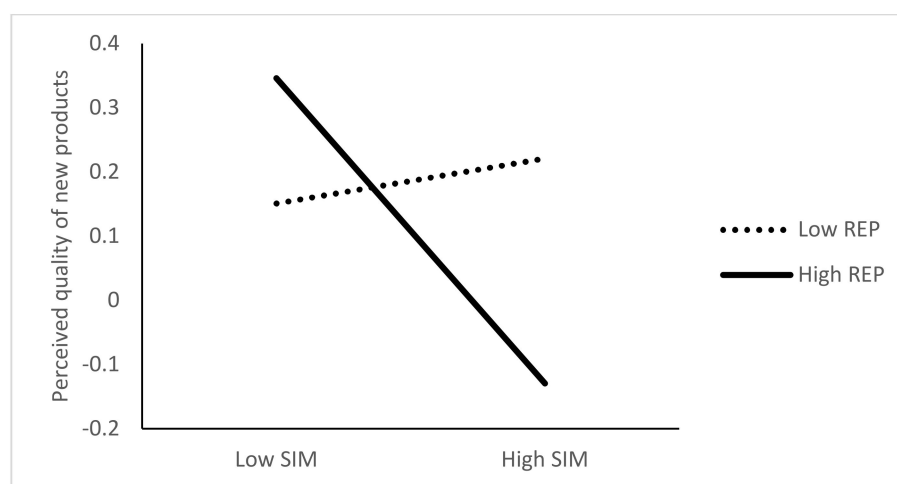

Figure 2. The moderating effect of brand reputation.

For the verification of H4, this paper used the Process plug-in of SPSS 23.0 to conduct the Bootstrapping test of conditional indirect effects. The test results are shown in Table 4. When the company had a high brand reputation, the similarity of remanufactured products had a significant indirect influence on the purchase intention of new products through the perceived quality of new products. On the contrary, the indirect effect was not significant while with a low brand reputation. Thus, H4 was partially supported.

Table 4. Conditional indirect effects test.

Moderated Variable	Effect	SE	CI at 95% Level	
Low REP	0.004	0.0119	−0.0194	0.0289
Medium REP	−0.0227	0.0094	−0.0432	−0.0066
High REP	−0.0495	0.0153	−0.0815	−0.022

Note: SE, standard error; CI, confidence interval; REP, brand reputation.

5. Conclusions and Implications

In the context of ecological recycling and sustainable development, as an important part of the recycling system of waste materials, the research on remanufactured products is of great significance to the healthy development of the remanufacturing industry. Previous research is based on the assumption that remanufactured products and new products are identical or completely different. In contrast to previous research, this paper relates remanufactured products to new products, regarding remanufactured products as similar but different products from the new ones, and studies the effect of remanufactured products to purchase intention of new products from the perspective of the similarity between remanufactured products and new product, as well as reveals the mediating role of the perceived quality of new products and the brand reputation's moderating impact.

The findings of this study are as follows. Firstly, the similarity of remanufactured products does have a negative impact on the purchase intention of new products. The more similar the remanufactured product is to the new product, the lower the willingness of consumers to purchase the new product. Secondly, the perceived quality of new products plays a partial mediating role between the similarity of remanufactured products and the purchase intention of new products. The high similarity of remanufactured products can negatively affect consumers' perceived quality of new products and reduce consumers' purchase intention of new products. Thirdly, brand reputation negatively moderates the relationship between the similarity of remanufactured products and the perceived quality of new products and the mediating effect from the similarity of remanufactured products to purchase intention of new products through the perceived quality of new products. High brand reputation strengthens the negative impact of remanufactured product similarity on the perceived quality of new products, and also strengthens the mediating effect. The research conclusions of this paper not only broaden the scope of existing theoretical research, but also provide a reference for enterprises to make remanufacturing decisions and for the construction and healthy development of the remanufacturing industry, which has important practical significance and positive managerial implications.

Aiming at the direct effect of similarity of remanufactured products, remanufacturing enterprises can carry out differentiated marketing strategies for remanufactured products and new products. This study shows that the similarity of remanufactured products has a direct negative impact on the purchase intention of new products, which can be reduced by the differentiation marketing strategy due to the perceived similarity of consumers. First of all, using models or time differentiation marketing strategy, manufacturers can limit the number of remanufactured products they bring to market to older models, or to ensure that the time of remanufactured product launch at the end of the cycle of the product market, in order to reduce the similarity between new products and remanufactured products, mitigating the market impact of remanufactured products on new products so as to avoid the weakening of new purchase intention. Secondly, the dynamic differential pricing is adopted. The nonlinear differential pricing is carried out for the remanufactured products. The price of remanufactured products close to the price of new products is designed first to reduce the substitution effect brought by the price advantage of remanufactured products. In the next stage, reasonable discount prices are designed for remanufactured products.

Moreover, in view of the mediating effect of perceived quality, remanufacturing enterprises can apply digital technology in the closed-loop supply chain of recycling and remanufacturing. This study finds that the similarity of remanufactured products negatively affects the perceived quality of new products, thus reducing the purchase

intention of new products. The assimilation effect pulls down the perceived quality of new products to the lower perceived quality of remanufactured products. Uncertain risk is the most prominent risk in the perceived quality of remanufactured products [23]. Enterprises can widely promote digital technology in the recycling system, building the Internet of Things as well as the application of cryptography closed-loop supply chain scenario based on the fifth-generation communication technology. The Internet of Things supports information connectivity in a closed-loop process of initial sales, use, recycling, remanufacturing, and resale, while encryption technology ensures authenticity and that information cannot be tampered with [37], effectively reducing the consumers' perceived uncertainty of remanufactured product risk through more fully and more transparent information, reducing consumers' doubts, further improving the perceived quality of remanufactured products with green attributes. As a result, the perceived quality and purchase intention of new products can be improved, so as to promote to form a good linkage cycle system.

Finally, as for the moderating effect of brand reputation, the original equipment manufacturer can adopt the strategy of entrusting the third party enterprises to recycle, remanufacture and resell. This study shows that brand reputation negatively moderates the relationship between the similarity of remanufactured products and perceived quality of new products as well as the mediating effect of the perceived quality of new products. The original manufacturer may entrust the recycling and remanufacturing business to a third party enterprise in the form of a contract, for example, HP's IPG (Imaging and Printer Group) commissioned the third-party remanufacturers and logistics providers to recycle and remanufacture products from its inkjet printer line [38]. Compared with the original manufacturers, the third-party enterprise is usually with a shorter operation time, smaller scale, and different business scope, therefore the brand reputation will usually be lower than the original manufacturer, which will not strengthen the relationship between similarity of remanufactured products and perceived quality of new products, as well as the mediating role of perceived quality. In addition, the third-party companies can provide specialized recycling, remanufacturing, sales, and after-sales service systems for the remanufactured products. Its production line, channels, platforms and service is very different from the new products', highlighting the differentiation between the remanufactured and new product market segments, while also weakening the similarity between remanufactured products and new products, thereby reducing the negative influence on the new product purchase intention.

6. Limitations and Future Research

The limitations and prospects of this paper mainly include the following three points. Firstly, this paper studies the manufacturers in the form of oligopoly, without considering the participation of third-party remanufacturers or other competitors in the competition. However, in the actual competitive market environment, the new products will not only compete with the remanufactured products launched by the original manufacturers but also compete with the remanufactured products of the third-party enterprises. In the future, the competitive market structure can be considered for further research. Secondly, the products involved in this paper are still limited to the electronic product market. Electronic products are innovative products, and functional products are not included in this research. In the future, comparative studies of remanufactured products in multiple industries and categories can be considered to obtain more comprehensive conclusions. Thirdly, due to the high uncertainty, fuzziness, and complexity of the recycling and remanufacturing industry, the application of digital technology can reduce information asymmetry and transaction costs. Further research can make an in-depth exploration on the enabling of digital technology for the recycling and remanufacturing industry.

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