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## The Effects of Online Product Reviews on Sales Performance: Focusing on Number, Extremity, and Length\*

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### Abstract

**Purpose** - The purpose of this study is to analyze the impact of customer 's communication on sales performance in the online market.

**Research design, data, and methodology** - This study uses linear regression analysis to examine the effects of product review characteristics which are the result of customer 's communication, on sales performance by using product reviews of online marketplace Amazon.

**Result** - The increase in the number of product reviews positively affected sales performance. An increase in extreme opinions in the product review has a positive effect on sales performance. The product review length has a negative effect on sales performance.

**Conclusions** - This study has shown the online marketplace customers' communication can influence sales performance using product review big data. This study contributed to the theoretical completeness by analyzing all the products of the book category in Amazon online market. This research will complement the theories regard to the customer behavior affecting sales performance. We expect the empirical analysis result will provide empirical help to sellers, online marketplace operators, and customers. In particular, the number of letters in the product may negatively affect sales performance, so sellers need to consider this effect carefully when exposing product reviews.

**Keywords:** Online market, product reviews, rating extremity, sales performance, Amazon.

**JEL Classifications:** C21, D71, E20.

### 1. Introduction: backgrounds and the purpose of the research

An online marketplace is a place where sellers and buyers make transactions online, and it sometimes referred

to as an e-marketplace(Wang & Archer, 2007). The online marketplace, which has developed rapidly after the emergence of the Internet(Lee, Park, & Han, 2011; Ahn, Ryu, & Han, 2004), is growing enough to drive out some traditional offline markets such as department stores(Koo & Ju, 2010). Especially after 2007, the emergence of smartphones and the spread of various mobile devices has had a major impact on the growth of the online marketplace (Lu & Yu-Jen, 2009).

Perea, Dellaert, and De Ruyter (2004) found the factors affecting the success of the online marketplace. Those were the product quality, service quality, customer return on investment (CROI), experience, operability, convenience, and pleasure. They insisted that the consumers' attitudes to an online marketplace that influence purchase intent are affected by usability and enjoyment factors. The characteristics of the online market itself, such as web site design, the reliability of the payment process, response to the request, and the trust of the shopping mall, can also affect the sales

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performance, so (Lee & Lin, 2005). The quality of user interface, the quality of product information, the quality of service information, security, and shopping mall awareness also affect the purchase behavior of online marketplace (Park & Kim, 2003). The impact of those factors, such as usability, convenience, and enjoyment, on sales performance, depends on whether it is a utilitarian or a hedonic style shopping (Childers, Carr, Peck, & Carson, 2001).

Since the online marketplace is separated from time and space with the customer by nature, it is hard to trust compare to the general offline face-to-face transaction. So, there are a variety of ways to increase trust in online marketplaces such as credit cards, public accountants, and agents. But they do not fully cover transaction risk issues and it is causing additional cost problems (Kollock, 1999).

In relation to trust issues in the online marketplace, communication with customers and sellers (companies) has begun to attract attention. In the 1990s, research related to product success has focused on communication between companies (Lust & Brown, 1996; Grönroos, 1997; Webster, 1992) and between companies and customers (Condit, 1994; von Hippel, 1988). In the early 2000s, the study of product success was focused on the influence of experts' products review (Chen & Xie, 2005) and the influence of recommendation systems (Chen et al., 2004; Gretzel & Fesenmaier, 2006). The effects of feedback mechanisms also have been studied extensively (Ba & Pavlou, 2002; Pavlou & Gefen, 2004).

In addition to these factors affecting the sales performance of the online marketplace, the recent noteworthy part is social media factors such as product reviews. Online communities have formed a gift economy (Rheingold, 1993), which provides meaningful information, but does not want an immediate reward. The online community related to product evaluation began to gain popularity like Angie's List (1995), TripAdvisor (2000), Yelp (2004), Facebook Page (2007), and Foursquare (2008). An effective online branding community creates value-creating practices, and enhance brand loyalty (Ha, 2018). Social media is a Web 2.0-based internet media that enables users to produce and exchange content (Kaplan & Haenlein, 2010). In Web 1.0, content creators were few and most users are simply content consumers (Cormode & Krishnamurthy, 2008). The early online marketplace functioned as Web 1.0 to provide the product, payment, and delivery information. Recently, however, the online marketplace has a Web 2.0-based social media element that allows consumers directly write a product review, and other consumers can evaluate the usefulness of such product review. These social media factors can also affect the reputation of corporate brands (Lee & Kwag, 2017). In the past, these social media elements exist outside of the online marketplace, such as professional product review sites Cnet.com and Yelp.com. But these days the elements also exist internally in the form of product reviews or instant messengers (Guo, Wang, &

Leskovec, 2011). These online consumers communication is called an electronic word of mouth (e-WOM) comparing the word of mouth (WOM) in offline. Word of mouth provides product reputation as a whole and affects consumer's purchase Intent (Amblee & Bui, 2011).

Product reviews usually consist of ratings, review text, product photos, writer's names, titles, and date of writing. Consumer-written product reviews are among the most influential factors in the online marketplace's purchase decision making (Hu, Pavlou, & Zhang, 2006; Huang, Lurie, & Mitra, 2009). A certain amount of information about the product is essential for purchasing decisions (Byun, 2018). Amazon (www.amazon.com), a leading online marketplace, places a lot of product reviews, average ratings, positive reviews, negative reviews, and useful reviews in a prominent place so that buyers can easily visible. People who want to buy products from the online marketplace often get information from product descriptions that sellers provide. They also get a lot of information from consumers' product reviews. Because sellers are likely to reduce negative information in and exaggerate positive information in order to increase sales performance. Product reviews left by buyers may be more reliable because they may be relatively less biased than sellers' information (Brister, 1991; Robertson et al., 1984; Xiao & Benbasat, 2011). Consumers can use positive and negative contents of product reviews as criteria for decision making (Eisend, 2006).

The sociology theory and information economics theory related to the formation of public opinion provides various implications. In the opinion formation theory, group opinions are influenced by the members, converging to the mean or being polarized to a specific opinion(s) (Ryan, 2006; Coovert & Reeder, 1990). Negative information enhances discrimination (Eisend, 2006). From the information economics theory, the aspect of a product review is different according to the characteristics of the product (Mudambi & Schuff, 2010). Mudambi and Schuff (2010) argue the moderating effects in the usefulness of extreme product reviews depending on product characteristics as search or experience product. But, the search and experience product criteria in that research are not clearly applicable in the current online market. For example, in the past research, experience product is defined that it is difficult to judge the value before purchasing. However, current online marketplace such as Amazon.com, show some pages of books which help the valuation of the book intuitive. Because of this ambiguity, On the other hand, cameras were classified as an experience product (Milgrom & Roberts, 1986; Mudambi & Schuff, 2010), although they are classified as search product (Huang et al., 2009). Studies based on a small number of these products should be researched in a similar group or similar product category dimension. In this study, we conducted an empirical analysis at the category level in order to overcome the limitations of a small number of products.

In the meantime, interest in the product reviews of the

online market has been high, but studies related to product reviews have been conducted on limited products (Varian, 1980; Milgrom & Roberts, 1986; Bei et. al., 2004; Bhattacharjee et. al., 2006; Weathers et. al., 2007; Huang et. al., 2009; Mudambi & Schuff, 2010). There have been various reasons why the research on the product review has been done in such a fragmented form, but the major reason was difficult to get the desired product review data easily.

Fortunately, in recent decades, product reviews and product sales data have been relatively easy to obtain in the form of big data. The use of this big data can be a great help to fill the lack of past research. And the research on the product review of the online market has been limited within the framework of limited theories such as information economics. If we analyze the various behaviors of customers with the product review by referring to the formation of public opinion theory which has been carried out for a long time in sociology, it can suggest not only expansion of theory but also empirical implications.

## 2. Literature Review

Information Economics Theory (Varian, 1980; Milgrom & Roberts, 1986) has begun to emerge analyzing the effect of search costs on product information on purchase decisions. Information economics theory has been studied mainly on information recognition, diagnosis, and convergence of opinion in the marketplace. For example, research on information cognition shows that people perceive positive information as more positive and negative information as more negative (Higgins & Lurie, 1983). Also, when positive information and negative information is recognized at the same time, people are more impressed with negative information (Coovert & Reeder, 1990). People expect to have unexpected information in extreme information which is not included in normal information (Fiske, 1980) and recognize the extreme information is more diagnostic (Skowronski & Carlston, 1989). Buyers who leave a product review on the online marketplace may give more extreme opinions to show off their claims, which may be perceived as more persuasive and diagnosable by other consumers.

In online space such as the Internet, group opinions converge to one side or become polarized not randomized (Spears et. al., 1990; Lee, 2007). Depersonalization is more likely to occur in online because members of an online subgroup are guaranteed anonymity, and the influence of group opinion is greater than that of individuals (Lea & Spears, 1991; Spears & Lea, 1992; Reicher et. al., 1995). Also, unlike in the offline, there is no arbitrator in the online space to arbitrate the discussion. The expression of opinion in the online space is likely to become extreme (Wallace, 1999). The anonymity and decentralization in online spaces can easily lead to deviations such as human attacks (Postmes & Spears, 1998). For community groups exist

online space, extreme opinions are more likely to occur when homogeneity is high (Wallace, 1999). From this point of view, if someone searches product review in the online marketplace for product evaluation, there is a high possibility that the evaluation will be extreme in the absence of an arbitrator who will have appropriate control compared to the purchase history.

Providing two-sided arguments both with negative and positive information, rather than providing only positive information when advertising the product, increases consumers' diagnosticity (Eisend, 2006). For example, it is more confident that "twice as expensive, but twice as good" than the ad that says "Our product is twice good" in the advertisement. Negative comments may negatively affect sales performance by highlighting the negative aspects of the product. However if the negative product reviews exist with positive product reviews in the online marketplace, it may also have a positive effect on performance.

It is a considerable effort for buyers to leave a product review on the online marketplace. Nevertheless, many buyers spend time for a product review because they want to influence other people's purchasing activities (Chatterjee, 2001). In addition, just because the online platform supports writing a product review, they leave a product review. In order to purify the negative emotions after purchasing the product, worry about others, positive self-confidence in purchasing the product, advising others and the expectation of compensation, they write a product review (Henning-Thurau, 2004).

Product review is more reliable than the product information provided by the firm (Chatterjee, 2001). Ratings checked when writing product review has a positive effect on the sales ranking (Benlian et al., 2012). Consumers who have read others' product review can vote whether it is useful or not. The useful product review which many people voted as useful has a positive influence on the purchase intention (Benlian et al., 2012). Based on the above research, it can be expected that product review will affect sales performance, whether positive or negative, an online marketplace. But how product review directly affects sales performance is not well studied.

According to the information economy theory (Varian, 1980), people try to evaluate the value of a product through information search and reduce the purchase cost. But when searching for additional information is not likely better, the purchasing decision is made mainly by referring to the information so far.

In order to analyze the influence of product review on sales performance, several studies were conducted empirically using several product review data. However, when conducting an empirical analysis of several products, a subjective error may occur when selecting a product. To overcome this problem, the product selection process should be changed by extending product selection to category level and analyzing all the products in a particular category.

### 3. Methodology: research design, data, and methodology

#### 3.1. Hypotheses

##### 3.1.1. The product review numbers' impact on the sales performance

The process of purchase decision-making is a process of reducing uncertainty (Mudambi & Schuff, 2010). The increase of the information provided by the seller and the buyer reduces the uncertainty, it has a positive effect on decision making. Sellers in the online marketplace provide a variety of information to increase sales volume. This information includes product value, price, quality, performance, ingredient, content, purchase method, special offer, taste, nutrition, packaging method, warranty, safety, external agency evaluation, internal agency evaluation and new idea (Abernethy & Franke, 1996). When more information is added, decision-makers are more confident (Shogren, 2018). Providing a lot of information increase the persuasiveness to buyers (Schwenk, 1986).

However, the information provided by the seller is bound to the intention to increase sales volume. Sellers are more likely to miss out on negative information that may negatively affect sales volume and exaggerate positive information, so reliability is relatively low compared to product review (Chatterjee, 2001). Because buyers often write product reviews to help others make purchasing decisions, the increase in information delivered in the product review is more positive than by the sellers. Therefore, if the number of product review increases, there is a high possibility that reliable information increase, which has a positive effect on sales performance.

Buyers leave a product review simply because the online platform supports product review writing (Henning-Thurau, 2004). But there is needed much effort for buyers to write product reviews on the online market. Still, the main reason for leaving a product review is to influence other people's purchasing activities (Chatterjee, 2001). The existence of a lot of product review includes the much intention to actively influence other people's purchase of the product. And the more positive or negative the product review make the higher the diagnosticity (Eisend, 2006) for other buyers which will have a positive effect on sales performance.

The following hypotheses are presented on the basis of the above.

**H 1:** The increasing number of product reviews will have a positive impact on sales performance.

##### 3.1.2. Product review extremity impact on sales performance

Online market buyers use product reviews to make purchasing decisions (Hu, Pavlou, & Zhang, 2006; Huang,

Lurie, & Mitra, 2009). Consumers want to collect information to help them make purchasing decisions in the process of evaluating the value of the product and comparing prices. The product review can contain greatly help information for their decision (Mudambi & Schuff, 2010). Therefore, online market buyers actively utilize product review to make purchasing decisions (Hu, Pavlou, & Zhang, 2006; Huang, Lurie, & Mitra, 2009). One of the elements of the product review can be easily used to judge the value of the product is the rating. On the Amazon market, when writing a product review, the product is rated at 1 in the worst case and 5 in the worst case. To make it easy for consumers to use ratings in product evaluations, Amazon places a number of product reviews in a prominent place and rating with the five stars. Also, when someone selects the star of a rating, the ratio of the rating disclosed. If someone wants to see the detail page of the product review, one just clicks the review number beside the star.

Consumers who purchased a product may be able to write objective product reviews without being influenced by other people's opinion. But in many cases, they will be influenced by previous reviews (Chatterjee, 2001; Henning-Thurau, 2004). According to the self-categorization theory, individuals have a habit of being included in a group with similar opinions, and there is a high possibility that opinions are shifted to one side (Turner et al., 1989). In particular, in the online space, the expression of opinion is somewhat more anonymous and unlike offline discussions, there is no mediator, it is more likely to go more extreme direction (Wallace, 1999; Spears, Postmes, Lea, & Wolbert, 2002). Opinions of product reviews in the online marketplace may be biased in the extreme direction. A person with a negative opinion on the product will give a more extreme rating (eg 1 point) to persuade others and a more extreme positive rating (eg 5 points) who have a positive opinion (Laughlin & Earley, 1982), to be accepted (Laughlin & Earley, 1982; Isenberg, 1986).

The reason for writing a product review in an online market is to influence others, such as helping others to buy. Therefore, someone would like to see that their assertions expressed in the product review can contribute to the decision making of other consumers (Skowronski & Carlston, 1989). Diagnosticity refers to making the distinction between the choices and the alternatives (Bassok & Trope, 1984). Extreme or negative behavior has a diagnosticity which is better distinguished than normal or positive behavior (Skowronski & Carlston, 1989). Negative feedback gives a greater impression than positive feedback (Coovert & Reeder, 1990).

Mudambi and Schuff (2010) showed that in the last study, the extreme product review is highly diagnostic and useful to consumers. This is in line with the argument that advertising reliability is enhanced when the two-sided argument is used not only positive information but also negative information about the product value in the advertising text (Eisend,

2006). Consumers rate extreme ratings reviews more useful (Mudambi & Schuff, 2010). Useful reviews have a positive effect on sales performance (Benlian et al., 2012). In the case of Amazon shopping malls, as the extreme rating increases, the rating will be 1 point (negative) or 5 points (positive). Ultimately, extreme product review will give diagnostics to help one make purchasing decisions, which will have a positive impact on sales performance.

The following hypothesis is presented on the basis of the above.

**H 2:** Increase of extreme opinions in the product review will have a positive impact on sales performance.

3.1.3. The influence of the product review length on sales performance

The product review length is known to affect the usefulness of product reviews (Mudambi & Schuff, 2010; Schindler & Bickart, 2012). If the product review length is small, it means the writer left a little information. According to the social sharing of emotion theory (Rimé et al., 1992), people tend to share emotions and experiences with others to receive recognition. In the sharing of emotions, negative situations, emotions, and information have a greater weight than positive ones, which is called negativity bias (Lee et al., 2009). As a result, buyers are more actively sharing their negative experiences and information (Zeelenberg & Pieters, 2004). Negative comments in product reviews give a greater impression than positive comments (Covert & Reeder, 1990). Those who want to convey negative experience or information will write a long product review with a greater weight. In relation to the effect of product review length on sales performance, Mudambi and Schuff (2010) argued that the product review length had a positive effect on the usefulness evaluation. Chevalier and Mayzlin (2006) found that longer product previews are negatively related to product market share. They argued that the reasons are the negative review is written more enthusiastically and longer, and the impact of the negative review is greater than the positive review. As a result, relatively long product reviews

are likely to have been written for negative emotional remediation (Henning-Thurau, 2004). So the long product review would negatively impact sales performance.

The following hypotheses are presented on the basis of the above.

**H 3:** The product review length will have a negative impact on sales performance.

3.2. Research Model

The research model of this study is shown in the following Figure 1.

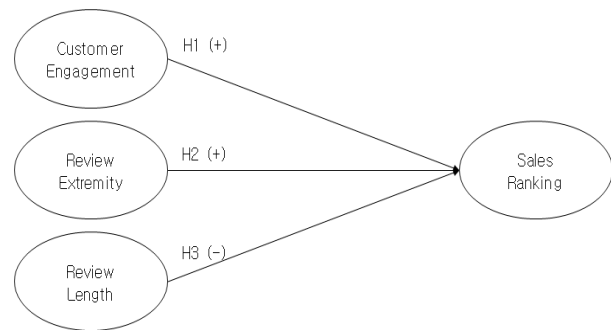


Figure 1: Research Model

3.3. Data collection

The data used in this study is mainly based on the research data of He and McAuley (2016). They used the data to research related to the product repurchases. In this study, the variables related to the product review and the sales performance are mainly used for analysis among the data. The product review data used in the empirical analysis include 8,898,041 product reviews of 367,982 products in the Book category in the Amazon Online Marketplace for the last 19 years, from 1996 to 2014 (He & McAuley, 2016). The results of the descriptive statistics analysis are as follows.

Table 1: Descriptive Statistics

	Minimum	Maximum	Average	Standard Deviation
Number of product reviews	5	7,440	24.18	66.30
Rating standard deviation	0.00	2.19	0.88	0.418
Product Review length	63.00	13,459.50	887.40	563.15
price	0.00	930.75	9.45	10.40
Average rating	1.00	5.00	4.26	0.51
Product description text	0	135,095	965.54	1,287.19
Skewness of rating	-10.23	3.69	-.94	.76
Sales Rank	1	14,618,049	1,194,753.44	1,551,714.74

\* n = 367,982

### 3.4. Methodology

Based on the previous studies (Mudambi & Schuff, 2010; DiMaggio et al., 1996; Liu, 2006; Cui, Lui, & Guo, 2012; Herr, Kardes & Kim, 1991; Varian, 1980; Milgrom & Roberts, 1986; Benlian et al., 2012; Miao & Mattila, 2007), the dependent variable is set to the sales ranking of the last day of data collection.

As the independent variable, the number of products, the standard deviations of the product, and the average word count of the product reviews are set based on the previous studies (Mudambi & Schuff, 2010; DiMaggio et al., 1996; Liu, 2006; Cui, Lui, & Guo, 2012; Herr, Kardes & Kim, 1991; Varian, 1980; Milgrom & Roberts, 1986; Benlian et al., 2012; Miao & Mattila, 2007).

As the control variables, price, and product description, and skewness of rating are set. The details of the definition of each variable are shown in below Table 2.

### 3.5. Data analysis techniques

The Amazon product review data used in the empirical analysis are in the form of JSON file, but it is non-standard. So, the non-standard JSON file has been transformed into a regular JSON file using the regular expression in VI editor. And then converted the regular JSON file into MS-Access database file for easy analysis. MS-Access file was loaded in SPSS 25 using SQL query. Finally, the descriptive statistical analysis and correlation analysis, and multiple effects were confirmed through multiple regression analysis in SPSS 25.

## 4. Results

Table 3 shows the results of this study using multiple regression analysis.

**Table 2:** Variable Definitions

	Variable name	Conceptual definition	Operational definition	references
Independent variable	Number of product review	Number of product review per product	How many product reviews per each product in Book category at Amazon.com	Liu(2006); Cui, Lui, and Guo(2012)
	Standard deviation of rating	Standard deviation of rating per product	Calculating the standard deviation of product review rating per each product	Mudambi and Schuff(2010); DiMaggio et. al.(1996)
	Product Review length	Average of the review text length	Calculating the average of characters of product review text per each product	Mudambi and Schuff(2010)
Control variable	Price	Price based on data collection date	Using the price value from the product metadata	Miao and Mattila(2007)
	Average rating	Average rating per product	Calculating the average of product review rating per each product	Mudambi and Schuff(2010)
	Product description text	Descriptive text per product	How many characters of product description text per each product	Meyvis and Janiszewski (2002)
	Skewness of rating	Skewness of rating per product	Calculating skewness of product review rating per each product	DiMaggio et. al.(1996)
Dependent variable	Sales Ranking	Sales ranking by date of data collection	Using sales ranking value from the product metadata	Benlian et al.(2012)

**Table 3:** Multiple regression analysis results

	Unstandardized Coefficients			Hypothesis
	B	Std. Error		
Constant	14.933***	0.061		
<b>Independent variable</b>				
Number of product reviews	-.002***	.000		H1
Rating standard deviation	-.188***	.014		H2
Product Review length	.176***	.003		H3
<b>Control variable</b>				
Price	-.020***	.000		
Average rating	-.243***	.013		
Product description text	-2.900E-05***	.000		
Skewness of rating	.406***	.006		
Adj. R <sup>2</sup>	.117			
F	4110.587***			

n= 367,982, p< .001 \*\*\*

The hypotheses are tested by multiple regression analysis. The results were as follows. First, product review numbers, rating standard deviations, and product letters are used as dependent variables. The independent variable is sales ranking which gets a small number when the ranking is high. As a result of the analysis, the ranking of sales increases when the product review number increase (-.002\*\*\*), it means the number of sales ranking becomes smaller) and the standard deviation of the rating increases (-.188\*\*\*). So, <Hypothesis 1> and <Hypothesis 2> are verified. In addition, the product review length gives a negative influence on the ranking of sales (.176\*\*\*), which prove <Hypothesis 3>.

## 5. Discussions and/or Conclusions

First, the increase in the number of product reviews positively affected sales performance. It can be explained that the amount of communication through the product review is increased, it provides more information for purchase decision making and it has a positive influence on sales performance. Second, an increase in extreme opinions in the product review has a positive effect on sales performance. This can be interpreted as the diagnostic ability of extreme opinion helped the purchase decision. Third, the product review length has a negative effect on sales performance. This is because one of the main reason for the communication between customers in the online marketplace is aimed at purifying the negative emotions.

This research will help theoretically the information economy. The purpose of this study is to investigate the effect of communication between customers on sales performance in the online marketplace by analyzing big data of product review. In the previous study, there were no clear criteria for the selection of the products to be analyzed and the research was conducted on limited products. However, this study contributed to the theoretical completeness by analyzing all the products of the book category in Amazon.com. In addition, we analyzed the influence of the product review in relation to the sales ranking, it contributes to the theory in relation to the customers' behavior and the company performance in the online market. In addition, we expect the empirical analysis of the Amazon online marketplace to provide empirical help to sellers, online marketplace operators, and customers. For example, in the online market, the statistical value of the product is disclosed only the average of the ratings and the total numbers. If the disclosure of the distribution of the product review rating (the frequency of the extreme evaluation) is disclosed, it will be useful for product selection and marketing. It is also expected that if the online market sellers appropriately use the length of product review data which have a negative impact on sales performance.

This study can give practical implications in relation to online distribution. The sellers of the online marketplace are able to forecast the sales performance of specific products by analysis of the product review because the online customer considers the product review in the purchase decision-making process. In addition, analysis of product review will be helpful to construct a more efficient distribution system related to the lack or excess of product inventory, and the product return or replace.

The limitation of this study is that we analyzed only the quantitative aspects of product reviews. It might be thought inevitable in the analysis process of millions of product review big data. In future studies, if we use text mining methodology such as content analysis of product review it would be able to produce a more meaningful result. In addition, this study analyzed only the book categories' product review where most product reviews are written in Amazon's online marketplace. In the future, comparative analysis of product reviews of all categories in the Amazon will lead to more meaningful research results. The researches related to the moderation effects of the product characteristics that have appeared in many pieces of researches in recent years are also considered to be studied.

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