Original Research Article

Decision-Making Management of Consumer Behavior Based on Component Regression Model

Abstract: In this study component regression model is used as research method to explore the influencing factors of compromise effect in decision-making management of consumers, and new hypotheses are proposed by referring to three important concepts of personality psychology. Conclusion can be drawn that professional level, cognitive needs, and trust tendencies have significant impacts on compromise effect, which is the focus and innovation of this paper. The study found that compromise effect is more likely to occur in those who have lower level of expertise, cognitive need or higher level of trust tendency. The study also found that some result will be partially overestimated while some will be underestimated if standard linear regression is applied in analyzing decision-making management of consumers. Based on the component regression model, the influencing factors of the consumer decision-making process are analyzed from a more accurate and detailed perspective, and relevant suggestions for marketing practice have been provided according to the research results.

Key Words: Component Regression; Consumer Behavior; Professional Level; Cognitive Need; Trust Tendency

1. Introduction

With the improvement of science technology, the convenience to search information is greatly enhanced, and the asymmetry of information is gradually decreasing. The effort needed to search and collect a large amount of product information has been reduced thanks to the progress of Internet technology, so consumers nowadays can be free from time and space constraints when purchasing, which helps them gain more initiative in the transaction. Currently, consumers can easily obtain information about products and make decisions after comparing the pros and cons of related attributes. However, fierce market competition has push enterprises to only stress their differentiated advantages in the process of marketing communication. For example, some companies only highlight the functional advantages of their products while others highlight the price advantages. In this case, consumers tend to be more confused to make decisions, especially when faced with a selection set with no absolute advantage options.

Consumer behavioral preference in this decision-making process is an interesting question that worth studying. Exploring the intrinsic psychological transmission mechanism in the decision-making process of consumers is a common demand of the theoretical and practical circles. Understanding the influencing factors exerts a constructive effect on marketing practice. The existence and mechanism of the compromise effect have important guiding significance for the positioning of the enterprise, the property setting of new products and the competitive relationship of similar product.

Therefore, to deepen the understanding of this field and help enterprise adapt to their target market better by knowing more about the decision-making process of consumers, this paper has further explored the influencing factors of the compromise effect based on component regression model. In this paper, the illustration of research method is followed by the literature review. After conducting the empirical analysis, some conclusions are drawn and relevant suggestions on business practice are given. Compared with previous researches, this paper takes component regression model as the research method and puts forward new hypotheses and explores consumption in combination with several concepts in the field of personality psychology.

2. Literature Review

Studies have pointed out that when making decisions in a selection of options without absolute advantageous options, many consumers will have a compromise effect, that is, preference for intermediate items. However, there have been few studies which analyses the influencing factors of the compromise effect based on component regression. According to previous studies, it is said that compromise effect of consumers in decision-making is unstable, which will be influenced by external situational factors and internal personality factors. Under different situations and personality characteristics, the compromise effect will be strengthened or weakened to various degrees.

Yan Jian et al. (2012)[1] pointed out that both marketing strategies and product types have a significant impact on compromise effect. Guo Junhui (2013)[2] believed that the information prompting mode has the main effect on the compromise effect, and the one-sided information prompting is more likely to have the compromise effect than the two-sided information prompting mode. Chen Junsong et al. (2011)[3] found that when consumers face price-induced information directly, their choice results will not be affected, still showing a strong compromise effect. Only when consumers make choices in the absence of induced information and then choose again in the same situation, and under the regulation of spontaneous reference, price-induced information will have an impact on the compromise effect.

In addition, Li Dongjin et al. (2012)[4] also proposed that whether the compromise effect will be caused by price information depends on the presentation of price information, consumers' perception of price-quality relationship and the existence of brand. Sun Hongjie and Zhou Tingrui (2011)[5] also found that the similarity and difference structure of the selection set could significantly affect the risk dilution effect of convergent attributes and the perceptual focusing effect of convergent attributes in decision-making. Dhar and Nowlis (2000)[6] pointed out that under the pressure of time, consumers tend to reduce the comparison between alternatives and regard attributes as non-compensatable, and pay more attention to those attributes which have obvious advantages, leading to the reduction of compromise effect.

In summary, although those variables are in common that can be classified as external situational factors and rely on consumers' personal perception to play a role, the impact of these external factors on the compromise effect is inconsistent. The above research mentioned that marketing strategy, product type and information prompting can directly affect the compromise effect, but price-induced information has no such effect.

However, price-induced information can significantly affect the compromise effect under the self-reference regulation. The reason for this difference is that consumers' self-reference, an individual cognitive feature, plays a regulatory role, and induces information to achieve real differentiation by means of consumers' self-reference cognitive differences, thus affecting consumers 'decision-making.

In addition to external situational factors, internal personality factors also have a great impact on consumer decision-making. Only by considering the individual psychological characteristics variables and the situation variables in the process of decision-making comprehensively, can we understand how the individual psychological characteristics affect the behavior and results in the process of decision-making.

Internal factors of consumers mainly include personality psychological characteristics, personality traits, emotions and so on. Previous studies on the impact mechanism of compromise effect suggest that the level of interpretation may be an important factor affecting the strength of compromise effect, which also implies the importance of

personality psychological characteristics to consumer choice. According to Interpretation Level Theory, different personality psychological characteristics will lead to different interpretations and responses of people to events, which may affect their judgment and decision-making of events.

However, there are few literatures on this aspect in the past, and the relationship between personality psychological characteristics and compromise effect has not received enough attention. Therefore, to further explore this field, this study introduces three variables reflecting consumers' personality psychological cognitive characteristics - professional level, cognitive needs, and trust tendency. Because consumers' decision-making is based on information processing, and professional level, cognitive needs and trust tendencies, as three important psychological characteristics of information processing methods, are likely to affect the performance of consumers in the decision-making process, and may also have an impact on the compromise effect.

According to the basic principles of personality psychology, the concepts of professional level, cognitive needs and trust tendency are as follows.

The level of specialization is the embodiment of cognitive ability. It will have an impact on consumers information processing activities. Consumers with different levels of specialization will have different decision-making processes and uncertainties in the use of information. Sun Jin (2013)[7] pointed out that consumers with high level of specialization tend to use mismatched attributes to evaluate their choices.

Cognitive needs explore the way and process people deal with information, which greatly affects the breadth and depth of consumer organization, extraction and evaluation of information. Therefore, the study of cognitive needs helps to understand the motivation and response of each consumer in the face of different information.

Trust tendency refers to an inherent tendency of trusting others in personality, which reflects the degree of individual trust in others. Some studies have pointed out that trust tendencies will affect online shopping trust, and some studies have shown that the increase of trust tendencies will not only make decision makers avoid trade-offs, but also weaken the intensity of negative feelings involved. The trade-offs of gains and losses and negative emotions are the main motivations of the trade-off effect, thus it is speculated that trust tendencies will have an impact on the trade-off effect. However, there is still a lack of empirical research on the impact of individual's trust tendency on the compromise effect. Therefore, to further explore the research in this field, this study introduces three variables reflecting consumers' personality psychological cognitive characteristics, namely professional level, cognitive needs and trust tendency.

Through questionnaire experiment, we examine the impact of different personality psychological characteristics on the compromise effect, and tries to explore what other individual characteristics are under the premise of self-reference as an internal factor. Variables will have an impact on the compromise effect, exploratory use of component regression estimation model to explore whether the three variables have an impact on the occurrence of the compromise effect, and to put forward corresponding suggestions for marketing practice according to the conclusions.

Based on the review of the previous literature, this study puts forward three hypotheses based on three concepts in the field of personality psychology.

Hypothesis 1: Professional level (X1) has a significant negative impact on the occurrence of compromise effect (Y).

Hypothesis 2: Cognitive needs (X2) has a significant negative effect on the occurrence of compromise effect (Y).

Hypothesis 3: Trust propensity (X3) has a significant positive effect on the occurrence of compromise effect (Y).

3.Research Method

The traditional ordinary least squares regression model (OLS)is conducted by minimizing the sum of squared residuals for parameter estimation. It only shows the extent to which the independent variables affect the dependent variable evenly. The ordinary least squares method is very sensitive to extreme values. If there are outliers in the sample, it may have a considerable impact on the measurement model constructed by the ordinary least squares method, and the results of the regression analysis may be misleading. Moreover, in general, the ordinary least squares method is used to estimate the residual term that must be assumed to conform to the normal distribution, but in the case of different data, the above assumptions cannot always be matched. Therefore, in this study, in order to solve the problem that there are outliers or the residuals do not conform to the normal distribution, it is necessary to use different statistical methods to estimate, such as equal part linear regression model or component regression model.

The research method of this study is component regression model proposed by Koenker and Bassett(1978)[8.9.10]. Under the assumption that the normal distribution is not met, the square of the variance obtained by minimizing the sum of squared residuals value is not the smallest, but it is the sum of the absolute values of the minima of the minimization in the component regression. In the component regression method, the classification of the observed samples must be considered, and the samples are arranged from low to high. Therefore, if there are outliers in the sample, the absolute sum of the residuals of the minimization is used to estimate, compared with the ordinary minimum. The method is less susceptible to impact. In addition, component regression can plot different conditional assignments under different conditional component values, and it is easier to show the distribution of the two-tailed tails, thus achieving the goal of comprehensively observing the overall trend of the dependent variable and providing more detailed analysis. In recent years, studies related to component regression has developed rapidly. Wen-Tsao Pan(2017)[11] proposed a newer equal part linear regression model based on component regression.

Since the component regression is estimated by summing the absolute values of the residuals of the minimization, it is calculated from the weights given by the different weights. For example, if the 0.75 component is estimated, the ratio of the number of sample values to the ratio of the 0.75 component is a ratio of 1:3. Therefore, the sample deviation higher than the 0.75 component accounts for only a quarter of the total sample, while the sample deviation lower than the 0.75 component accounts for only three quarters of the total sample. Therefore, a sample higher than the 0.75 component is given. The deviation is 0.75 weight, and the sample with a lower value than the 0.25 component is 0.25 weight.

4. Empirical analysis

In the research, convenient sampling method was used, and all the 153 subjects participated in the questionnaire experiment, including 59 males (38.56%) and 94 females (61.44%). The age range of the subjects is that the group of 18-25 years old accounts for 67.97%, followed by 26-30 years old, accounting for 17.65%.

Before the formal experiment, a pilot study was conducted to confirm whether the 153 subjects have significant different levels of expertise, cognitive needs and trust tendency. They are required to finish a psychological test

according to some professional scale which has high reliability and validity. Results shown that these participants cover different levels of these psychological features, which means the formal experiment can be continued.

To start with, the questionnaire was developed based on the hypothesis. In the questionnaire, there are four decision-making contexts, including the context of purchasing tangible products (such as personal computer and umbrella) and the context of choosing intangible services (such as selecting a restaurant and renting an apartment). Then, the study was conducted to examine how the participants with different psychological features would react to the decision-making contexts in the questionnaire.

Removing 34 unqualified questionnaires (i.e. questionnaires with questionable authenticity and credibility due to less than 10 seconds of filling), there are 119 valid questionnaires, and the validity of the questionnaires is about 77.78%.

After collating and coding the data of 119 valid questionnaires, linear regression and component regression analysis have been carried out with Stata software, and the results are as follows.

Table 1 is the result of standard linear regression(OLS), Table 2 is the result of simultaneous component regression, and table 3 is the comparison of significant results obtained from Tables 1 and Table 2.

Table 1. Result of standard linear regression

Y	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
X1	-.04	.0098731	-4.05	0.000	-.0595585	-.0204415
X2	-.06	.0105426	-5.69	0.000	-.0808848	-.0391152
X3	.06	.0084979	7.06	0.000	.0431656	.0768344
_cons	.4	.1607041	2.49	0.014	.0816464	.7183536

Table 2. Result of simultaneous component regression

Y	Coef.	Bootstrap Std. Err.	t	P>|t|	[95% Conf.	Interval]
q25						
X1	-.04	.0202503	-1.98	0.051	-.0801156	.0001156
X2	-.06	.0284432	-2.11	0.037	-.1163458	-.0036542
X3	.06	.0270443	2.22	0.028	.0064254	.1135746
_cons	.4	.2216951	1.80	0.074	-.0391762	.8391762
q50						
X1	-.0701754	.024277	-2.89	0.005	-.1182679	-.022083
X2	-.0175439	.0337841	-0.52	0.605	-.0844699	.0493822
X3	.0701754	.0207546	3.38	0.001	.0290608	.1112901
_cons	.2807018	.3807782	0.74	0.463	-.4736169	1.03502
q75						
X1	-.1111111	.0459099	-2.42	0.017	-.2020582	-.020164
X2	-2.24e-09	.0300117	-0.00	1.000	-.0594529	.0594529
X3	3.24e-10	.0216832	0.00	1.000	-.0429543	.0429543
_cons	1.666667	.5125839	3.25	0.002	.6512419	2.682092

Table 3. Comparison of results between standard linear regression and simultaneous component regression

Y	OLS			q 25			q 50			q 75		
Stat.	Coef.	T	Sig.	Coef.	T	Sig.	Coef.	T	Sig.	Coef.	T	Sig.

X1	-0.04	-4.05	***	-0.04	-1.98	*	-0.07	-2.89	***	-0.11	-2.24	**
X2	-0.06	-5.69	***	-0.06	-2.11	**	-0.02	-0.52	—	-2.24	-0.00	—
X3	0.06	7.06	***	0.06	2.22	**	0.07	3.38	***	3.24	0.00	—

Independent variables, namely professional level(X1), cognitive needs(X2) and trust tendencies (X3) have reached 99% significant statistical level under the analysis results of standard linear regression OLS. Moreover, X1 professional level and X2 cognitive needs have significant negative impacts on the compromise effect, and X3 trust tendencies have significant positive impacts on the compromise effect.

In other words, both professional level and cognitive needs weaken the compromise effect. The higher the professional level or cognitive needs is, the lower the probability of compromise effect will be. The stronger the trust tendency is, the easier the compromise effect will occur.

However, in Table 2, it can also be found that by using the method of simultaneous component regression, the result is more detailed and not completely consistent with the standard linear regression. The following is a detailed analysis combined with the component regression curve and confidence interval diagram of Figure 1.

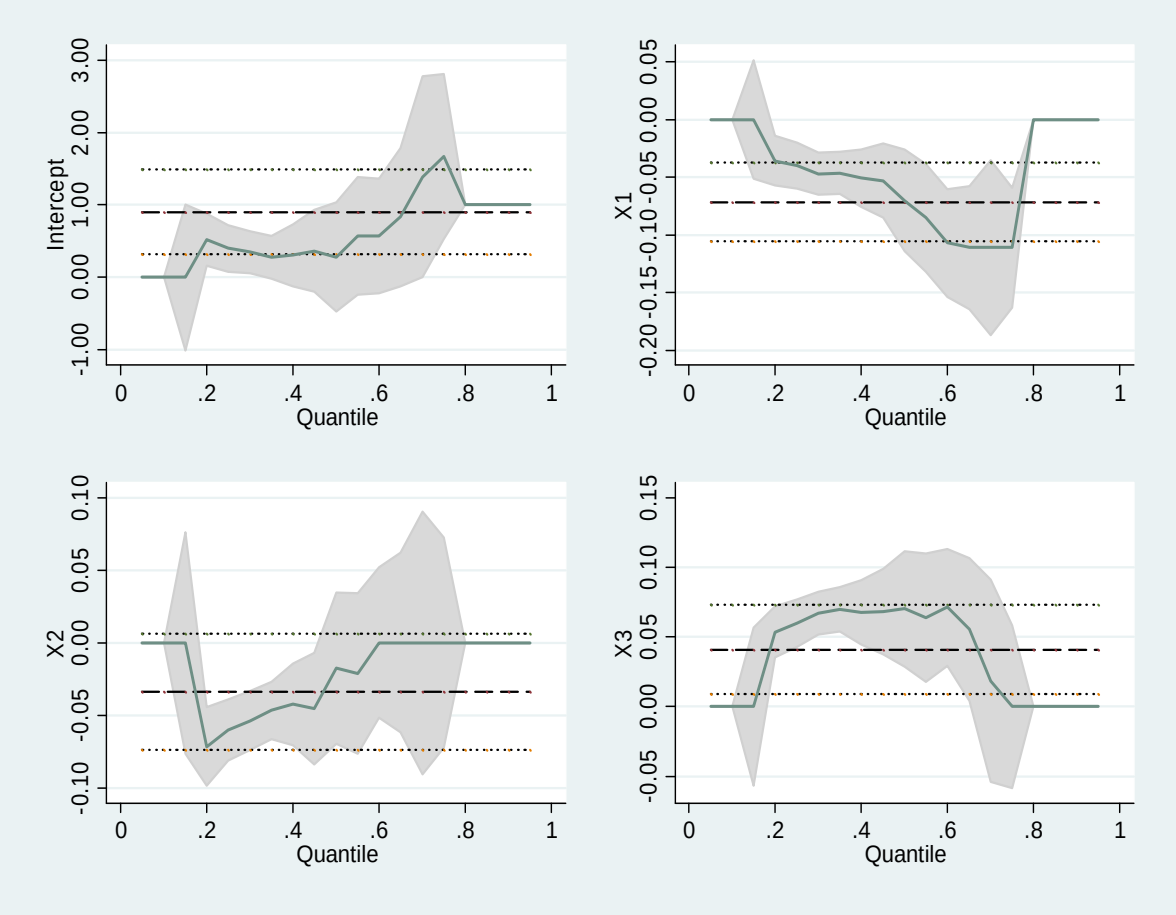

Figure 1. Component regression curve and confidence interval diagram

In Figure 1, the rough dashed line represents the coefficient estimated by the standard linear regression OLS, and the fine dashed line above and below the rough dashed line represents the 95% confidence interval of the standard linear regression OLS. The line represents the estimated coefficients under different components, and the grey interval is the 95% confidence interval of component regression.

From Figure 1, the difference can be compared between OLS and component regression in estimating the impacts of consumers' professional level, cognitive needs and trust tendencies on the compromise effect.

In the upper right corner of Figure 1 is the component regression graph of the independent variable X1, i.e. the influence of professional level on the compromise effect. It can be seen that under 0.2 component, the solid line is above the confidence interval of OLS, which means that the standard linear regression OLS underestimates the impact of professional level on the compromise effect relative to component regression. With the increase of components, the degree of underestimation declines, showing a marginal decline. In the range of 0.2 to 0.6 components, the real line returns to the confidence interval of linear regression, and the judgment of component regression and linear regression is basically the same. Over the 0.6 component, the impact of OLS on the trade-off effect at professional level is slightly overestimated, and then gradually coincides with the linear regression with the increase of the component. At 0.8 component, the impact of professional level estimated by component regression on compromise effect is significantly increased, showing a marginal increasing trend. Over the 0.8 component, linear regression is underestimated again. Thus, the professional level of consumers has a significant impact on the compromise effect. Linear regression underestimates the impact of this variable on the compromise effect at the extreme time. If OLS is used for linear regression analysis, it is easy to cause empirical errors, resulting in the estimated coefficients not in line with the actual situation.

In other words, for consumers at both ends, i.e. lower or higher professional level, their existing knowledge of related products or services will significantly affect their decision-making behavior, while consumers with medium professional level have greater uncertainty in choosing centralized decision-making, and the impact of compromise effect is not as high as OLS estimates. Specifically, consumers with lower professional level lack knowledge of products and services, they will prefer intermediate items when choosing to make compromise decisions, so as to reduce perceived risk, which will strengthen the compromise effect, that is, consumers with lower professional level are more likely to have compromise effect; while consumers with higher professional level are more likely to have compromise effect because they have a certain degree of relevant products. Therefore, we should follow the principle of value maximization and make clear which attributes are more important to ourselves. Therefore, in the process of decision-making, we will mainly judge according to our own needs and preferences, and less affected by the position of options, so that there will be less compromise effect, or the compromise effect will be weakened. It can be seen that component regression can be more detailed and in-depth analysis of the impact of professional level on the compromise effect.

In the lower left corner of Figure 1 is the component regression graph of the independent variable X2, that is, the influence of cognitive needs on the compromise effect. Component regression curve is within the confidence interval of linear regression, which shows that the conclusion of component regression is basically consistent with that of linear regression. Specifically, under the 0.2 component, the estimation of the impact of component regression on cognitive demand on the compromise effect first remains unchanged and then has a marginal decreasing trend. From the 0.2 component, with the increase of the component, the estimated impact of cognitive demand on the compromise effect shows a marginal increasing trend on the whole. That is to say, with the increase of cognitive demand, consumption increases. Whether the compromise effect occurs or not in decision-making will be affected to a greater extent.

It can be inferred that for consumers with lower cognitive needs, they are relatively averse to complex problems

and are reluctant to spend too much time thinking. Therefore, when choosing the middle item with both advantages and disadvantages is difficult to choose, they often unconsciously think that choosing the middle item with two attributes is the best choice, which can shorten the contrast time, simplify the decision-making process and reduce the cost of thinking. Such behavioral characteristics reinforce the compromise effect. For consumers with higher cognitive needs, they are relatively more willing to think and explore, so they will be more cautious in making decisions, making choices by integrating various elements and multiple information, so it is not easy to produce a compromise effect, in other words, for consumers with higher cognitive needs, the compromise effect will be suppressed.

In the lower right corner of Figure 1 is the component regression graph of the independent variable X3, that is, the influence of trust tendency on the compromise effect. It can be seen from the graph that the linear regression OLS overestimates the impact of trust tendency on the compromise effect in the two intervals below 0.18 component and above 0.72 component. That is to say, the impact of trust tendency on the compromise effect is not so significant for people with extreme trust tendency. In the range of 0.18 to 0.72 components, the linear regression OLS is more consistent with the component regression in estimating the impact of trust tendency on the compromise effect, while the overall trend is mainly marginal increase - maintain stability - marginal decline. This shows that the compromise effect is not obvious for consumers with lower or higher trust tendency, and linear regression overestimates the impact of trust tendency on the compromise effect at this time; but for people with moderate trust tendency, the occurrence of compromise effect will be significantly affected, which may be due to the fact that choosing the middle term will reduce their internal psychological conflicts and discord. Regulating sensation.

Based on the theory of component regression estimation model, this study puts forward new hypotheses according to relevant literature, and systematically explores the impacts of three variables, professional level, cognitive needs and trust tendency, on the compromise effect of decision-making.

Through the above research and data analysis, the three hypotheses proposed in this paper have been confirmed. In standard linear regression, professional level and cognitive needs have a significant negative impact on the compromise effect, while trust tendency has a significant positive impact on the compromise effect. However, under the component regression estimation model, we can find that the impact of standard linear regression on the trade-off effect of professional level extreme value is underestimated, while the impact of trust tendency extreme value on the trade-off effect is overestimated.

In other words, for consumers with lower or higher professional level, their existing knowledge of relevant products or services will significantly affect their decision-making behavior, while consumers with medium professional level have greater uncertainty in choosing centralized decision-making, and the impact of compromise effect is not as high as estimated by linear regression. For consumers with lower or higher trust propensity, the impact of their own trust propensity on the compromise effect is not so significant, while linear regression overestimates the impact of trust propensity on the compromise effect at this time; but for people with moderate trust propensity, their trust propensity has a significant strengthening effect on the occurrence of the compromise effect.

5.Conclusions

This paper introduces three important concepts of personality psychological characteristics, and exploratorily uses the estimation model of component regression for data processing and analysis. By comparing the results of component regression with those of traditional linear regression, a more accurate and detailed conclusion can be drawn, which provides a new angle and thought for the study of the compromise effect of decision-making management of consumer. It is conducive to enriching related theories of consumption mechanism and decision-making process.

6. Academic Value and Practical Implications

The study has practical implications in business management. According to the analysis above, suggestions for marketing practices can be proposed as follows.

Firstly, enterprises can try to manage product categories according to the personality and psychological characteristics of target consumers. Many enterprises often launch high, medium and low-end products, and expect to guide consumers to buy through relevant marketing strategies to enrich their product lines and meet the needs of different types of consumers. However, this kind of behavior may not play a role in promoting the sales of products at both ends, instead, it may lead to the phenomenon of compromise purchase. If enterprises want to increase the sales of products at both ends, they can consciously conduct marketing propaganda and promotion to people with higher professional level, higher cognitive needs or lower trust. Since these consumers' personality and psychological characteristics will weaken the compromise effect, they are more likely to buy high-end or low-end products, rather than choose mid-end products because of the compromise effect. But if enterprises want to increase the sales of mid-grade products, they can reduce the low-grade products appropriately to avoid the occurrence of compromise effect. In addition, enterprises can strategically launch some "foil products" to enhance the middle position of an existing product and enhance its possibility of being selected. Whether an enterprise will introduce a new product line or cancel the original product category depends on the internal and external environment.

The second implication for enterprises is to optimize product positioning according to the individual psychological characteristics of target consumers. New product market positioning should be based on target consumers. It should select market positioning according to the personality and psychological characteristics of target consumers, avoid internal competition caused by the similarity of their own products, try to distinguish them from the products of their own enterprises, and be similar to those of their competitors. In order to pursue the benefits of new product listing, we can use the compromise effect to design the attributes of new products and design a compromise market positioning, so as to attract target consumers with low professional level, low cognitive needs or high trust tendency. The market positioning of mature products can also take advantage of the compromise effect, because in this situation, consumer decision-making behavior is based on safe purchase and chooses the middle items under the weights of various attributes. Therefore, when facing a subdivided market, enterprises should not only pay attention to the products with the same attributes as their own products, but also pay attention to the preponderant products and compromise products in the same market.

Reference

[1] Jianyuan Yan, Hailing Guo, Yan Hao. Research on the Impact of Marketing Strategy on the Equilibrium Effect Based on B2C E-commerce Platform [J]. *Management Review*, 2012,24(11):36-59

[2] Junhui Guo. Integration Mechanism of Compromise Effect [J]. *Science of Psychology*, 2013,36(2):434-439

[3] Junsong Chen, Guoqun Fu, Jintao Wu. The Effect of Inducing Information on the Compromise Effect of Consumer Choice [J]. *Journal of Management*, 2011,8(3):437-442

[4]Dongjin Li, Yan Li, Ruijuan Wu. The Effect of Product Price Information on the Compromise Effect in Online Shopping[J]. *Contemporary Finance*, 2012,336(11):67-79

[5]Hongjie Sun, Tingrui Zhou. Research on the Influence of Selecting Different Structures on Consumer Decision Conflicts[J]. *Journal of Management* .2011,8(6):898-903

[6] Dhar R, Nowlis S M, Sherman S J. Trying Hard or Hardly Trying: An Analysis of Context Effects in Choice [J]. *Journal of Consumer Psychology*, 2000, 9(4):189-200

[7]Jin Sun. The Impact of Attribute Comparability on Consumer Brand Evaluation: The Moderating Role of Evaluation Model[J]. *Management Review*, 2011,23(8):103-111

[8] Koenker R, Bassett G W. Regression Quantiles, *Econometrica* [J].1978, 46(1): 211-244.

[9] Koenker R, Bassett G W. Robust Tests for Heteroscedasticity Based on Regression Quantiles [J]. *Journal of Derivatives*, 1982, 50(1): 43-62.

[10] Koenker R, Hallock K F. Quantile Regression[J], *Journal of Economic Perspectives*, 2001,15(4): 143-156

[11] Wen-Tsao Pan. A Newer Equal Part Linear Regression Model: A Case Study of the Influence of Educational Input on Gross National Income. *Eurasia Journal of Mathematics, Science and Technology* [J], 2017,13(8):5765-5773.