Research on the Internal Structure of Product Uncertainty and Scale Development

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Abstract. With the rapid development of platform-based e-commerce, shopping uncertainty and shopping risks due to information asymmetry in online shopping have increased, which has attracted widespread attention from academia and practice. This paper combines consumer behavior theory and transaction cost theory to explore the connotation and structure of product uncertainty, and develop and test measurement scales. Study 1 adopts a grounded theoretical method to explore the connotation and structure of product uncertainty. Based on exploratory factor analysis and confirmatory factor analysis, Study 2 clarifies three dimensions: product description uncertainty, product fitting uncertainty and product performance uncertainty. Affective dysregulation was used as the association standard, and the prediction validity of the scale was verified based on correlation analysis and regression analysis. This study provides a measurement tool and theoretical basis for the research on the uncertainty of consumer online shopping, which is of great significance for the strategy design of business enterprises.

Keywords: online shopping uncertainty · product uncertainty · Scale development

1 Introduction

As of 2022, the size of China's Internet users is 1.051 billion, and the Internet penetration rate has reached 74.4%. Information asymmetry in the online retail market leads to serious return problems, and the expulsion of bad money from good money causes the proliferation of counterfeit and shoddy products, which greatly increases consumers' perception of uncertainty in online shopping and affects consumers' subsequent return and repurchase behavior.Therefore, this paper intends to solve two research questions: What is the connotation and internal structure of product uncertainty? How is this concept measured? Based on the grounded theoretical method, combined with exploratory and confirmatory factor analysis, this paper develops and verifies the internal structure and measurement of product uncertainty.

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2 Product Uncertainty Concept and Composition

Product description uncertainty. Hong and Pavlou (2010) [4] argue that consumers cannot obtain complete, truthful and reliable information through website descriptions of products. 2) Product performance uncertainty. Hong and Pavlou et al. (2007) [5] argue that the current state and future performance of the product by the customer does not match the seller's promises and descriptions. 3) Product fitting uncertainty. Hong (2014) [2] argues that it is the consumer's inability to assess the extent to which a product's attributes match his preferences.

3 Study 1: Explore the Structure of Product Uncertainty

1) Data Collection. a) Open-ended questionnaires. This open-ended questionnaire contains two parts: basic personal information and product uncertainty. A total of 138 valid questionnaires were collected in this survey. At the same time, based on the results of the open-ended questionnaire survey and the existing research results, four discussion outlines were proposed. b) Consumer Talks. 10 respondents were invited to conduct offline discussions to elaborate on the concerns and concerns encountered in the online shopping process, which lasted about 2 h and obtained a total of 15,774 words of text.
2) Coding process. a) Open coding. First, three masters were invited to analyze the original data word by word, and 89 original sentences were selected for labeling. Second, the initial labels are further refined and clustered to obtain 22 initial concepts; Third, three conceptual categories are divided according to the principle of logical consistency. b) Pivot coding. On the basis of open coding, the empirical data is matched with the conceptual category, and the main concepts of three dimensions are aggregated to obtain a total of three dimensions, and the selective coding results are shown in Table 1. c) Selective encoding. Selective coding aims to develop the core category, and after comparison and analysis, finally develop "product uncertainty" into the core category.
3) Reliability and validity guaranteed. In order to ensure the reliability of the research, 3 Ph.D. in management were invited to code independently, and 2 marketing professors were invited to repeatedly screen and proofread the coding results. In order to ensure the validity of the study, this study strictly screened the interview subjects, and used a

Table 1. Selective encoding results

Second-order categories	First-order categories	Initial concept
Product uncertainty	Product description	The accuracy of the description of the product,…
	Product performance	The quality of goods, the use effect of goods…
	Product fit	,the expectations are inconsistent…

variety of data sources such as symposiums and questionnaires to enrich the research data.

4) Theoretical saturation test. After using the remaining 1/4 of the material for theoretical saturation test, coding analysis and comparison with the existing results, no new concepts or new categories were found, indicating that the above theory has reached saturation.

4 Study 2: Product Uncertainty Scale Development

1) Formation of the initial scale. Based on the coding analysis above, 45 questions were identified. On this basis, 15 questions were identified from the existing maturity scale, and then merged and sorted out significantly, and the specific operations are as follows. Four masters of management studies were invited to merge, organize and analyze these 60 questions, and finally retained 34 questions. A content validity survey was carried out on a questionnaire of 34 questions, and 4 experts were invited to evaluate and classify the question items, and the Likrt 5-point scoring method was used to finally form 18 initial measurement items.
2) Data Collection. Two rounds of questionnaires were conducted, the first of which was to investigate consumers' uncertainty in shopping; In the second round, in order to test the validity of predictions, the scale uses the Likert 5-point scoring method. A total of 519 questionnaires were collected in the first survey, and after removing invalid questionnaires, 378 valid questionnaires were finally obtained and the individual characteristics of the first round of questionnaire samples accounted for 55.0% of women and 45.0% of men. 10.6%, 62.7% and 18.8% were concentrated at master's degree or above, undergraduate level and college level, respectively. 69.0% and 13.2% of the occupations were concentrated in enterprise employees and engaged in institutions and institutions, respectively. A total of 365 valid questionnaires were collected in the second round of surveys.
3) Factor analysis. 78 valid data were used for exploratory factor analysis and 365 valid data were used for confirmatory factor analysis. a) Initial scale purification. After scale cleanup, Cronbach's was 0.952, and the reliability coefficient after Q2-Q18 was 0.949, 0.949, 0.951, 0.948, 0.948, 0.949, 0.947, 0.947, 0.947, 0.948, 0.949, 0.948, 0.951, 0.949, 0.949, 0.949, 0.950, 0.949 is less than 0.952, and the reliability coefficient after deleting the item in question 1 is greater than Cronbach's coefficient, so it needs to be deleted. b) Project analysis. Using the independent sample t-test method, the top 27% of the total scores of the 17 questions of product uncertainty were set as high group, and the last 27% were set as low group, showing significant differences and good scale discrimination. c) Exploratory factor analysis. The exploratory factor analysis results showed that the three variables Cronbach's α were 0.842, 0.942, 0.877 > 0.8, and the total Cronbach's α was 0.952, and all indicators met the criteria, so 17 questions could be retained, and 17 questions were classified as 3 common factors, and the final question items were shown in Table 2.

d) Confirmatory factor analysis. The model fit results (see Table 3), $\chi 2/df = 2.080$ are between 2–5, which meets the conditions; CFI $= 0.971 > 0.9$, TLI $= 0.965 > 0.9$, SRMR $= 0.034$, RMSEA $= 0.054 < 0.08$, so the degree of fitting is acceptable, and it is

Table 2. Final item of consumer online shopping uncertainty

Secondary Conception	Question item
PDU (Product description uncertainty)	Q2: Not sure if the product description information provides an in-depth and comprehensive picture of the product
	Q3: I am not sure that I have grasped all the characteristics and attributes of the product from the page description
	Q4: I am sure that I have all the necessary information about the product according to the product description on the website
PPU (Product performance uncertainty)	Q5: I am not sure whether the product I received looks the same as described on the page
	Q6: It is difficult to determine the degree of exaggeration of the product description on the web page
	Q7: The authenticity of product reviews (positive and negative) cannot be determined
	Q8: It is difficult to determine whether the product effect is consistent with the description on the website
	Q9: It is not possible to determine whether the product performance is as expected
	Q10: It is difficult to judge the true composition and quality level of the product
	Q11: Unable to determine the matching between product quality and selling price (price/performance ratio)
	Q12: The stability of the effect of different batches of products cannot be determined
	Q13: It is difficult to determine whether products purchased online perform the same as products in physical stores
PFU (Product fit uncertainty)	Q14: I am sure that this product can meet my requirements in all aspects
	Q15: Not sure if the product matches my preferences
	Q16: Not sure if this product can meet my needs
	Q17: I can't identify the product with these characteristics that I am looking for

(*continued*)

Table 2. (*continued*)

Secondary Conception	Question item
	Q18: Not sure if the characteristic attributes of the product can match my needs (such as size, texture, color, style, type and composition, etc.)

Table 3. Comparison of model fit

model	χ^2	χ^2/df	CFI	TLI	SRMA	RMSEA
Three-factor model	241.220	2.080	0.971	0.965	0.034	0.054
PDU + PFU	484.835	4.109	0.914	0.900	0.050	0.092
PDU + PPU	549.750	4.659	0.898	0.883	0.065	0.100
PPU + PFU	613.971	5.203	0.883	0.865	0.067	0.107

more appropriate to compare the three-factor model. The CR of the three variables was 0.858, 0.941 and 0.877, all > 0.8, and the factor load was also highly significant. AVE was 0.669, 0.638, 0.589 > 0.5, correlation coefficients were 0.574, 0.585 and 0.663, and the two pairs were significantly correlated with each other, and AVE square roots of 0.818, 0.799 and 0.767 were greater than the correlation coefficients.

4) Externalities test. This paper refers to Dong's (2015) [1] definition of emotional dysregulation, a state of anxiety, doubt and regret caused by consumers' incongruity between prior expectations and actual experiences. Yao et al. (2014) [3] verified that consumer uncertainty positively affects cognitive dissonance. Propose research hypotheses:

H1: Product uncertainty positively affects emotional disorders.

The correlation coefficients between uncertainty and emotional imbalance were 0.283, 0.194 and 0.319. The regression coefficients of 0.336, 0.229 and 0.354 were significant, and the H1 hypothesis was verified.

5 Conclusions and Revelations

This study concluded the following: 1) product uncertainty includes three sub-dimensions: product description uncertainty, product performance uncertainty and product fitting uncertainty; 2) Develop an effective scale containing 17 questions, suitable for 3-factor models. The management enlightenment of this study lies in the fact that the relevant conclusions of this study can be applied to e-commerce enterprises, fully understand the concerns and needs of consumers, and improve the operation mechanism of online shopping platforms; The limitations and prospects of this study are as follows: sample selection has certain limitations. The vast majority of the sample studied in this paper were corporate professionals. From the perspective of the market distribution of

platform e-commerce in China, the employee group of enterprises cannot fully represent the user group of the entire platform e-commerce.

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