

Study on Consumers' Multiple Levels Cognitive Behavior to Purchase Fresh Agricultural Products Online

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Abstract. Based on 505 consumers' sampling data from Shandong province, taking apple as an example, consumer cognitive behavior can be divided into three levels: know, trust and usage. The study builds multivariate Probit model to analyze the factors influencing consumer multilevel cognitive behavior. It finds that, consumer cognitive behavior to purchase fresh agricultural products online presents a significant heterogeneity; there are different cognitive effects of gender and income at all levels, while age and education have significant effects at all levels of cognition in individual characteristics; there are different cognitive effects in network security awareness, and computer operation skills, and information channels of fresh agricultural products, and consumer involvement at all levels; the popularity of shopping websites has a significant effect on cognitive performance at all levels. Through the empirical analysis, some feasible suggestions for the government, the electricity supplier enterprises and consumers can be provided.

1. Introduction

Fresh e-commerce market is in a period of rapid development, which is sought by the capital in China. Fresh e-commerce industry has constantly improved all aspects of the industrial chain and the market performance is strong. According to Analysis statistics, the trade scale of fresh e-commerce market reached approximately 91.4 billion yuan in China in 2016, which was an increase of 45% over the previous year. It is estimated that the trade scale will reach about 350 billion yuan by 2019. However, the penetration rate of fresh e-commerce market is less than 2%, and the vast majority of fresh e-commerce companies are running at a loss under the rapid growth scale. According to the statistics, 88% of the national fresh e-commerce platforms were in a loss state in 2016. It is difficult to keep agricultural product fresh and the damage rate remains high. Fourteen fresh e-commerce enterprises had closed down in 2016.

E-commerce can directly sell agricultural products to consumers, and reduce the intermediate links in the circulation of agricultural products, and shorten the distance of agricultural products from the field to the table, and break the geographical limitations of past tangible markets, which can help to solve the problem of the asymmetry of agricultural production and market demand in China. It is conducive to expand the circulation of agricultural products. The characteristics of agricultural products, especially fresh agricultural products, are perishable, time-sensitive, and low in standardization. It puts forward new requirements in the aspects of cold chain preservation, logistics distribution and so on, which can easily cause the problem of unstable user experience, and lead to the



distrust of consumers to purchase fresh agricultural products online. The lack of consumer cognition of fresh agricultural products restricts the healthy and rapid development of fresh e-commerce industry, and how to break through the predicament of consumer trust crisis and enhance consumer cognition of fresh e-commerce business. It is an urgent problem to be solved in the process of e-commerce development of fresh agricultural products in China, and also a difficult problem in current research.

Due to the significant impact on food selection, consumer cognition has become an important issue for academics (Briz et al, 2009). However, the existing literature rarely further analyzes its corresponding influencing factors after the empirical description of cognition. In a small number of studies, scholars generally use binary Logit (or Probit) models (Breen et al, 2013; Wu Xiaodan et al., 2016) and simple linear regression models (Liu Zengjin et al., 2011; Hahne et al, 2014) to explore the possible factors that affect consumer cognition. The former sets the cognition simply as the "to know it or not" binomial variable which is too coarse to reflect the level of cognition; the latter sets the cognition as an orderly choice for the approximate continuous variable, although it can reveal the cognition. It is more informative, but it magnifies the fact that the dependent variable depends more on the subjective expression of the respondents.

In view of this, this study starts with consumer cognition of the characteristics of purchasing fresh agricultural product online, and explores the motivations for the purchase or refusal of fresh agricultural products online. Then, taking apple as an example, it divides consumer cognitive behavior into three levels: know, trust and usage, and introduces multivariable Probit (Multivariate Probit, MVP) model to overcome the inability of traditional defect models, such as binary logit, to interpret the deficiencies of multiple dependent variables, and to examine the changes in cognitive influencing factors, which can help explore how to promote the transformation of the demand to the actual demand.

2. Research hypotheses and Variable settings

2.1. Research hypotheses

Due to the diversity of consumer preferences and the diversity of products, the factors that influence consumer's perceptions of purchasing fresh produce online may be multi-dimensional, which leads to consumer cognitive motivation and behavioral complexity. Based on the literature research, this study summarizes the influencing factors of the cognitive behavior of purchasing fresh produce online in five aspects (see Figure 1).

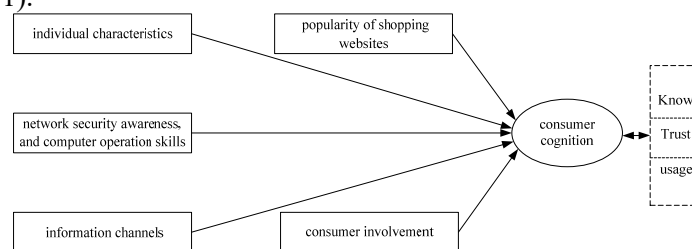


Fig. 1 hypothesis model of consumer cognition

Based on the theoretical analysis and literature review, this study puts forward the following hypothesis on the factors that affect consumer cognitive behavior of purchasing fresh agricultural product online: (1) The more women consumers often purchase fresh agricultural product, the higher the cognitive level of purchasing fresh agricultural product online is. (2) The younger consumers are more familiar to purchase online, the higher the cognitive level of purchasing fresh agricultural product online is. (3) The higher consumers are skilled in computer operations and like fresh things, the higher the cognitive level of purchasing fresh agricultural product online is. (4) The higher annual income consumers pay more attention to the quality of life, the higher the cognitive level of purchasing fresh agricultural product online is. (5) The more consumers are familiar to use computers

and network, the higher consumers' network security awareness is; the more consumers are proficient in the computer operation skills, the higher the cognitive level of purchasing fresh agricultural product online is. (6) The more channels consumers can obtain fresh agricultural product, the higher the cognitive level of purchasing fresh agricultural product online is. (7) The more knowledge consumers can obtain from the shopping websites, the higher the cognitive level of purchasing fresh agricultural product online is. (8) The higher degree consumer involvement of fresh agricultural product is, the higher the cognitive level of purchasing fresh agricultural product online is.

2.2. Variable settings

In order to reflect consumer cognitive differences of purchasing fresh agricultural product online, this study sets three interpreted variables from know level, trust level, and usage level respectively. In the process of data processing, the sample variable assigned to hear purchasing fresh agricultural product online will be assigned to 1; otherwise, it is assigned to 0. The sample variable assigned to trust purchasing fresh agricultural product online will be assigned to 1; otherwise, it is assigned to 0. The sample variable assigned to purchase fresh agricultural product online will be assigned to 1; otherwise, it is assigned to 0. The set of explained variables is mainly based on the research of consumers' food selection and cognitive behavior in the relevant literature.

3. Basic situation of the investigation

3.1. Data sources

The investigation was conducted in two cities (East: Qingdao, Yantai; Central: Jinan, Weifang; West: Liaocheng, Heze) which were respectively selected in each of the eastern, central and western regions of Shandong Province. These cities could better reflect the different economic and social development conditions in China. The selected samples were expected to have better representation and coverage.

The street intercept sampling method was used in the survey. 80 consumer samples were selected to carry out pre research to adjust and perfect the questionnaire from Jinan City, Shandong Province in January 2018. Afterwards, a formal survey was conducted in these cities from February to March 2018. A total of 561 questionnaires were distributed (about 90 in each city), and 505 valid questionnaires were returned. The effective recovery rate was 90%. The statistical results of the questionnaires showed that the demographic characteristics such as age and income, were relatively broad, and it had good representation and it could be used for analysis.

3.2. Sample characteristics analysis

The survey data comes from field surveys. The statistical characteristics of basic samples are shown in Table 1.

Table 1 Descriptive statistical analysis of the sample

Characteristic variable	Type	Number of respondents	Ratio (%)	Characteristic variable	Type	Number of respondents	Ratio (%)
Sex	male	151	29.90	Education Level	under university	11	2.18
	female	354	70.10		junior college	24	4.75
Age	Under 20	51	10.10		bachelor	328	64.95
	21~30	295	58.42		postgraduate	142	28.12
	31~40	103	20.40	Annual Household Income	Under 50000	109	21.58
	41~50	43	8.51		50001~100000	168	33.27
	Above 51	13	2.57		100001~200000	162	32.08
					200001~300000	38	7.52
					Above 300000	28	5.54

From 505 valid questionnaires collected from the formal investigation, it shows:

(1) Gender status. Among consumers of the investigation, the number of female consumers was 353, which was 70.10%, and the number of male consumers was 151, which was 29.90%. It is consistent with the actual situation of Chinese households whose agricultural product buyers are mostly women.

(2) Age composition. According to the statistical data, it shows that consumers who are between 21 and 40 years old have higher general cultural quality and can be familiar with operating computers and mobile phones to purchase, and easy to accept fresh things and more easily trust to purchase fresh products online.

(3) Education Background. According to the statistical data, it shows that highly-educated consumers are more likely to purchase fresh products online.

(4) Annual household income. According to the statistical data, it shows that households with an annual income of more than 50,000 yuan are mostly the employees of enterprises and institutions and households with an annual income of 50,000 yuan or less are mostly students, who are more likely to purchase fresh products online.

In general, it is basically consistent with the current characteristics of purchasing online with young people, higher education, stable work and high income in China. The sample has good typical and representative features.

4. Model selection and empirical analysis

4.1. MVP model

According to the relevant literature analysis of consumer cognition research, consumer cognition for fresh e-commerce industry may be affected by the following factors: (1) individual characteristics (I_i); (2) network security awareness and computer operation skills (N_i); (3) information channels (C_i); (4) habit of selecting fresh products (H_i); (5) consumer involvement (P_i). The econometric model can be expressed in the form of the following functions:

$$Y_i = f(I_i, N_i, C_i, H_i, P_i) + \varepsilon_i \quad (1)$$

This paper studies consumer cognitive behavior of purchasing fresh products online from the levels: know, trust and usage. It introduces MVP model to analyze the variables of different levels by drawing on the practice of Zhu Di (2013). The dependent variables are analyzed to determine the factors that play a major role in the process of increasing consumer cognition. The basic form of MVP model is:

$$\text{Prob}(Y_i = 1) = F(\varepsilon_i \geq -X_i\beta) = 1 - F(-X_i\beta) \quad (2)$$

If ε_i satisfies normal distribution, which satisfies the assumption of MVP model:

$$\text{Prob}(Y_i = 1) = 1 - \Phi(-X_i\beta) = \Phi(X_i\beta) \quad (3)$$

Based on the variable settings, the corresponding log-likelihood function is:

$$\ln(L(\theta)) = \ln\left(\prod_{i=1}^{505} \varphi(Y_i|\beta, \Sigma)\right) = \sum_{i=1}^{505} \ln\{\varphi(Y_i|\theta)\} \quad (4)$$

Thereinto, $\theta = (\beta, \Sigma)$ is parameter space.

4.2. Model operation results and discussion

This study uses SPSS software to process the data of 505 respondents. The final model fitting results are shown in Table 2.

The model fitting results in Table 2 showed that -2LL was 397.1536, Cox & Snell R² and Nagelkerke R² were 0.7323 and 0.8537 respectively, so the overall regression was good. $\sigma_{12}=0.9462$, $\sigma_{13}=0.8771$, $\sigma_{23}=0.8753$, indicated that respondents had high correlations between cognitive behaviors at different levels and using MVP model was a reasonable choice. From the model fitting results it could be inferred:

(1) There are differences in the effects of gender at different levels of cognition

Male consumers' level of know is higher than that of female consumers, but their levels of trust and usage are lower than that of female consumers. Most families purchase fresh agricultural products by

women, who tend to pay more attention to the purchase channels of fresh agricultural products, and thus have higher awareness of trust and usage.

(2) The effects of age at all levels of cognition are significant

Young people are rich in information channels and have more opportunities to understand how to purchase fresh products online. They can use the website to understand the information of fresh produce online. Therefore, they have higher cognition at all levels.

(3) The effects of education at all levels of cognition are significant

Higher-educated consumers have more abundant sources of knowledge and information and are more capable of receiving and understanding new things and related information. In addition, highly-educated people often have higher income levels, and thus pay more attention to the quality of life. They tend to search for food safety and environmental information more proactively, and a full understanding of information can also help increase their trust in fresh e-commerce providers.

Table 2 MVP model fitting results

independent variable	coefficient	Standard error	T statistic	P value	independent variable	coefficient	Standard error	T statistic	P value
GR1	0.2743*	0.1732	1.6014	0.0600	IC2	0.7754	0.3428	2.2486	0.0160
AG1	0.4535**	0.2345	1.4864	0.0314	PW2	0.0657**	0.1847	0.3607	0.0604
ED1	0.6520**	0.1742	3.3578	0.0219	CI2	1.1060**	0.1832	5.9917	0.0302
IE1	0.0653	0.4542	0.2596	0.4567	GR3	-0.3932**	0.2424	-1.8771	0.0249
NS1	0.1902*	0.2561	0.5525	0.0906	AG3	0.5370***	0.2109	1.9747	0.0075
CO1	0.1010*	0.3024	0.3864	0.0692	ED3	0.1171*	0.2714	0.3925	0.0665
IC1	1.0283**	0.1476	5.5681	0.0124	IE3	0.0125*	0.1852	0.1261	0.0581
PW1	0.2108**	0.2135	0.4867	0.2099	NS3	0.3948	0.1759	2.1087	0.1217
CI1	1.6125	0.2105	7.8963	0.1241	CO3	0.0614*	0.3598	0.1255	0.0641
GR2	-0.5251**	0.1952	-2.3562	0.0162	IC3	1.0918	0.4567	4.4137	0.1027
AG2	0.3753*	0.1865	2.8852	0.0789	PW3	0.1142**	0.1956	0.5655	0.0480
ED2	0.0947*	0.2145	0.3985	0.0521	CI3	0.6057**	0.2324	2.6506	0.0170
IE2	0.3023	0.1968	1.0289	0.1350	σ_{12}	0.9462***	0.0052	180.9708	<0.0001
NS2	0.1240	0.2034	0.5684	0.2564	σ_{13}	0.8771***	0.0120	79.7455	<0.0001
CO2	0.1549*	0.2054	0.5568	0.0742	σ_{23}	0.8753***	0.0117	74.7621	<0.0001

-2LL=397.1536; $p=0.0000<0.0001$; Cox & Snell $R^2=0.7323$; Nagelkerke $R^2=0.8537$

Note: * indicates significant at the level of 10%; ** indicates significant at the level of 5% ; *** indicates significant at the level of 1% .

(4) The effect of income is not significant at the level of know and trust, but significant at the level of usage.

The effect at the usage level is significant. Most of consumers who purchase fresh agricultural products online are related to the high-income class, which are also consistent with the research findings of Long Zhenjie et al. (2013). Wu et al. (2014) finds that income has a significant effect on consumers' perceptions of purchasing fresh produce online, and Wang et al.(2015) believes that there is no significant correlation between the two. The definition of consumer cognition from different levels may be an important reason for the inconsistency of research findings.

(5) The effect of network security awareness and computer operation skills is significant at the level of know and trust, but not significant at the level of usage.

In general, the stronger the awareness of network security and the stronger the computer operation skills is, the more they will actively search for fresh agricultural product safety and risk information, and thus have more knowledge and higher awareness of purchasing fresh products online. However, the reasons for not being verified at the use level may be that male consumers have higher awareness

of network security and computer skills, while men are often not food buyers in the family, and relatively few purchase fresh products.

(6) The effect of information channels is significant at the level of know, but not significant at the level of trust and usage.

The more information channels of consumers is, the more opportunities to understand the purchase of fresh agricultural products online are, but as the level of usage is more dependent on whether consumers really need to purchase fresh agricultural products online, only those who have the willingness or interest of purchasing fresh agricultural products online are further closed by "selective attention".

(7) The effects of the popularity of shopping websites at all levels of cognition are significant.

The well-known shopping websites have wide ranges of products and rich information. Consumers can easily get information about fresh agricultural products. At the same time, the well-established purchase and payment systems of these well-known websites are relatively easy to gain the trust and recognition of consumers and become the main online channels for consumers to purchase fresh produce, so they have higher cognition at all levels.

(8) The effect of consumer involvement is significant at the level of know, but not significant at the level of trust and usage.

The cognition of the level of awareness has played a similar threshold, and the effect of consumer involvement has not been significant. The significant effects at the level of trust and usage are consistent with the previous hypothesis, indicating that the higher the degree of consumer involvement is, the more consumers purchase fresh agricultural products online are, and the higher the level of awareness is.

5. Main conclusions and policy implications

This study sets consumer cognitive behavior into three levels: know, trust and usage, and builds multivariate Probit model to analyze the factors influencing consumer multilevel cognitive behavior. The empirical study finds that consumers have a significant heterogeneity in the perception of purchasing fresh agricultural products online. The main manifestations are as follows: (1) Male consumers' level of know is higher than that of female consumers, but their levels of trust and usage are lower than that of female consumers; (2) the effect of income is not significant at the level of know and trust, but significant at the level of usage, while the effects of network security awareness and computer operation skills are opposite at all levels compared with that of income; (3) the effect of information channels is significant at the level of know, but not significant at the level of trust and usage, while the effects of consumer involvement are opposite at all levels compared with that of information channels; (4) the effects of age, education and the popularity of shopping websites at all levels of cognition are significant. The research conclusions of this study have a significant guiding role in exploring consumer cognitive behavior of purchasing fresh products online.

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