



Full length article

What affect consumers' willingness to pay for green packaging? Evidence from China

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ARTICLE INFO

Keywords:

Green packaging

Consumer

Willingness to pay

Influential factors

Factor analysis

ABSTRACT

With the growing popularity of worldwide environmental protection and the concept of sustainable development, eco-friendliness has become the trend of the times. In this regard, green packaging has received increasing attention in the logistics industry. Therefore, to promote the development of green packaging in China, it is of key importance to know consumers' cognition and willingness to pay for it. In this study, the data of 781 respondents from a carefully designed survey is used to analyze the influential factors of consumers' willingness to pay for green packaging. By employing the principal factor analysis method, four principal factors affecting consumers' willingness to pay are uncovered: environment, green packaging quality, commodity, and packaging price. According to the estimation results, even though the majority of consumers have insufficient certain knowledge regarding green packaging, they have a fairly strong willingness to pay for it. Additionally, we observed that compared with the price and appearance of green packaging, consumers would like to attach greater importance to the practicality of green packaging, such as convenience, reusability, and protective capability.

1. Introduction

The package, one of the most common elements in consumption, has various functions and provides great convenience to consumers. In recent years, with the continuous development of China's economy and its rapidly growing internet and social activities, e-businesses, especially online shopping, have become increasingly popular. The logistics industry is also booming in China.

The quantity of packages continues to surge, and the problems of excessive resource consumption and mounting environmental pollution have become increasingly acute. Additionally, with modern citizens' profound influence on and wide acceptance of sustainable development, economic development at the price of overexploitation of natural resources and mounting pollution is no longer welcome. As the biggest developing country in the world, China is facing great pressure at home and abroad to achieve ecological balance and environmental protection. Because the packaging industry is closely related to environmental protection and sustainable development, green packaging is a new

pursuit of consumers to achieve a balance between economic growth and ecological development (Martinho et al., 2015).

This is a foresighted study with practical significance and in line with future economic development trends. Green packaging, a new eco-friendly product, has contributed to various aspects of environmental protection (Grönman et al., 2013). To some extent, consumers tend to use green packaging and are willing to pay for it (Nordin and Selke, 2010). Additionally, the purchase intention toward eco-friendly packaging is significantly influenced by personal norms, attitudes, environmental concerns, and willingness to pay (Prakash and Pathak, 2017). Notably, a study regarding the significance of social impacts on green packaging showed that the preference for green packaging varies (Rokka and Uusitalo, 2008). In this study, we adopt a unique perspective of consumers' preference for payment. We conducted our research among customers who are the most frequent users of packages and gained sufficient first-hand data regarding their willingness to pay. Based on the statistical analysis of the data, we posed several constructive suggestions to help green packaging with its promotion in the

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Received 4 April 2018; Received in revised form 1 October 2018; Accepted 1 October 2018

Available online 18 October 2018

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market. Hence, this study is forward-looking.

The literature regarding green packaging has presented mainly qualitative analyses from an engineering design perspective and few studies have performed quantitative analyses. This study collected 781 valid pieces of data and analyzed the 11 most influential factors, which cover a range of people and influential factors. These raw data can also serve as a reference for further research. The literature conducted from the perspective of consumers' willingness to pay has mainly investigated the food industry, and few studies have investigated the green packaging industry. Nowadays, with the advocacy of low-carbon development, in which green packaging plays a significant role, this study enriches the achievements in this field. Additionally, the literature has been mainly based on populations other than a Chinese population. This study conducted a survey among consumers in China and proposed several policies and regulations in line with Chinese national conditions. These proposals are instructive for the promotion of green packaging nationwide and worldwide.

To sum up, the main contribution of this study is twofold. First, this study, for the first time, starts from a user's perspective, rather than a producer's perspective, to investigate the influential factors and scope of payments of consumers' willingness to pay for green packaging in China. The estimation results of this study reflect the overall preference of the consumption market and could help producers produce better-received green packages by combining technology requirements and consumption preferences. Additionally, the results could also provide constructive advice for the promotion of green packaging. Second, a panel dataset of consumers' willingness to pay for green packaging is constructed based on first-hand data collected nationwide. This dataset could provide data support for future research.

The remainder of this study is organized as follows. The second section presents a brief literature review on related studies. The third section briefly introduces theoretical analysis and modelling. The fourth section explains the research design and data sources. The fifth section explains the empirical analysis in detail and presents corresponding discussions. The sixth section concludes and provides relevant policy recommendations. The final section states the limitations of this study and indicates possible directions for further research.

2. Literature review

The core element of green packaging is its environmentally friendly, resource-saving technology. During the whole lifecycle, including the design, research and development, manufacturing, use, and recycling, green packaging causes little or no harm to the ecological environment or human health. In addition, the techniques required save energy and reduce consumption are in accordance with sustainable development.

Scholars have mainly divided the studies of green packaging into three categories. From a micro-perspective, the first category focuses on the study of materials and manufacturing standards. For example, several design principles of green packaging were proposed: reduction, simplification, light weight, innocuousness, and cleaner production (Liu et al., 2010). Scholars outside China started from the manufacturing of material and proposed the novel idea of using organic and low-cost crops as raw material. According to recent studies, traditional approaches to manufacturing packages have been related to environmental waste. Notably, bio-based materials play a significant role in sustainable development, and cassava has great potential (Tumwesigye et al., 2016). Additionally, the preparation and characterization of a bio-based carbon-silica material derived from rice husk agricultural waste was discussed and proved useful in electronic packaging applications (He et al., 2017). These studies have not merely provided references for raw materials and manufacturing standards; more significantly, technical support and scientific proof have been provided. Nevertheless, this category of study simply targets the design and fails to consider consumers' reactions once these products are on the market.

The second category of studies begins from a macro-perspective. On

the basis of analyses of the status quo of green packaging, a conclusion was made that the prosperity of green packaging requires a collaborative effort from governments at various levels, enterprises, and consumers if the goal is a complete, well-functioning recycling system. The designing, manufacturing, transporting, consuming, abandoning, and recycling phases, that is, all the phases of the packaging industry, must strictly control carbon emissions. Legislation and regulations must also be improved to promote the popularization and utilization of green packaging and establish low-carbon awareness and environmentally friendly consumption habits. Through these efforts, sustainable development can be achieved (Yu, 2011). For instance, a system related to a can lifecycle that requires the participation of government, enterprises, and individuals has been designed that realizes zero pollution in design and recycling (Hauschild et al., 2017). With the increasing popularity of online shopping, package consumption and the packaging industry have boomed. Fan et al. (2017) estimated the environmental load of express packaging materials consumed in China, and the results indicated that the express delivery industry would become a serious burden on China's environment. This category of studies has investigated the packaging lifecycle and mainly focused on the theoretical level of system construction and regulation improvement. Notably, targeted and detailed research into green packaging has been limited.

The third category of studies begins from the perspective of consumers' behavioral psychology and regional cultural differences and has analyzed the relation between consumers' individual characteristics and their choices of green packaging. Analyses of the social impact of various packaging waste management systems demonstrated that formal collection systems have an optimistic effect on social security and residential health. In addition, social security and residential health impose an effect on the collection system (Altun-Ciftcioglu et al., 2017). Given that recycling and collection are crucial for green packaging, four typical internet recycling modes have been explored by Wang et al. (2018a,b); most important is for urban citizens to establish recycling habits. This third category of study emphasizes the influence of green packaging on consumers and ignores the potential influence consumers can pose on green packaging.

Self-esteem, perception, and recognition had a significant influence on consumers' willingness to pay for a premium (Boateng et al., 2015). From simulation research in China, several factors of consumers' willingness to pay for low-carbon products have been determined (Liu et al., 2017). These outcomes have provided thoughts and evidence for this study regarding the identification of factors affecting consumers' willingness to pay.

The literature has also presented sufficient analyses on consumers' willingness to pay for various subjects, and these analyses have provided references for this study regarding research design, modelling, and methodology. For example, for decentralized renewable hybrid mini-grids, Alam and Bhattacharyya applied the contingent valuation method to analyze the off-grid customers' willingness to pay and explored the estimated maximum amount (Alam and Bhattacharyya, 2017). Likewise, Wahid and Hooi used multiple regression and identified and analyzed four main elements that determine Malaysian household consumers' willingness to pay for water consumption under a new government policy, then proposed corresponding suggestions to promote of this new policy (Hooi and Wahid, 2015). For leasing a solar power system, similar research was conducted by Shih and Chou, who built a conjoint model to analyze consumers' willingness to pay (Chou and Shih, 2011). For green packaging, however, few studies have investigated consumption preference or willingness to pay.

In a study regarding the promotion of green packaging, scholars that investigated the United States found that taxation was a means to promote the research into packaging factories and increase the use of green packaging among consumers. In this manner, ecological balance was achieved (Fullerton and Wu, 1998). However, because of different social backgrounds and cultural traditions, domestic and foreign consumers may have different consumption preferences. Moreover, the

study by Fullerton and Wu was conducted 20 years ago; thus, the policy might be too dated to borrow directly. A recent study that investigated Western consumers' attitudes toward products from emerging economies, including China and India, found that social factors (e.g., national identification, cultural sensitivity, consumer ethnocentrism, and value consciousness) would affect consumption behaviors and choices (Wang et al., 2018a,b). Additionally, environmentally friendly packaging initiatives have been advised to feature eco-advantages that pertain to the post-use phase and differentiate packaging strategies across countries (Herbes et al., 2018). To promote the development of green packaging in China, it is necessary to conduct domestic research to explore suggestions compatible with China's national conditions and consumption market.

3. Theoretical analysis and modelling

3.1. Theoretical analysis

The development of green packaging is in the early stages and provides a theoretical basis for the investigation of factors affecting consumers' willingness to pay for green packaging is necessary.

- (1) Philip Kotler proposed a simple model of social consumption behaviors (Fig. 1). First, consumers receive stimuli for the information, including marketing and external stimulus. The marketing stimulus mainly include price, place, and promotion, and external stimulus are psychological effects from sociocultural environments. After receiving this information, consumers with different characteristics make different purchase decisions in the process of issue cognition, information collection, and decision consideration. This process finally leads to different consumption behaviors among individuals.
- (2) The subject of this study is green packaging. In addition to the basic consumable attributes, the eco-friendly attributes are an important factor for consumers to consider and cannot be neglected. One study adopted Ajzen's Theory of Planned Behaviour and concluded that what significantly affected consumers' behavioral intentions was mainly their attitudes toward green products, subjective norms, and perceived behavioral control (Yadav and Pathak, 2017). Attitude refers to an individual's evaluation of initiative to perform a particular action and the combined result of behavioral beliefs and outcome evaluations. A subjective norm refers to the social pressure an individual undertakes when performing a particular action, which reflects the influence of others and groups on the decision of individual behavior. Perceived behavioral control refers to the degree of difficulty an individual perceives when performing a particular action and reflects an individual's perception of factors promoting or hindering this particular action (Hall and Johnson, 2005).
- (3) As the literature has demonstrated, individual distinctions are inevitable regarding consumers' cognition and willingness to use green consumption. The distinctions exist in sex, age, educational background, and so forth. Therefore, based on these consumption

behaviors and the influence of consumers' intention supported by planned behavior theory, and with the help of questionnaires from the pre-survey, we proposed the following influential factors. From the perspective of behavioral attitude, we propose package appearance, reusability, convenience of use (e.g., light weight, easily disassembled, portable) and protective capability. Subjective influential factors include the status quo of environmental pollution, impacts from others, government subsidies/sales discounts and social advocacy and promotion. Regarding perceived behavioral control, there is the price and category of packaged goods. Hence, we proposed the following hypothesis: we assume that fundamental attributes, such as package appearance and reusability of green packaging, are positively correlated to consumers' willingness to purchase, and package price and environmental pollution are negatively correlated to consumers' willingness to pay. Additionally, the specific price and category of packaged goods also influences consumers' willingness to pay.

3.2. Modelling

With the 11 influential factors ascertained, a factor analysis must be applied to initially testify and systematically integrate the data. Factor analysis is a technique of dimension reduction and data simplification. By studying the internal dependencies among various variables, the basic structure in the observed data is explored, and a few "abstract" variables are used to represent the data structure. These "abstract" variables are called "factors," which can reflect the main information of the original variables (Brabenec and Nešetřilová, 2007). Every original variable can be represented by factors after dimension reduction:

$$X_i = a_{i1}F_1 + a_{i2}F_2 + \dots + a_{im}F_m + \varepsilon_i (i = 1, 2, \dots, p) \quad (1)$$

In Eq. (1), F_1, F_2, \dots, F_m are common factors, ε_i is the special factor of X_i . The whole formula can be interpreted in the form of a matrix: $X = AF + \varepsilon$.

$$X = \begin{pmatrix} X_1 \\ X_2 \end{pmatrix} \quad A = \begin{pmatrix} a_{11} & a_{12} & \dots & a_{1p} \\ a_{21} & a_{22} & \dots & a_{2p} \end{pmatrix}$$

A is factor loading matrix, a_{ij} is factor loading and described as the loading the i_{th} variable exerts on the j_{th} factor. There are many means to implement factor extraction, such as principal component analysis, maximum likelihood principal, principal factor, and iterated principal factor. In this study, principal component analysis is adopted to extract factors. Gaining a more polarised coefficient of factor loading, namely approximate to either 0 or 1, makes it easier for the structural simplification, interpretation, and designation of factors. Therefore, we decide to perform further factor rotation.

4. Research design and data sources

We first conducted a pre-survey to obtain the main entries of the pre-questionnaire from 20 consumers in the Beijing district through interviews. These 20 consumers had different individual characteristics, for example, 18 consumers often shopped online or used express

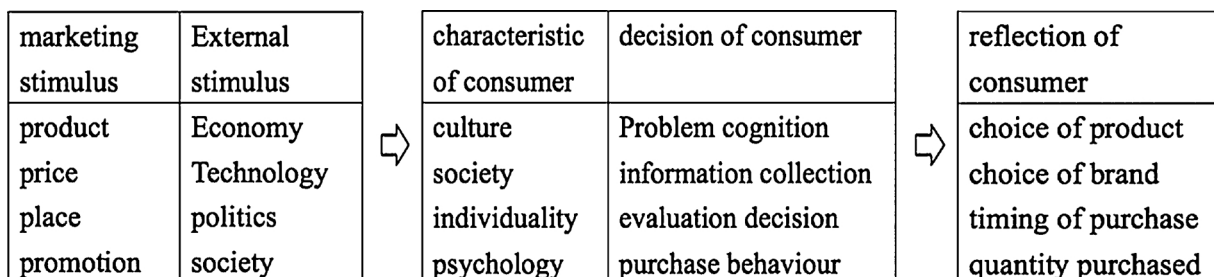


Fig. 1. Simple module of consumer behavior.

packaging. We asked the interviewees to name the factors they considered influential in consumers' willingness to pay for green packaging and obtained 166 entries (including repeated entries). After classification and combination, we had 13 entries; on the basis of those entries, the pre-survey questionnaire was designed and distributed among consumers across China. To complete the questionnaire, consumers were asked to rank these 13 entries according to their importance and add supplementary entries if possible. After reclaiming 134 valid questionnaires, we received 23 new entries (including repeated entries). We again reclassified and merged the entries and identified the 11 most powerful factors: package price, package appearance, reusability, convenience of use (e.g., light weight, easily disassembled, portable), protective capability, price of packaged goods, category of packaged goods (e.g., costumes, fresh, delicacies), the status quo of environmental pollution, and impacts from others.

After the identification of the influential factors, we designed a formal three-part questionnaire. Part one aimed to acquire the basic information of each consumer, including sex, age, region, income level, and online shopping consumption level. In part one, consumers' environmental awareness and knowledge regarding green packaging were also tested through 1 or 2 questions. All the questions in part two were 5-point Likert scales (e.g., 1 is most important, and 5 is least important) and measured consumers' preference for the 11 factors affecting their willingness to pay for green packaging. Part three comprised various types of questions, which covered the measurements of consumers' choices regarding a premium payment, acceptable payment ranges, and confidence in the future development of green packaging.

Next, we applied the principle of stratified sampling to distribute the formal questionnaires across China in accordance with the distribution percentages in "Chinese Online Shopping Consumption Insight in 2016" (China E-business Research Centre, 2016). The questionnaires were distributed online and offline across China. Online questionnaires were circulated on social media in the form of link, and offline questionnaires were distributed in the form of paper in communities, on campuses, and at work places. We distributed 801 questionnaires and 781 valid responses were received. Among all the questionnaires distributed, 20 were discarded because of incomplete or nonmatching answers. These attributes suggested that the respondents might have answered the questions blindly and casually, which would reduce the reliability of the questionnaires.

5. Empirical analysis

5.1. Questionnaire reliability test

In this study, SPSS 22.0 was used to test the overall reliability of the 781 questionnaires. The Cronbach's alpha reliability coefficient is 0.812, suggesting that this questionnaire has a high credibility.¹ In Table 1, the test coefficient of sample adequacy (Kaiser–Meyer–Olkin) is 0.820, which is greater than the experience value of 0.5. Bartlett's spherical test chi-square approximation value is 2150.886, the degree of freedom is 45, and the significance is 0.000, indicating that factor analysis is suitable for this study.

¹ Cronbach's alpha value could be considered as the expected correlation of two tests that measure the same construct. According to this definition, it is presumed that the average correlation of a set of items is an accurate estimate of the average correlation of all the items that belong to a certain construct. In factor analysis, Cronbach's alpha value evaluates the reliability of a common factor that estimates a set of related items as a group. If $0.7 \leq \alpha < 0.8$, the estimate is acceptable; if $0.8 \leq \alpha < 0.9$, the estimate is good. For more information about Cronbach's alpha, refer to DeVellis (2016).

Table 1
KMO and Bartlett test results.

Kaiser-Meyer-Olkin	Measuring the adequacy of sampling	0.820
Bartlett's spherical test	Chi-square approximation	2,150.886
	Df	45
	Significance	0.000

5.2. Sample analysis of reclaimed questionnaires

The result of the reclaimed questionnaires shows that the 18–27-year old age group has the highest response rate, is more interested in green packaging than other age groups, and is optimistic regarding the future development of green packaging. By contrast, consumers in the 38–47-year-old age group have a relatively weak awareness of environmental protection and hold a pessimistic attitude toward the development of green packaging. When these participants filled in the questionnaire, the answers tended to be defective or contradictory, which led to the low response rate. This result indicates that the young generation, compared with the elderly generation, have stronger environmental awareness and pay more attention to green packaging. Although most survey respondents were 18–27 years old, the corresponding Cronbach's alpha value (0.812) is higher than the recommended level 0.7 and indicates that this survey is scale reliable (Singh and Verma, 2017). Notably, some recent literature used survey data with a certain dominant age group. In a case study of consumers' perceptions, purchase intention, and willingness to pay a premium price for safe vegetables, the main respondents were young and middle-aged with a high education, middle income, and middle food expenditures (Zhang et al., 2018). Similarly, their Cronbach's alpha value was greater than 0.7, which ensures the scale reliability. As another example, Duarte et al. (2018) conducted a survey to identify which dimensions of online convenience affect Portuguese consumers' intention to shop online. Their sample consisted of 167 women and 83 men, and the majority were younger than 26 years old (87.2%). Duarte et al. (2018) acknowledged the possible limitation of the unbalanced age distributions but argued their study reflected customer perception of online shopping convenience at that time and contributed to the further research that investigated how the customer perception of online shopping convenience may change over time.

From the analysis results of the questionnaires (Table 2), we perform a statistical analysis on the basic characteristics of each individual sample.

Among the valid samples of this survey, the proportions of males and females are, respectively, 48.66% and 51.34% and relatively equal. The respondents' regions of residence are mainly Beijing, Shanghai, Guangzhou, and Shenzhen (54.16%). It is plausible that household annual income and average monthly online shopping expenditure follow normal distribution. In addition to certain deviations in the age structure distribution, other individual characteristics are basically in accordance with corresponding distributions in "Chinese Online Shopping Consumption Insight in 2016," including region, sex, and consumption level. This accordance ensures the effectiveness of the data. Among all the samples, the 18–27-year-old age group accounts for 66.58%, and this result is reasonable because young people tend to have a stronger awareness of environmental protection than elderly people and pay greater attention to green packaging.

At the same time, consumers' willingness to pay for green packaging can be statistically analyzed.

- Most consumers admit having little knowledge about the harms of the conventional packaging (63.77%) and benefits of green packaging (66.07%); thus, these responses indicate that the majority of consumers have a poor cognition of green packaging.

(2) 78.4% of the consumers indicate a greater willingness to pay for

Table 2
Descriptive statistics of the basic characteristics of individual sample.

Statistical indicators	Classification indicators	Time	Percentage	Cumulative percentage
Sex	Male	380	48.7	48.7
	Female	401	51.3	100.0
Age	17 years and younger	16	2.0	2.0
	18–27 years	520	66.6	68.6
	28–37 years	71	9.1	77.7
	38–47 years	100	12.8	90.5
	48 years older	74	9.5	100.0
Habitual residence	Beijing, Guangzhou, Shanghai, or Shenzhen	423	54.2	54.2
	Provincial capitals and municipalities	144	18.4	72.6
	Prefecture-level city	149	19.1	91.7
	Rural areas	65	8.3	100.0
Household annual income	Less than 3000 RMB	48	6.1	6.1
	3000–30,000 RMB	178	22.8	28.9
	30,001–80,000 RMB	218	27.9	56.9
	80,001–300,000 RMB	254	32.5	89.4
	300,001–1,000,000 RMB	65	8.3	97.7
Average monthly online shopping expenditure	Greater than 1,000,000 RMB	18	2.3	100.0
	Less than 100 RMB	149	19.1	19.1
	100–500 RMB	338	43.3	62.4
	501–1000 RMB	143	18.3	80.7
	1001–2000 RMB	89	11.4	92.1
Whether more willing to consume products from companies with environmental consciousness and social responsibility	2001–5000 RMB	42	5.4	97.4
	Greater than 5000 RMB	20	2.6	100.0
	Yes	612	78.4	78.4
Knowledge about the harms of traditional packaging	No	34	4.4	82.7
	Not certain	135	17.3	100.0
	None	180	23.0	23.0
Knowledge about the benefits of green packaging	Know a little	318	40.7	63.8
	Know part of it	226	28.9	92.7
	Know most of it	44	5.6	98.3
Knowledge about the benefits of green packaging	Know it very well	13	1.7	100.0
	None	256	32.8	32.8
	Know a little	260	33.3	66.1
Knowledge about the benefits of green packaging	Know part of it	205	26.2	92.3
	Know most of it	42	5.4	97.7
	Know it very well	18	2.3	100.0

environmentally conscious and socially responsible enterprises, and this response indicates that most consumers, to certain extent, are aware of environmental protection; 91.81% of consumers have different degrees of willingness to pay for green packaging. The samples generally have the willingness to pay for green packaging, which ensures the credibility of this study.

(3)74.39% of consumers responded that green packaging has a relatively substantial effect on improving the ecological environment, and 63.38% of consumers have considerable confidence in the future of green packaging, which guarantees the significance of this study in the future development of a low-carbon society.

5.3. Variable selection and feature analysis of influential factors

5.3.1. Correlation analysis of factors

A correlation coefficient is a measure of the linear correlation between two variables. The correlation coefficient r between two variables x and y is calculated by using the following formula:

$$r = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2 \sum_{i=1}^n (y_i - \bar{y})^2}} \quad (2)$$

Where \bar{x} and \bar{y} represent the average values of x and y , respectively.

The software SPSS 22.0 was used to obtain the correlation coefficient matrix.² Afterward, by using the correlation coefficient matrix, the correlation analysis over 10 factors after normalization was performed. The correlation coefficient matrix of various factors is presented in Table 3.

We conclude from the correlation coefficient matrix that the correlation coefficients of many factors are large. For instance, protective capability is highly correlated with convenience of use. Additionally, a close correlation is observed between the category and price of packaged goods. Therefore, strong correlations exist among many factors.

5.3.2. Characteristic analysis of influential factors

In the survey, the consumers were asked to rate each factor according to its importance. The variables and statistical characteristics of the survey are listed in Table 4.

In the first column of Table 4, 11 influential factors affecting consumers' willingness to pay for green packaging are listed: the package price means the price of the package; reusability means whether the package can be used more than once; convenience of use means whether the package is light weight, easily disassembled, or portable; protective capability means whether the package is sufficiently strong to protect the goods from damage; price of packaged goods means the price of the purchased goods itself; category of packaged goods means whether the goods are costumes, fresh, or delicacies; status quo of environmental pollution means the current situation of pollution in China; impacts from others means whether an individual's behavior toward, attitude of, and opinion of green packaging can be influenced by others; government subsidies/sales discounts means whether an individual's willingness to pay will be affected if the government provides subsidies or merchants provide discounts once the consumer chooses to use green packaging; social advocacy and promotion means whether advocacy of using green packaging affects consumers' willingness; and package appearance means the outlook of the package.

The scale of each factor varies from the minimum value of 1 to the maximum value of 5; the mean represents the average importance the consumers attach to each influential factor. The higher the mean, the greater the importance. As Table 4 illustrates, the means of 11 factors are all greater than 3.5 (The minimum of the means is of "price of packaged goods," which is 3.69.), and this result reflects that the factors listed in the questionnaire are the factors affecting consumers' decision to purchase green packaging. The mean of package appearance is only 2.97; hence, we do not consider package appearance as an important factor. By ranking the factors according to their means, we obtain the following: protective capability, status of environmental pollution, convenience of use, reusability, social advocacy and promotion, category of packaged goods, government subsidies/sales discounts, impacts from others, package price, and price of packaged goods. Among these factors, the means of protective capability, the status quo of environmental pollution, and convenience of use are greater than 4.0, indicating that these three factors are the most influential in consumers'

² The correlation coefficient is computed by the following program statement:

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FACTOR.
/VARIABLES Package price Package appearance Package appearance
Convenience of use Protective capability Price of packaged goods Category of
packaged goods. The status quo of environmental pollution Impacts from
people around Government subsidies/sales discounts Social advocacy and
promotion
/PRINT INITIAL CORRELATION SIG DET EXTRACTION ROTATION.

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Due to space limit, the detailed procedures of calculating the correlation coefficients are not reported, but they are available upon request.

Table 3
Correlation coefficient matrix of factors^a.

	1.Package price	2.Reusability	3.Convenience of use	4.Protective capability	5.Price of packaged goods	6.Category of packaged goods
1.Package price	1.000	0.237	0.305	0.291	0.297	0.251	
2.Reusability	0.237	1.000	0.360	0.295	0.124	0.123	
3.Convenience of use	0.305	0.360	1.000	0.564	0.214	0.286	
4.Protective capability	0.291	0.295	0.564	1.000	0.263	0.331	
5.Price of packaged goods	0.297	0.124	0.214	0.263	1.000	0.535	
6.Category of packaged goods	0.251	0.123	0.286	0.331	0.535	1.000	
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^a Due to space limitations, only part of the correlation coefficients is listed in Table 3. The full table is available upon request.

Table 4
Variable selection and characteristics of influential factors.

	Mean	Minimum value	Maximum value	Standard deviation
1. Package price	3.71	1	5	1.086
2. Reusability	3.99	1	5	1.092
3. Convenience of use	4.17	1	5	0.991
4. Protective capability	4.57	1	5	0.767
5. Price of packaged goods	3.69	1	5	1.164
6. Category of packaged goods	3.91	1	5	1.115
7. Status quo of environmental pollution	4.28	1	5	0.900
8. Impacts from others	3.73	1	5	1.169
9. Government subsidies/sales discounts	3.75	1	5	1.114
10. Social advocacy and promotion	3.97	1	5	1.068
11. Package appearance	2.97	1	5	1.290

decision-making.

The standard deviation represents the degree of consent of consumers' opinion. If the deviation is near to or less than 1, most consumers agree with result. For instance, the standard deviation of protective capability is 0.767 (the corresponding mean is 4.57), which indicates that the majority of consumers think the protective capability of green packaging is critical, and this opinion is widely accepted among the consumers. All the standard deviations of these 11 influential factors are close to 1, which indicates that the mean of each factor represents what most of the consumers think.

5.4. Factor analysis on willingness to pay for green packaging

5.4.1. Extraction of common factors

The results of Kaiser–Meyer–Olkin and Bartlett tests illustrate that the correlation matrix is not a unit matrix; hence, factor analysis is applicable for this study. Next, by using principal component analysis, we extract factors and perform factor analysis. To explain the variables in a more convenient manner, the rotating squares and loadings were calculated. The total variances that interpret the variables are shown in Table 5.

According to the eigenvalues of the correlation coefficient matrix and the cumulative contribution rate of the variance, the first three factors with an eigenvalue greater than 1 are taken as the common factors. In this case, the cumulative contribution rate is only 58.881%. Table 5 also shows that among the rotating squares and loadings, the cumulative contribution rate of the first four factors remains the same, whereas the eigenvalues and variance interpretation rate of each factor have changed. This result is because the rotation does not affect the commonality of the original variables but allocates the variance of the various factors, making the factors easier to explain. We also consider the fourth factor as a common factor; thus, the cumulative contribution

rate increases to 69.336%, which implies that these four common factors collectively account for 69.336% of the original ten factors. This rate proves that the ten factors are now sufficiently and effectively reflected.

How well the variables are interpreted by common factors can be analyzed by the common factor variances shown in Table 6. The initial column is the commonality of the variables given by the preliminary results of the factor analysis and indicates the degree to which each variable can be interpreted by all the factors. The extracted column is the commonality when the eigenvalues are extracted according to the required conditions of factor analysis and indicates the extent to which the extracted common factor can be explained. As Table 6 illustrates, most of the information contained in the indicators can be well explained by the common factors, and this result indicates that extracting these four common factors is feasible. By contrast, the interpretation of the appearance of the package is limited by the common factors, and this result indicates that classifying the “package appearance” into any one of the common factors is unsuitable.

5.4.2. Factor loadings matrix analysis

The factor loadings after rotation are calculated and presented in Table 7.

Among the loadings of the first common factor, the variables with relatively high coefficients include social advocacy and promotion (0.767), impacts from others (0.730), government subsidies/sales discounts (0.717), and status quo of environmental pollution (0.675). Additionally, according to Table 4, the average score of the survey on the status quo of environmental pollution is 4.28 and the second highest score among all the factors. The status quo of environmental pollution serves as a crucial factor in consumers' consumption decisions on green packaging and is considered the “natural environmental factor.” Social advocacy and promotion, impacts from others, and government subsidies/sales discounts have scores of 3.97 (No. 5), 3.73 (No. 8), and 3.75 (No. 7), respectively. The standard deviations of these three factors are lower than that of the status quo of environmental pollution, and this result suggests that the status quo of environmental pollution poses a greater effect on consumers' purchase intention. Hence, we take social advocacy and promotion, impacts from others, government subsidies/sales discounts and the status quo of environmental pollution as “social environmental factor.” By combining “social environmental factor” and “natural environment factor”, the first common factor is named as “environment factor.”

Among the loadings of the second common factor, the coefficients are relatively high of convenience of use (0.794), protective capability (0.792) and reusability (0.579). Additionally, according to Table 4, the average scores of these three factors are respectively 4.17 (No. 3), 4.57 (No. 1) and 3.99 (No. 4). Among these three factors, protective capability has the highest score and the smallest standard deviation, which proves to be the most significant factor being taken into account by consumers when purchasing green packaging. Additionally, protective capability and reusability are also important when consumers decide whether to purchase green packaging or not. It can be seen from the

Table 5
Influential factors' deviation contribution rate of willingness to pay for green packaging.

factor	Initial eigenvalue			Extracting square and loadings			Rotating squares and loadings		
	Eigenvalue	Variance/%	Accumulation/%	Eigenvalue	Variance/%	Accumulation/%	Eigenvalue	Variance/%	Accumulation/%
1	3.806	38.056	38.056	3.806	38.056	38.056	2.352	23.522	23.522
2	1.207	12.072	50.128	1.207	12.072	50.128	1.906	19.057	42.579
3	1.106	11.057	61.185	1.106	11.057	61.185	1.630	16.303	58.881
4	0.815	8.151	69.336	0.815	8.151	69.336	1.045	10.455	69.336
5	0.723	7.228	76.564						
6	0.599	5.990	82.554						
7	0.525	5.253	87.807						
8	0.447	4.473	92.281						
9	0.410	4.099	96.380						
10	0.362	3.620	100.000						

Table 6
Common factor variances.

	Initial	Extracted
1. Package price	1.000	0.864
2. Reusability	1.000	0.543
3. Convenience of use (e.g., light weight, easily disassembled, portable)	1.000	0.701
4. Protective capability	1.000	0.718
5. Price of packaged goods	1.000	0.727
6. Category of packaged goods (e.g., costumes, fresh, delicacies)	1.000	0.750
7. Status quo of environmental pollution	1.000	0.687
8. Impacts from others	1.000	0.620
9. Government subsidies/sales discounts	1.000	0.676
10. Social advocacy and promotion	1.000	0.648
11. Package appearance	1.000	0.190

Extracting method: principal component analysis

Table 7
Rotating factor matrix loadings.

	Common Factor			
	1	2	3	4
10. Social advocacy and promotion	0.767	0.150	0.050	0.188
8. Impacts from others	0.730	0.120	0.259	−0.070
9. Government subsidies/sales discounts	0.717	0.047	0.182	0.356
7. Status quo of environmental pollution	0.675	0.427	0.134	−0.174
3. Convenience of use (e.g., light weight, easily disassembled, portable)	0.139	0.794	0.156	0.164
4. Protective capability	0.083	0.792	0.278	0.080
2. Reusability	0.398	0.579	−0.180	0.130
6. Category of packaged goods (e.g., costumes, fresh, delicacies)	0.207	0.175	0.822	0.040
5. Price of packaged goods	0.137	0.085	0.818	0.177
1. Package price	0.118	0.231	0.178	0.875
11. Package appearance	0.347	0.000	0.264	0.243

Extracting method: principal component analysis.

Rotating method: maximum variance method with Kaiser orthogonality.

scores of these three factors that the quality of green packaging plays a significant role in consumers' purchase decision-making since quality is directly related to users' satisfaction. With poor quality, people may be reluctant to purchase them. Even if certain people purchase and use them, green packaging will be difficult to be widely promoted. In summary, the second common factor can be named as "green packaging quality factor".

Among the loadings of the third common factor, the coefficients are relatively high of category of packaged goods (0.822) and price of packaged goods (0.818). Additionally, according to Table 4, the average values of these two factors are respectively 3.91 (No. 6), 3.69 (No. 10). These two figures are quite low, suggesting that consumers are relatively less affected by the category of packaged goods and the

price of packaged goods when purchasing green packaging. Additionally, the deviations of the two are larger than those of other factors, indicating that the influence of the property of packaged goods vary widely from consumer to consumer. Therefore, the third common factor can be named as "commodity factor".

Among the loadings of the fourth common factor, the coefficient of package price is relatively high (0.875). Additionally, according to Table 4, the average score of package price is 3.71 (No. 9), indicating that package price has some influence on consumers' purchase decision on green packaging. Thus the fourth common factor can be named as "packaging price factor".

The correlation coefficients of package appearance under each common factor are quite low. Together with previous findings, the appearance of packaging should not be seen as an important factor affecting consumers' willingness to pay for green packaging.

5.4.3. Rank of the importance of common factors

We take the proportion that each common factor's variance contribution occupies in the accumulative variance rates of four main extracting factors as weight and then calculate the weight average. The function for the comprehensive score of each factor is given as follows.

$$F = 0.589F_1 + 0.174F_2 + 0.159F_3 + 0.118F_4 \quad (3)$$

F in Eq. (3) stands for the influence on consumers' willingness to pay for green packaging. As Eq. (3) illustrates, common factor F1 has the greatest weight, indicating that environment (including the social environment and the natural environment) has the greatest influence on consumers' willingness to pay for green packaging. The weight of common factor F2 and F3 are close, which means package quality and packaged commodity have similar influence. Common factor F4 has the smallest weight, indicating that consumers do not care much about the price of packaging. This is mainly because packaging accounts for a relatively small part of consumers' total expense.

6. Conclusions and policy recommendations

6.1. Conclusions

Based on previous discussion, conclusions can mainly be drawn as follows.

- (1) Consumers' cognition of green packaging is relatively low. Among all respondents, only 33.9% have partial knowledge about the benefits of green packaging and 63.8% know little about the harms of traditional packaging. Most of the consumers have environmental consciousness and certain willingness to pay for green products. Among them, 78.4% are more willing to purchase products from corporations with greater social responsibility. It is widely believed by consumers that green packaging has a great influence on improving ecological environment, the purchase and

use of which can result in better social recognition. Additionally, respondents are generally optimistic about the development of green packaging and 63.38% of them even have rather high expectations and great confidence in its future.

- (2) Ten main factors affect consumers' willingness to pay for green packaging: package price, reusability, convenience of use, protective capability, price of packaged goods, category of packaged goods, the status quo of environmental pollution, impacts from others, government subsidies/sales discounts, and social advocacy and promotion. Through factor analysis, four principal factors are obtained: environment, green packaging quality, commodity, and package price. After being ranked by weight, environment factor occupies the biggest weight, followed by package quality factor. The weight figures for commodity factor and packaging price factor are relatively small.
- (3) Nowadays, as the environmental consciousness of consumers improves, higher requirements for green packaging have been proposed. Packaging should be equipped with the basic function of conventional packaging and feature the function of environmental protection. At present, consumers' do not decide what type of package to use. If packaging manufacturers intend to appeal to consumers that favor this current trend of environmental protection, they should provide two options for consumers: green and conventional packaging. In terms of green packaging, manufacturers should focus on four principal factors that affect consumers' willingness to pay for green packaging: environment, green packaging quality, commodity, and package price.

6.2. Policy recommendations

Based on our conclusions, recommendations are made as follows.

- (1) The government and social nonprofit organizations should endeavor additional efforts into the promotion of environmental protection. On the one hand, journals, social media, and the internet, together with community lectures and advertising campaigns should collaborate to popularize knowledge regarding green packaging and improving consumers' cognition of green packaging. On the other hand, promotions should be more focused on certain target groups. For example, young consumers are the major consumption group of online shopping and have a great demand for packaging. In this case, youngsters comprise the target group. Conducting promotion campaigns aimed at youngsters would achieve an improved outcome.
- (2) The government should propose more policies favorable to factories and companies that produce or use green packaging, to stimulate more corporations to go green in their manufacturing and operating activities.
- (3) The conclusions drawn from the factor analysis provide a good reference for the producers and users of green packaging. For green packaging producers, more investments should be made into research and development to encourage technical innovation. As is shown in this study, package appearance is not one of the main factors that affects consumers' willingness to pay for green packaging. Therefore, instead of package appearance, manufacturers should devote greater effort to practicality, namely, reusability, convenience of use, and protective capability. Package price is also not a major influential factor that affects consumers' willingness to pay for green packaging, and 75.8% of the consumers are willing to pay a premium of 2–5 RMB for green packaging. This result means consumers are willing to pay a higher price for green packaging. Manufacturers can increase their production input regarding the precondition of quality improvement and environmental protection, without worrying about unsalable problems from the price increase. In addition, we recommended that manufacturers design and produce different types of green packaging to meet the various

demands of consumers.

7. Limitations and possible further research

Although this is the first study to investigate the influential factors of consumers' willingness to pay for green packaging based on evidence in China, this review is preliminary and room remains for follow-up research. For instance, despite the efforts to obtain a representative sample, the ratio of respondents between the 18–27-year-olds is relatively high. Although the age distribution of our sample is in line with some reports and studies on China's online shopping, the information regarding the relatively elderly people (e.g., greater than 45 years old) remains insufficient. In this regard, in further research, the sample can be further spanned to cover additional elderly people to create more elaborate analysis and additional targeted policies for different age groups.

The possible impact of environment policy changes could also be considered. As China has attached increasing significance to environmental protection (especially after the Environment Protection Law was implemented in 2015), Chinese people's notions and ideas of green packaging may also change. Therefore, idea changes influenced by environmental policies may also affect the willingness to pay for green packaging, which deserves further assessment and follow-up empirical studies when sufficient data is available. In addition, because the changes in people's notions is a dynamic process that may be affected by the environmental policy, the willingness to pay for green packaging may differ by stage. Therefore, it may be worthwhile to conduct follow-up studies at different times in the future to investigate how the consumers' attitudes and willingness to pay for green packaging may change over time at different stages of economic and social development.

Acknowledgments

The authors acknowledge financial support from the National Natural Science Foundation of China (71761137001, 71403015, 71521002), Beijing Natural Science Foundation (9162013), the key research program of Beijing Social Science Foundation (17JDYJA009), the National Key Research and Development Program of China (2016YFA0602801, 2016YFA0602603), and Joint Development Program of Beijing Municipal Commission of Education, and Beijing Undergraduate Training Programs for Innovation and Entrepreneurship of Beijing Institute of Technology (BJ17044). The authors are also very grateful to the anonymous reviewers and handling Editor Prof. Dr. Junbeum Kim for their insightful comments that help us sufficiently improve the quality of this paper. The usual disclaimer applies.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.resconrec.2018.10.001>.

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