Evaluation of Family Property Insurance Companies based on Probabilistic Linguistic Almost Stochastic Dominance Criterion

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Abstract: Family property insurance provides consumers with timely financial compensation for property losses, and the evaluation of family property insurance companies is beneficial to consumers in choosing the right insurance company for themselves. The evaluation index system of consumer family property insurance companies is constructed, and the probabilistic linguistic entropy weighting method is applied to assign objective weights to the indexes. The probabilistic linguistic almost stochastic dominance evaluation method is proposed to calculate the utility value of family property insurance companies and obtain the strength ranking of family property insurance companies. The evaluation results are analyzed to provide consumers with strategies for choosing family property insurance companies under different situations and provide theoretical suggestions for the future development direction of family property insurance companies.

1 INTRODUCTION

According to statistics from the work report of the Supreme People's Procuratorate of the People's Republic of China, in 2020 burglary and other multiple criminal cases of property invasion, the prosecution of up to 350,000 people, the annual household losses caused by burglary up to 1,130 billion yuan, 450 million households can not be guaranteed the safety of household property. In the first quarter of 2021, a total of 176,000 fires were reported nationwide, of which 320 deaths in urban and rural residential fires, accounting for 82.1% of the total number of deaths in building fires, and 44.6% of residential fires were fires caused by various types of household appliances and electrical wiring, resulting in larger direct economic losses. In order to cope with various hazards that may occur in the home such as burglary, fire, burst plumbing pipes, etc., family property insurance can give families a certain amount of financial compensation to make up for the large economic losses caused by sudden disasters and reduce the burden of family property. In recent years, due to the frequent occurrence of fire, burglary, gas explosion, etc., people's awareness of family

property insurance is gradually increasing. Overall, the share of family property insurance held in China is still very low in the insurance market, but with the increase of China's population, people's living standard and consumption level, the public pays more and more attention to the allocation of family property insurance, and the share of family property insurance and the proportion of family property insurance to property and casualty insurance increases year by year. in 2015, China's family property insurance premium income was 4.1 billion yuan, and the premium income of family property insurance has reached 9.1 billion yuan by 2020, which has more than tripled, and China's family property insurance has been developed in recent years from the scale alone.

At present, domestic and foreign scholars have mainly studied family property insurance from the macro level, mainly focusing on the factors influencing consumers' demand for family property insurance, the supply and institutional design of family property insurance market, the development model and development dilemma of family property insurance, etc. Few scholars have studied the choice of family property insurance companies from the perspective of consumers. In terms of the factors

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influencing consumers' demand for family property insurance, the characteristics of "low probability and high loss" of sudden disasters affect consumers' risk perception. Using a large sample of micro-household data, (Huang 2013) found that different households have different levels of risk-taking in response to disasters, resulting in different levels of household property insurance holdings. In terms of family property insurance market supply, (Li 2018) found that the low level of recognition of family property insurance is caused by the unclear positioning of family property insurance products themselves, the lack of abundant additional clauses, the unreasonable rate design, and the single means of promotion. (Qi 2014) conducted an empirical analysis of survey data and verified that perceived risk factors such as time risk, functional risk, financial risk, and social risk and insurance demand were significantly and negatively correlated. The research on family property insurance system mainly includes the determination of product rates, the exploration of family property risks and the design of corresponding insurance schemes. Foreign family property insurance has certain advantages in terms of institutional design. (İmrohoroğlu, Zhao 2018), using an equilibrium model, found that between 1980 and 2010, the risks faced by the elderly and the one-child policy in China led to a decline in the number of people purchasing family property insurance, which may account for about half of the increase in the savings rate. In a study of Progressive Insurance Company in the U.S., (Zhang 2020) reported that bundling family property insurance with auto insurance would add 5-7 years to the life cycle of customers and insurers. Drawing on relevant concepts that have matured abroad, many domestic scholars have researched and found that the dilemma of China's family property insurance development model is mainly manifested in two aspects: insufficient product design and innovative channel marketing. (Zhang 2020) suggested the integration and development of blockchain technology with insurance to break through the development dilemma of family property insurance. (Zhang 2019) proposed the idea of combining family property insurance with other types of insurance such as auto insurance, travel insurance, livelihood insurance, smart home and family members insurance. On the whole, the current domestic and foreign scholars' research on family property insurance mainly explores several aspects of family property insurance, such as demand influencing factors, system design and rate design, dilemmas faced and corresponding enhancement measures from the perspective of managers, and no scholars have yet studied the choice of family

property insurance companies from the perspective of consumer demand. Therefore, this paper firstly constructs the evaluation index system of family property insurance companies from the perspective of consumers, proposes a probabilistic linguistic almost stochastic dominance evaluation model, and uses this model to evaluate family property insurance companies and provide consumers with strategies to choose family property insurance companies under different situations.

2 CONSTRUCTION OF EVALUATION INDICATORS

2.1 Complete Indicator System

When choosing an insurance company, consumers need to select the company that matches their needs in order to best meet their needs. On-demand matching not only reduces the time and cost of product selection and transaction for consumers, but also improves their overall economic efficiency. Therefore, consumer needs need to be taken into account in the evaluation of family property insurance companies. Based on the above research, we found that two aspects, the quality of family property insurance products and the strength of the insurance company itself, have a major impact on consumer demand. Therefore, this paper constructs an index system for evaluating family property insurance companies from two aspects, namely, the quality of family property insurance products and the comprehensive strength of family property insurance companies, from the consumer's perspective. By means of literature, this paper obtains the factors that affect consumers' demand for family property insurance companies.

2.1.1 Factors Influencing Consumer Demand for Family Property Insurance Products

It is found that factors such as rates, contracted coverage, and definition of contracted liability of family property insurance products influence consumers' demand for family property insurance products. Meanwhile, drawing on the design principles of family property insurance by large insurance companies in the market, this paper adds factors such as online sales, offline sales, additional insurance, and coverage status that affect consumers' demand for family property insurance products. This paper upholds the principles of scientific, systematic,

typical and operable, and uses the five dimensions of service quality theory as the principle of index selection, and selects nine indicators that affect consumers' demand for family property insurance products, as shown in Table 1.

Table 1: Factors influencing consumer demand for family property insurance products.

Primary Indicators	Secondary indicators	Five Dimensions
Product positioning	C1 Additional coverage	Tangibility
	C2 Coverage	Guaranteed
	C3 Sum insured status	Tangibility
	C4 Reasonableness of the insured amount of time	Reliability
	C5 Reasonableness of premium	Tangibility
	C6 Claims settlement	Reliability
	C7 Clarity of liability definition	Empathy
	C8 Internet sales	Responsiveness
	C9 Off-line sales	Responsiveness

2.1.2 Factors Influencing Consumer Demand for Family Property Insurance Companies.

Drawing on the service quality evaluation indexes of China's insurance industry (Feng 2017) and the evaluation indexes of insurance companies' claims service quality (Huang 2009), this paper uses the five-dimensional theory as the principle of index selection and the whole process of consumers' insurance purchase as the main line, and selects 21 more important indexes covering the process from insurance purchase to claims service that affect consumers' demand for insurance companies, as shown in Table 2.

Table 2: Factors influencing consumer demand for family property insurance companies.

Primary Indicators	Secondary indicators	Five Dimensions
Show work	C10 Clean and tidy store environment	Tangibility
	C11 Staff service etiquette standard situation	Tangibility
	C12 Staff dressing decently	Guaranteed
	C13 Company reimbursement situation	Reliability

	C14 Company credibility	Reliability
Claims work	C15 Insurance network situation	Guaranteed
	C16 Company's claims	Responsiveness
	C17 Professionalism of surveyors	Reliability
	C18 Accuracy of loss determination	Reliability
	C19 Accuracy of damage verification	Reliability
	C20 Simplicity of claim documents	Guaranteed
	C21 Professionalism of adjusting process	Reliability
Service Timeliness	C22 Timeliness of claims service	Responsiveness
	C23 Quality of complaint handling	Tangibility
	C24 Callback during the hesitation period	Empathy
	C25 Inbound telephone call manual connection	Empathy
	C26 Timely processing of complaints	Responsiveness

2.2 Indicator Selection

This section must be in one column. Since consumers consider a large number of factors when choosing a family property insurance company, in order to ensure the importance and typicality among the influencing factors, this paper will conduct a correlation analysis, aiming to eliminate redundant indicators.

In order to eliminate redundant indicators, correlation analysis was conducted for each factor of product positioning. It is generally believed that the absolute value of Spearman coefficient is greater than 0.8, then there is a strong correlation between two factors. In this paper, the Spearman coefficient between two two factors is calculated by using a one-sided test. From the calculation results, we know that the nine factors in the product positioning correlation analysis, the seven factors in the claims work, and the five factors in the service timeliness become insignificantly correlated with each other, so no indicator is deleted.

The correlation analysis of the factors of the presentation was conducted as shown in Table 3. The Spearman coefficient of ''Staff dressing decently'' and ''company reimbursement situation'' is 0.827, which means that there is a strong and significant correlation between these two factors. Therefore, the indicator of "Staff dressing decently" is deleted.

Table 3: Factors influencing consumer demand for family property insurance products.

	C10	C11	C12	C13	C14
C10	1	0.141	0.049	0	0.144
C11	-0.141	1	.715*	0.519	0.476
C12	-0.049	.715*	1	.827**	0.154
C13	0	0.519	.827**	1	0.048
C14	-0.144	0.476	0.154	0.048	1

**. The correlation is significant at a confidence level (one-sided) of 0.01. *. At a confidence level (one-sided) of 0.05, the correlation is significant.

The above influencing factors are sorted out and summarized to establish the evaluation index system of family property insurance company from the perspective of consumers, as shown in Figure 1.
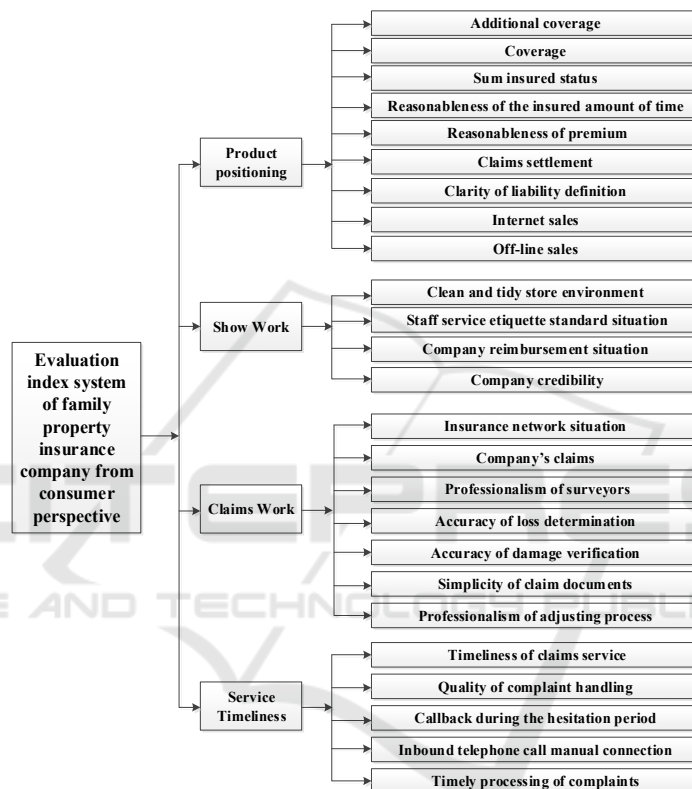

Figure 1: Evaluation index system of family property insurance company from consumer perspective.

3 ESTABLISHMENT OF EVALUATION MODEL

3.1 Determination of Indicator Weights

A questionnaire survey was administered to consumers who had purchased family property insurance to obtain information on consumers' linguistic evaluations of family property insurance companies. Since the probabilistic linguistic term set can not only describe the linguistic evaluation information provided by the group, but also portray the probability of the occurrence of these linguistic information. Therefore, this paper uses the probabilistic linguistic term set to comprehensively and accurately describe the consumer group's evaluation information about family property insurance companies.

In order to better allow decision makers to express decision information, the definition of a probabilistic linguistic term set is introduced.

Definition 1 (Pang 2016) Let $S = \{s_0, s_1, ..., s_t\}$ be an ordered set of linguistic terms, where BB s_i $(i = 0,1,...,t)$ is a linguistic term and t is an even number, then the probabilistic linguistic term set $PLTS$ can be defined as

$$L(p) = \left\{ L_k(p_k) \middle| L_k \in S, 0 \le p_k \le 1, k = 1, 2, ..., \right.$$
$$\left. \#L(p), \sum_{k=1}^{\#L(p)} p_k \le 1 \right\} \qquad (1)$$

where L_k denotes the kth linguistic term item in $L(p)$, p_k denotes the probability of occurrence of the linguistic term L_k, and $\#L(p)$ is the number of linguistic terms in $L(p)$. When $\sum_{k=1}^{\#L(p)} p_k < 1$, it indicates that the probabilistic information of some linguistic terms is missing. For this reason, (Pang, 2016) proposed a method to standardize the probabilistic information.

Definition 2 (Pang 2016) Let $L(p)$ be a probabilistic linguistic term set with partially missing probabilistic information, then the normalized probabilistic linguistic term set $\overline{L}(p)$ is defined as

$$\overline{L}(p) = \left\{ L_k(\overline{p}_k) \middle| L_k \in S, \overline{p}_k = p_k / \sum_{k=1}^{\#L(p)} p_k, \right.$$
$$\left. k = 1, 2, ..., \#\overline{L}(p) \right\}. \qquad (2)$$

Example 1 Let $S = \{s_0 : verybad, s_1 : bad, s_2 : medium, s_3 : good, s_4 : verygood\}$ be a linguistic terminology set. Suppose 20 consumers evaluate an insurance company's additional insurance index based on this linguistic terminology set, 3 people rate it as "very poor", 4 people rate it as "poor", 2 people rate it as "fair", 6 people rate it as "good", and 5 people rate it as "very good". Three people gave the rating "very poor", four people gave the rating "poor", two people gave the rating "fair", six people gave the rating "good", and five people gave the rating "very good". At this point, the probabilistic linguistic term set $\{verybad(0.15), bad(0.2), medium(0.1), good(0.3), very$ $good(0.25)\}$ can be used to represent the information about the 20 consumers' evaluation of the insurance company's additional insurance indicators.

The evaluation problem of family property insurance companies studied in this paper is a multi-indicator evaluation problem described as follows: $A = \{A_1, A_2, ..., A_n\}$ is assumed to be a set consisting of family property insurance companies, $S = \{s_0, s_1, ..., s_t\}$ is a linguistic term set, $C = \{C_1, C_2, ..., C_m\}$ is an evaluation indicator set, and the indicator weights are completely unknown. 100 consumers who have purchased family property insurance products are invited to evaluate the family property insurance company A_i based on the linguistic term set S, and the evaluation indicators

C_j considered are the evaluation indicators established in Chapter 2. In this way, based on the definition of the probabilistic linguistic term set, the probabilistic linguistic term set $L_{ij}(p_{ij})$ can be used to represent the evaluation information of 100 consumers for the family property insurance company A_i under the indicator C_j.

In the evaluation process of family property insurance companies, the weights of each indicator will have an important impact on the evaluation results. In this paper, the entropy measure of probabilistic linguistic term sets will be used to objectively assign weights to each evaluation index. First, the theory about the entropy measure of probabilistic linguistic term sets is as follows.

Definition 3 (Liu 2014) Let $L(p) = \{L_k(p_k) | k = 1, 2, ..., \#L(p)\}$ be a probabilistic linguistic term set, then define its fuzzy entropy $\overline{\theta}_F(L(p))$ as

$$\overline{\theta}_F(L(p)) = -\frac{1}{\ln 2} \sum_{k=1}^{\#L(p)} p_k \left[\alpha_k \ln \alpha_k + \right.$$
$$\left. (1 - \alpha_k) \ln(1 - \alpha_k) \right] \qquad (3)$$

where $\alpha_k = I(L_k)/t, k = 1, 2, ..., \#L(p)$. Here $I(L_k)$, is the subscript for the linguistic term item L_k.

Definition 4 [14] Let $L(p) = \{L_k(p_k) | k = 1, 2, ..., \#L(p)\}$ be a probabilistic linguistic term set, then define its hesitation entropy $\overline{\theta}_H(L(p))$ as

$$\overline{\theta}_H(L(p)) = \begin{cases} \sum_{i=1}^{\#L(p)} \sum_{j=i+1}^{\#L(p)} 4 \times p_i p_j \times f(\gamma_{ij}), & \#L(p) \ge 2 \\ 0, & \#L(p) = 1 \end{cases}$$
$$\qquad (4)$$

where $\gamma_{ij} = |\alpha_i - \alpha_j|, i, j = 1, 2, ..., \#L(p)$, α_i and α_j are shown in Definition 3, $f(\gamma_{ij}) = 2\gamma_{ij}/1 + \gamma_{ij}$.

The fuzzy entropy and hesitation entropy measure the fuzziness and hesitation of the probabilistic linguistic term set, respectively, and they reflect the degree of uncertainty of the probabilistic linguistic term set from different perspectives. On this basis, the total entropy of the set of probabilistic linguistic terms is defined as follows.

Definition 5 (Liu 2018) Let $L(p) = \{L_k(p_k) | k = 1, 2, ..., \#L(p)\}$ be a probabilistic linguistic term set, then its total entropy $\overline{\theta}_T(L(p))$ is defined as

$$\overline{\theta}_T\left(L(p)\right)=\overline{\theta}_F\left(L(p)\right)+\overline{\theta}_H\left(L(p)\right)$$
$$-\overline{\theta}_F\left(L(p)\right)\times\overline{\theta}_H\left(L(p)\right) \qquad (5)$$

where $\overline{\theta}_F\left(L(p)\right)$ is the fuzzy entropy of $L(p)$, $\overline{\theta}_H\left(L(p)\right)$ is the hesitant entropy of $L(p)$.

From the information entropy theory, it is known that for a certain index, the greater the entropy value of the evaluation information, the greater the uncertainty contained in the evaluation information, and therefore assign a smaller weight to the index; conversely, the smaller the entropy value, assign a larger weight to the index. In view of this, the weights w_j of evaluation indicators C_j are defined as follows.

$$w_j=\frac{\sum_{i=1}^{n}\left(1-\overline{\theta}_T\left(L_{ij}\left(p_{ij}\right)\right)\right)}{\sum_{j=1}^{m}\sum_{i=1}^{n}\left(1-\overline{\theta}_T\left(L_{ij}\left(p_{ij}\right)\right)\right)}, \quad j=1,2,...,m \qquad (6)$$

3.2 Model Establishment

In the evaluation process of family property insurance companies, insurance products are usually ranked comparatively. almost stochastic dominance provides the theoretical basis for the ranking of the options. almost stochastic dominance, which refers to comparing the distribution functions of two different random variables, stipulates that as long as most decision makers think that the insurance product A_1 dominates A_2, it is not necessary for all decision makers to make the same decision, eliminating extreme and unrealistic utility functions, and thus more consistent with actual decision making, so based on the traditional almost stochastic dominance criterion (Leshno, Levy 2002), this paper proposes an almost stochastic dominance evaluation method applicable to the probabilistic linguistic environment.

According to almost stochastic dominance theory.

Definition 6 (Leshno, Levy 2002) Suppose X and Y are random variables on $[a,b]$, $F(x)$ and $G(x)$ are the cumulative distribution functions of X and Y, respectively, $E_F(x)$ and $E_G(x)$ are the expectations of X and Y, respectively, u is the utility function of the decision maker, and $E_F u(x)$ and $E_G u(x)$ are the expectations of the utility functions of X and Y, respectively; for any $0.5<\varepsilon<1$, $U_{almost}(\varepsilon)$ denotes the other utility functions that exclude the extreme utility functions of

set. Then X almostly randomly prevails over Y when and only when for any $u\in U_{almost}(\varepsilon)$, there $E_F u(x)\ge E_G u(x)$ holds, where $U_{almost}(\varepsilon)=\left\{u\big|u'(x)\ge0,u'(x)\le\inf\{u'(x)\}\left[(1/\varepsilon)-1\right],\forall x\in[a,b]\right\}$.

In the evaluation process of family property insurance companies, decision members hold different decision attitudes toward insurance products in the actual decision making due to their different experiences and cognitive levels, and the variability of decision attitudes leads to different decision results. For this reason, the decision making attitudes of decision makers need to be considered in the decision making process. In this paper, we consider two types of decision making attitudes: pessimistic and optimistic attitudes. The decision maker with optimistic attitude is more bold and aggressive, and tends to choose larger elements, while the decision maker with pessimistic attitude is more cautious and tends to choose smaller elements.

The utility function is a measure of the change in the decision maker's preference or aversion to the consequences of the decision when faced with a risky situation, and the concept of probabilistic linguistic utility function is given below based on the decision maker's attitude.

Definition 7 Let $L(p)=\{L_k(p_k)|k=1,2,...,\#L(p)\}$ be a set of probabilistic linguistic terms and define the probabilistic linguistic utility function $u(L(p))$ when the decision maker is an optimist as

$$u(L(p))=\sum_{I(L_k)=0}^{t}\varphi(I(L_k),p_k) \qquad (7)$$

where

$$\varphi(I(L_k),p_k)=\begin{cases}I(L_k)\times\dfrac{\min p_k}{p_k} & ,0\le I(L_k)<\dfrac{t}{2}\\[2ex]\dfrac{t}{2}\times p_k & ,I(L_k)=\dfrac{t}{2}\\[2ex]I(L_k)\times\dfrac{p_k}{\max p_k} & ,\dfrac{t}{2}<I(L_k)\le t\end{cases}$$

Definition 8 Let $L(p)=\{L_k(p_k)|k=1,2,...,\#L(p)\}$ be a set of probabilistic linguistic terms and define the probabilistic linguistic utility function $u(L(p))$ when the decision maker is a pessimist as

$$u(L(p))=\sum_{I(L_k)=0}^{t}\varphi(I(L_k),p_k) \qquad (8)$$

where

$$\varphi\left(I\left(L_k\right),p_k\right)=\begin{cases} I\left(L_k\right)\times\dfrac{p_k}{\max p_k} & ,0\le I\left(L_k\right)<\dfrac{t}{2} \\[2mm] \dfrac{t}{2}\times p_k & ,I\left(L_k\right)=\dfrac{t}{2} \\[2mm] I\left(L_k\right)\times\dfrac{\min p_k}{p_k} & ,\dfrac{t}{2}<I\left(L_k\right)\le t \end{cases}$$

here, $I\left(L_k\right)$ is the subscript of the linguistic term item L_k.

Example 2 (continued from Example 1) Suppose that for the additional insurance (C_1) of the Chinese life insurance company (A_1), the evaluation information given by the decision makers can be expressed in a probabilistic linguistic term set $\{verybad(0.15),bad(0.2),medium(0.1),good(0.3),verygood$

$(0.25)\}$. When the decision maker is an optimist, the utility function can be calculated by equation (7) as

$$u\left(L(p)\right)=1\times\frac{0.1}{0.2}+2\times0.1+3\times\frac{0.3}{0.3}+4\times\frac{0.25}{0.3}$$

When the decision maker is a pessimist, the utility function is given by Equation (8) as

$$u\left(L(p)\right)=1\times\frac{0.2}{0.3}+2\times0.1+3\times\frac{0.1}{0.3}+4\times\frac{0.1}{0.25}$$

Based on Definition 7 or Definition 8, the utility function value $u\left(L_{ij}\left(p_{ij}\right)\right)$ of the evaluation information $L_{ij}\left(p_{ij}\right)$ of family property insurance company A_i under indicator C_j can be calculated. thus, the combined utility function value of family property insurance company A_i is defined as

$$u\left(A_i\right)=\sum_{j=1}^{m}w_j\times u\left(L_{ij}\left(p_{ij}\right)\right)\quad i=1,2,...,n \qquad (9)$$

In summary, this paper proposes a method for evaluating family property insurance companies based on a probabilistic linguistic approximation of the stochastic dominance criterion in the following steps.

Step 1: Consumers who have purchased family property insurance are invited to linguistically evaluate each evaluation indicator C_j of the insurance company and represent the consumers' evaluation indicator C_j in the form of a probabilistic linguistic term set.

Step 2: After obtaining the weight evaluation information in the form of the probabilistic linguistic term set, it is standardized, and then the weights of each evaluation indicator are calculated using the probabilistic linguistic entropy weight method (shown in Equation (6)).

Step 3: Using Equation (7) or Equation (8), the linguistic utility function value $u\left(L_{ij}\left(p_{ij}\right)\right)$ of the probabilistic linguistic evaluation information given by the decision maker based on the decision attitude is calculated, and the utility function matrix is constructed.

Step 4: Using Equation (9), calculate the combined linguistic utility function values $u\left(A_i\right)$ of decision makers regarding the insurance company A_i under all indicators C_j.

Step 5: Compare the magnitude of the combined linguistic utility function values between the two solutions based on almost stochastic dominance theory, and rank and select the best insurance company A_i based on the obtained combined linguistic utility function values.

4 EMPIRICAL ANALYSIS

4.1 Evaluation Process

A questionnaire survey was administered to consumers who had purchased family property insurance to obtain inWe hope you find the information in this template useful in the preparation of your submission.The level of technology and assets in China has increased dramatically in recent years, and the number and variety of products available for people's consumption have been expanding and enriching. In today's consumer market, consumer groups are not only concerned about the quality and reputation of the products themselves, but also about the personalization of the products in selecting goods and services. For this reason, consumers have different attitudes towards local established companies, small listed companies and emerging online companies when purchasing insurance. They choose the right insurance company for themselves according to their own preferences and pay more and more attention to the suitability of insurance companies.

Two representative local established insurance companies, China Life and Ping An of China, two small listed companies, Hong Kang Life and YangGuang Life, and two emerging netflix companies, Jingdong Financial and Allianz Financial, were selected as the insurance companies to be evaluated, and a questionnaire was designed to

evaluate the six selected insurance companies based on the linguistic term set $S=\{verybad(0.15), bad(0.2), medium(0.1), good(0.3), very\ good(0.25)\}$ and the 25 evaluation indexes constructed in the second part. 150 questionnaires were distributed, of which 96 valid questionnaires were returned.

In order to help consumers make better choices when purchasing family property insurance, this part uses the proposed probabilistic linguistic almost random dominance evaluation method to theoretically analyze the evaluation information and obtain the ranking of the advantages and disadvantages of each insurance company to provide a theoretical basis for consumers to choose a family property insurance company. Also this part will demonstrate the operation process of the evaluation model and verify the feasibility and validity of the proposed model.

Step 1: Construct the probabilistic linguistic evaluation matrix based on 96 valid questionnaires and the definition of probabilistic linguistic term sets.

Step 2: The probabilistic linguistic evaluation information is standardized, and then each indicator is assigned a weight using equation (6) to obtain the weight of each indicator, as shown in Table 4.

Table 4: Factors influencing consumer demand for family property insurance products.

weight	C1	C2	C3	C4	C5	C6	C7
	0.05	0.04	0.04	0.05	0.05	0.05	0.03
	C8	C9	C10	C11	C12	C13	C14
	0.03	0.04	0.04	0.04	0.03	0.04	0.04
	C15	C16	C17	C18	C19	C20	C21
	0.04	0.04	0.04	0.04	0.04	0.05	0.04
	C22	C23	C24	C25			
	0.04	0.04	0.04	0.03			

Step 3: Assuming that the decision maker is an optimist, the probabilistic linguistic utility function values $u(L_{ij}(p_{ij}))$ for the insurance company A_i ($i=1,2,\ldots 6$) under each indicator C_j are calculated using equation (7) and aggregated into a utility function matrix as follows.

$$U = \begin{pmatrix} 7.7 & 4.2 & 2.4 & 3.3 & 7.2 & 7.5 & 4.6 & 5.5 & 3.2 & 7.6 & 5.0 & 5.6 \\ 6.2 & 2.9 & 6.8 & 7.2 & 5.4 & 4.7 & 2.6 & 5.0 & 6.7 & 3.1 & 4.3 & 6.2 \\ 1.5 & 2.5 & 3.0 & 5.7 & 1.2 & 1.9 & 2.8 & 3.6 & 5.0 & 2.8 & 2.1 & 2.6 \\ 3.2 & 4.9 & 8.5 & 3.4 & 3.8 & 3.5 & 4.0 & 5.8 & 6.8 & 1.7 & 5.4 & 5.4 \\ 7.5 & 7.5 & 7.5 & 7.0 & 7.0 & 4.3 & 2.0 & 3.5 & 0.5 & 7.0 & 3.0 & 2.5 \\ 4.4 & 1.0 & 5.2 & 4.0 & 2.7 & 7.3 & 2.3 & 2.6 & 3.7 & 6.0 & 5.4 & 0.67 \end{pmatrix}$$

$$\begin{pmatrix} 5.6 & 4.8 & 5.3 & 4.8 & 2.6 & 3.4 & 8.3 & 4.5 & 5.0 & 2.2 & 3.1 & 6.0 & 7.9 \\ 7.4 & 4.8 & 5.5 & 3.4 & 6.6 & 5.6 & 4.3 & 4.8 & 2.4 & 5.5 & 4.4 & 7.6 & 4.4 \\ 5.9 & 4.1 & 4.9 & 2.8 & 3.5 & 5.9 & 3.2 & 1.6 & 1.6 & 3.4 & 4.8 & 3.5 & 0.7 \\ 6.8 & 1.6 & 2.7 & 5.8 & 5.1 & 2.8 & 3.7 & 4.1 & 4.7 & 4.4 & 6.2 & 2.1 & 2.5 \\ 7.5 & 7.0 & 3.5 & 4.5 & 4.5 & 3.5 & 3.0 & 7.0 & 3.0 & 2.5 & 3.0 & 5.5 & 3.0 \\ 2.4 & 4.3 & 7.3 & 3.7 & 0.3 & 4.7 & 3.0 & 7.3 & 3.6 & 5.0 & 2.0 & 1.3 & 2.0 \end{pmatrix}$$

Step 4: Using equation (9), the value of the combined utility function for each company is calculated as $u(A_1)=5.068, u(A_2)=5.143, u(A_3)=3.192,$ $u(A_4)=4.356, u(A_5)=4.779, u(A_6)=3.8.$

Step 5: Based on the above utility function values, we get the ranking of each insurance company in terms of advantages and disadvantages as $A_2 \succ A_1 \succ A_5 \succ A_4 \succ A_6 \succ A_3$.

4.2 Result Analysis

From the above calculation process, it can be seen that consumers focus on the reasonableness indicators regarding the setting of family property insurance products such as the claim settlement, additional insurance settings, reasonableness of premiums, and effectiveness of coverage, as well as the indicators of the degree of credibility ability of insurance companies when purchasing family property insurance, while online sales are not the indicators that consumers focus on when choosing family property insurance companies for the time being.

Looking at the primary indicator product positioning alone, the utility function value of each insurance company is calculated as $u(A_1)=44.43, u(A_2)=47.46, u(A_3)=27.06, u(A_4)=43.95, u(A_5)=46.83, u(A_6)=33.25$. In terms of product design positioning, it can be seen that Ping An of China has a strong competitive edge, and the product positioning of Ping An Insurance Company of China is clear in consumers' minds, which meets people's functional needs for the product as well as the expected loss protection. Looking at the primary indicator display work alone, the utility function value of each insurance company are $u(A_1)=23.82, u(A_2)=20.95, u(A_3)=13.4, u(A_4)=19.3, u(A_5)=20, u(A_6)=14.36$. At this time, the service display level of China Life Insurance Company is higher in consumers' mind, the company's solvency, degree of credibility and other

hard strengths are stronger, China Life Insurance Company's products have stronger contractual protection, and the service facade and staff's reception etiquette are more standardized. Looking at the primary indicator claims work alone, the utility function value of each insurance company are $u(A_1) = 33.59, u(A_2) = 34.97, u(A_3) = 25.97, u(A_4) = 25.81, u(A_5) = 33, u(A_6) = 30.7$. It can be seen that Ping An Insurance Company of China has a higher claim settlement rate in consumers' mind, and consumers are more inclined to choose Ping An Insurance Company of China. Looking at the first level indicator service hours alone, the utility function values for each insurer are $u(A_1) = 24.21, u(A_2) = 24.19, u(A_3) = 14.02,$

$u(A_4) = 19.91, u(A_5) = 17, u(A_6) = 13.88$, It can be seen that China Life Insurance Company is better than other insurance companies in terms of empathy and urgency in the minds of consumers.

Combining these three indicators, Ping An Insurance Company of China has the strongest overall strength. Different types of insurance companies have their own competitive advantages. Ping An of China and China Life, the two oldest insurance companies in China's insurance industry, are stronger than several other major companies in terms of overall strength, with strong capital and solid overall strength. Allianz Financial Insurance and Jingdong Financial Insurance Company, the emerging Netflix companies, excel in display work and claims work, focusing on improving the service quality of family property insurance products while improving the actual business level of the company in order to gain consumer recognition. Among the listed companies, Sun Life and Hong Kang Life were superior in terms of service timeliness and claims work. Hongkang Life outperforms other insurance companies in the underwriting business of family property insurance, and Sun Life outperforms other insurance companies in the professionalism of its surveyors.

Through the above analysis, it is beneficial for consumers to purchase family property insurance according to the characteristics and advantages of each company's insurance products. In conclusion, if a family property insurance company wants to get a long development in the future, besides creating its own outstanding advantages, it also needs to "strengthen the weak points" and "fill the short boards" to better realize the high-quality development of the company, so as to focus on the main business, build advantages, win with quality, standardize the operation, and innovate, and take the

lead in the future. We should focus on our main business, build up our strengths, win by quality, standardize our operation, innovate, and take the road of "specialization and innovation" development. Now, standing at the new wind of the 14th Five-Year Plan, companies should grasp the strategic opportunity period of developing modern insurance service industry, focus on customers, adhere to high-quality development, create a healthy structure and distinctive product system, meet the personalized needs of consumers in different dimensions, and devote themselves to building a value insurance company with differentiated business characteristics and sustainable development. The company is committed to building a value-based insurance company with differentiated business characteristics and sustainable development capabilities, providing customers with better quality and reliable products and services, and continuously promoting product diversification.

5 CONCLUSIONS

By clarifying the factors that consumers consider when purchasing family property insurance, this paper divides the factors that affect consumers' choice of family property insurance companies into two aspects, namely, the quality of family property insurance products and the comprehensive strength of family property insurance companies, establishes an index system for evaluating family property insurance companies from consumers' perspective, and proposes a probabilistic linguistic almost random The probabilistic linguistic almost stochastic method is proposed for the evaluation of family property insurance companies. The method first uses the probabilistic linguistic entropy weighting method to assign the indexes, which takes into account the ambiguity and hesitation of the experts in evaluating the indexes, and improves the accuracy of the index assignment. Then, the probabilistic linguistic term set is combined with the almost stochastic dominance criterion to propose a probabilistic linguistic almost stochastic dominance decision making method for calculating the utility value of family property insurance companies to obtain the strength ranking of family property insurance companies. The decision method proposed in this paper fully considers consumers' psychological behavioral preferences and provides a feasible methodological idea for family property insurance company selection, and the model can also be extended to the satisfaction evaluation of

insurance companies with the same type of characteristics.

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