ISSN (Online) 2456 -1304

International Journal of Science, Engineering and Management (IJSEM)

Vol 10, Issue 9, September 2023

Framing as Gain versus Loss: Effects of Risk Aversion on the Intention to Purchase Flood Catastrophe Insurance in Chongqing Municipality

[1] Jingwen Yin, [2] Supanika Leurcharusmee, [3] Piyaluk Buddhawongsa, [4] Tossapond Kewprasopsak

[1][2][3][4] Faculty of Economics, Chiang Mai University, Chiang Mai, Thailand

Email: [1] jingwen_y@cmu.ac.th, [2] supanika.l@cmu.ac.th, [3] piyaluk.b@cmu.ac.th, [4] tossapond.kew@cmu.ac.th

Abstract*— China is a vast country with frequent catastrophes, and catastrophe insurance is an important means to disperse catastrophe risks. In Chongqing, since the catastrophe insurance pilot was launched in 2017. However, the policy catastrophe insurance, which is fully funded by the government, has only 74% coverage in the city of Chongqing in 2020. Therefore, this paper focuses on the willingness of urban residents to purchase flood catastrophe insurance. The purpose of this paper is to gain an in-depth understanding of Chongqing residents' knowledge of catastrophe insurance, their acceptance attitudes, and examine their buying behavior through a questionnaire survey, analyze and test whether there is risk aversion with framing gain vs loss in commercial insurance buyers through the perspective of behavioral economics. Based on questionnaire data from all the districts and counties in Chongqing, this study uses the binary logit model to empirically analyze residents' perceptions of the factors affecting purchase intention for flood catastrophe insurance. It provides a scientific basis for subsequent research on catastrophe insurance and policies related to system development.

***Index Terms*— Flood Catastrophe Insurance; Risk Aversion; Purchase Intention; Binary Logit Regression Model**

I. INTRODUCTION

Natural disasters in China can lead to severe consequences, taking various forms and magnitudes. Given the significant losses they cause, catastrophe insurance becomes crucial for managing the risks linked with these events. International catastrophe insurance operates through market-led, government-led, and collaborative models, each tailored to different global contexts. In comparison to nations with more mature programs, China is still in the early stages of establishing its catastrophe insurance.

The "Several Opinions of the State Council on Accelerating the Development of the Modern Insurance Service Industry," introduced in 2014, outlined guiding principles for the development of a "catastrophe insurance system." In 2017, the Chongqing Municipal Government reviewed and approved the "Implementation Opinions on Carrying Out Catastrophe Insurance in Chongqing." Subsequently, they agreed to execute the catastrophe insurance pilot program throughout the city.[1] While the establishment of the catastrophe insurance system has started yielding results and addressing the issue of insufficient catastrophe insurance supply in China, there are still challenges. Existing studies reveal that market failures in catastrophe insurance stem from two factors: inadequate supply and limited demand for catastrophe insurance (Kunreuther and Pauly, 2004; Zhuo and Duan, 2010). Due to China's imperfect insurance system and the nascent development of its insurance market, the effective provision of catastrophe insurance products remains inadequate.

This paper examines Chongqing residents' willingness to get flood catastrophe insurance, considering risk aversion. It analyzes how risk aversion, risk perception, and insurance awareness influence their demand for this insurance. This research will aid in designing and promoting catastrophe insurance products, refining systems, enhancing their applicability, and bolstering overall effectiveness and feasibility.

II. LITERATURE REVIEW AND HYPOTHESIS

To examine the factors influencing the purchase intention of flood catastrophe insurance among Chongqing residents, this paper compiles existing literature and formulates research hypotheses primarily grounded in the gain and loss framework of risk aversion, as well as risk perception and insurance awareness. In the empirical research segment, this study delves deeper by incorporating highly educated residents as an interaction term. Additionally, the study incorporates fundamental personal characteristics, which might have an impact on purchase intention, as control variables.

(1) Risk aversion

Risk aversion is a fundamental concept in economics, relating to a person's attitude towards risk. Mascolell et al. (1995) define it as a situation where a decision-maker views a certain outcome as at least as good as a given uncertain outcome. On the "utility-wealth" axis, a concave utility function curve indicates risk aversion, expressed as: U[E(w)]>E[U(w)]. This behavior involves avoiding events with high expected losses and probabilities of occurrence. Risk-averse individuals struggle with uncertainty, dislike ambiguity, and prioritize safety over hazards. They tend to stick with existing practices and resist new ideas or approaches (Hillson & Murray, 2005). The assumption of risk aversion aligns with economic rationality, considering

ISSN (Online) 2456 -1304
International Journal of Science, Engineering and Management (IJSEM)
Vol 10, Issue 9, September 2023

individuals as risk-averse by default unless specified otherwise.

In prospect theory's value function, individuals are more sensitive to losses than gains, yet both experiences have diminishing effects. The function graph shows a convex shape for loss-related decisions and a concave shape for gain-related decisions, with the loss region being steeper. While utility enhancements have explained anomalies, challenges persist. Incorporating the probability weighting function improvement aligns research with reality: overestimating low-probability events becomes significant. Kahneman's reversal concept notes that individuals are usually risk-averse with losses, but extremely small probability and large loss scenarios can make them risk-taking, similarly for gains.

Hypothesis 1: The framing of risk aversion significantly affects the purchase intention of flood catastrophe insurance, with residents exposed to gain-framed risk aversion demonstrating a different purchase intention compared to those exposed to loss-framed risk aversion.

(2) Risk perception of flooding

In the existing body of literature focusing on risk perception, it has been highlighted that the precision and lucidity with which an individual comprehends their perception of risk play a pivotal role in shaping their decisions concerning insurance purchases. Employing experimental methodologies, Johnson (1993) conducted a study encompassing aviation insurance and hospitalization health insurance. The outcomes revealed that the incorporation of specific and visually descriptive portrayals of risks related to aviation and illnesses led to a more than twofold augmentation in the premiums respondents were willing to commit.

As residents' depth of understanding pertaining to flood risk heightens—encompassing factors such as their recognition of flood occurrences in their locality, the plausibility of flood incidents, the predictability of floods, and the risks posed by floods to their families—their perception of flood risk becomes more distinct and well-defined. Capitalizing on the insights drawn from prior studies, this research ventures into an exploration of whether the level of background awareness regarding flood risk holds significant sway over residents' inclination to purchase insurance. The following hypothesis is posited:

Hypothesis 2: As residents progressively enhance their awareness of flood risk, their propensity to acquire flood catastrophe insurance will exhibit a notable and substantial increase.

(3) Residents' insurance awareness

Currently, public awareness regarding participation in catastrophe insurance remains relatively modest. This circumstance is intertwined not solely with individuals' perceptions of social security but also with the guidance provided by governmental entities and the extent of media coverage. As the populace's standard of living undergoes improvements, the adequacy of basic insurance might encounter limitations in addressing the public's comprehensive protection requirements. In light of this, actively promoting commercial catastrophe insurance emerges as a necessary complement to foundational catastrophe insurance. In broader terms, a heightened emphasis on disseminating the advantages associated with insurance becomes imperative. Elevating residents' comprehension of insurance constructs a foundation upon which their willingness to engage in insurance purchases can be fortified. As an extension of this notion, the following hypothesis is postulated:

Hypothesis 3: An increased awareness level within the population regarding insurance correlates positively with the strength of their intention to purchase insurance.

III. DATA SOURCES AND SELECTION OF VARIABLES

(1) Date source

This questionnaire employed a random sampling method to select policyholders who had purchased insurance from the insurance company. The survey covered all districts and counties and involved distributing online questionnaires with the help of the insurance company's staff. Additionally, some data were collected through field research in the region, resulting in comprehensive sample data. The survey was conducted in February 2023, yielding a total of 494 samples. After reviewing the completeness and validity of the data provided by residents, 443 valid samples were retained for this research, excluding any invalid ones.

(2) Condition of the questionnaire

The questionnaire was divided into five sections, risk attitude, risk perception, insurance awareness and current insurance purchase, purchase intention, and basic personal information. The basic information of residents includes gender, age, education and other basic information, see Table 1

Table 1 Chongqing resident's basic characteristic

		Frequency	Percent (%)
Gender	Male	166	37.5
	Female	277	62.5
Education level	Elementary school or lower	8	1.8
	Junior high school	49	11.1
	High school	85	19.2
	Vocational degree	108	24.4
	Bachelor's degree or above	193	43.6
Annual family income	50,000 and below	115	26
	50,001–100,000	131	29.6
	100,001–150,000	91	20.5
	150,001–200,000	36	8.1
	200,001–250,000	30	6.8
	250,001–300,000	12	2.7

ISSN (Online) 2456 -1304

International Journal of Science, Engineering and Management (IJSEM)

Vol 10, Issue 9, September 2023

	300,001–350,000	7	1.6
	350,001 and above	21	4.7
Family member	<5	395	89.2
	>5	48	10.8
Family Decision Making Score	1	36	8.1
	2	35	7.9
	3	146	33
	4	139	31.4
	5	87	19.6
Value of residential property	Within 1 million Yuan	321	72.5
	1 million–3 million Yuan	105	23.7
	3 million–5 million Yuan	12	2.7
	More than 5 million Yuan	5	1.1
	Total	443	100

As can be seen from the table, the total sample size of respondents was 443, with more females than males at 277, accounting for 62.5% of the total sample. In terms of educational attainment, the largest group of people with a bachelor's degree or higher was 193, accounting for about half of the total 43.6%; followed by 108 people with vocational education degrees, and the smallest number of people with elementary school education or below was only 8 people.

(3) Variable selection

The primary source of data for this paper originates from the questionnaires administered by the authors to the residents of Chongqing Municipality. The variables of interest, along with their defined measurements, have been meticulously chosen and are detailed in Table 2.

Table 2 Basic statistics for dependent and independent variables

Variable abbreviation	Variable name	Variable description	Average value
intention	Purchase intention	0=low purchase intention; 1=high purchase intention	0.63
RA1	Self-risk rating	0-4=risk averse; 5=risk neutral; 6-10=risk lover	6.17
RA2	Gain area	1=determinant; 2=risk item	1.65
RA3	Loss area	1=determinant; 2=risk item	1.81
RP_exper1	Frequently experienced flood disasters of living area.	1=strongly disagreed;2=disagree;3=not sure;4=agree;5=strongly agree	2.91
RP_exper2	Possibility of flood disaster in the future.	1=strongly disagreed; 2=disagree;3=not sure;4=agree;5=strongly agree	3.06
RP_exper3	Flood disasters can be predicted.	1=strongly disagreed;2=disagree;3=not sure;4=agree;5=strongly agree	3.59
RP_exper4	Flood disaster would damage home and endanger the personal safety of me and my family.	1=strongly disagreed;2=disagree;3=not sure;4=agree;5=strongly agree	3.46
IA_policy1	Know all the details of Chongqing's catastrophe insurance pilot program. (If you do not know the program, choose strongly disagree.)	1=strongly disagreed;2=disagree;3=not sure;4=agree;5=strongly agree	2.44
IA_policy2	The catastrophe insurance pilot program is useful for family.	1=strongly disagreed;2=disagree;3=not sure;4=agree;5=strongly agree	3.38
IA_policy3	The initiative of insurance companies to pay for accidents during the implementation of the pilot has improved your perception of insurance.	1=strongly disagreed;2=disagree;3=not sure;4=agree;5=strongly agree	3.62
IA_commerce1	Know about other flood insurance programs from private insurance companies.	1=strongly disagreed;2=disagree;3=not sure;4=agree;5=strongly agree	2.93
IA_commerce2	You recognize the role of flood insurance.	1=strongly disagreed;2=disagree;3=not sure;4=agree;5=strongly agree	3.46
IA_commerce3	If you have flood insurance, you trust the insurance company to fulfill their payout promises in the future.	1=strongly disagreed;2=disagree;3=not sure;4=agree;5=strongly agree	3.53

It is found that the purchase intention of 443 samples of Chongqing residents is 0.63, which is at the evaluation level of "high purchase intention". Meanwhile, the reliability and validity of the questionnaires were tested with SPSS 25.0 software, and the reliability of the questionnaires was at a high level with the Cronbach's alpha coefficient of each scale is 0.787, the reliability of the questionnaire at a relatively high level, the KMO value is 0.792, and the significance level of Bartlett's spherical test is 0.000, which indicates that the questionnaire has a good validity structure, that is, the questionnaire has a high level of reliability and validity, and the design is more reasonable and reliable.

ISSN (Online) 2456 -1304

International Journal of Science, Engineering and Management (IJSEM)

Vol 10, Issue 9, September 2023

IV. EMPIRICAL ANALYSIS

(1) Model building

This paper uses the binary logit model to analyze the purchase intention of Chongqing residents for additional flood catastrophe insurance. The formula is as follows:

$$\Pr\{y_i = 1\} = L(\alpha + \beta RA_i + CI_i\gamma + RP_i\delta + IA_i\rho + X_i\phi + eduh\theta) \quad (1)$$

where y is high intention to purchase additional flood insurance, RA is the risk aversion, CI is a vector of the current catastrophe insurance situation, RP is vector of risk perception, IA is the insurance awareness, X is a vector of individual characteristics, $eduh$ is the interaction term, and $L(\cdot)$ is the logistic distribution function.

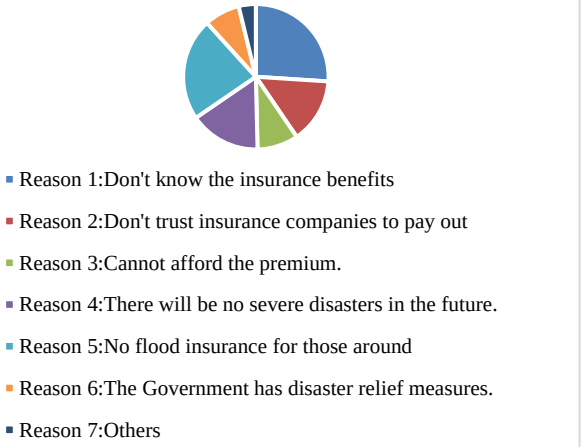
(2) Analysis results

As can be seen from table 3 above, model (1) regression results with risk attitude as the core independent variable and control variables; model (2) regression results with gain in risk aversion as the core independent variable and control variables; and model (3) regression results with loss in risk aversion as the core independent variable and control variables.

Table 3 Impact estimation of insurance intention on Binary Logit model

	(1) lo1	(2) lo2	(3) lo3
Variables	ybi_intention	ybi_intention	ybi_intention
RA1	0.190***		
	(0.063)		
int_ra1eduh	0.043		
	(0.083)		
RA2		-0.062	
		(0.429)	
int_ra2eduh		-0.406	
		(0.514)	
RA3			-0.808
			(0.510)
int_ra3eduh			1.660***
			(0.622)
CurrInsur_govt	0.902*	0.842*	0.905*
	(0.476)	(0.456)	(0.462)
CurrInsur_private	1.042**	1.119**	1.285**
	(0.514)	(0.514)	(0.527)
RP_exper1	0.195*	0.247**	0.260**
	(0.113)	(0.109)	(0.111)
RP_exper2	0.077	0.118	0.116
	(0.121)	(0.118)	(0.118)
RP_exper3	-0.352***	-0.354***	-0.381***
	(0.129)	(0.126)	(0.128)
RP_exper4	0.060	0.076	0.058
	(0.098)	(0.094)	(0.095)
IA_commerce1	0.449***	0.486***	0.470***
	(0.128)	(0.123)	(0.123)
IA_commerce2	0.294	0.208	0.200
	(0.179)	(0.174)	(0.174)
IA_commerce3	0.059	0.087	0.097
	(0.158)	(0.153)	(0.155)
x_female	0.440*	0.332	0.309
	(0.248)	(0.239)	(0.246)
x_edu_h	-0.088	0.335	-0.107
	(0.513)	(0.308)	(0.282)
x_inc	0.171**	0.181**	0.167**
	(0.079)	(0.076)	(0.076)
x_decisionweight	0.270**	0.317***	0.345***
	(0.116)	(0.111)	(0.112)
x_hsize	0.286***	0.281***	0.308***
	(0.087)	(0.086)	(0.087)
x_propertyvalueH	-0.444	-0.321	-0.372
	(0.316)	(0.305)	(0.306)
Constant	-6.509***	-5.893***	-5.731***
	(0.923)	(0.848)	(0.856)
Observations	443	443	443

Table 4 Reasons for not to Purchase Flood Catsatrophe Insurance



In the questionnaire, we included options for residents to indicate reasons behind their decision not to purchase flood catastrophe insurance, allowing each respondent to select multiple choices. As demonstrated in Table 4, the primary factors contributing to the reluctance among Chongqing residents to acquire flood insurance are "Do not know the benefits of flood catastrophe insurance." and "There is no one around to buy flood catastrophe insurance."

(1) Framing gain vs loss of risk aversion with purchase intention

The regression analysis reveals that the regression coefficient associated with risk attitude is 0.190, signifying its significance at the 1% level. This implies that risk aversion holds the potential to exert a substantial and positive impact on the willingness to purchase flood catastrophe insurance. The results suggest that even among this risk-averse group, there is a tendency for an elevated purchase intention as the risk rating climbs. This finding could be attributed to various factors such as compelling product features, attractive pricing strategies, or effective marketing campaigns that help mitigate the perceived risks.

Further analysis of the regression coefficients concerning gain and loss within the realm of risk aversion brings attention to noteworthy observations. Specifically, the coefficients of -0.062 and -0.808 yield non-significant effects and exhibit negative correlations with the propensity to purchase flood insurance. This outcome corroborates the principles of prospect theory put forth by Kahneman and Tversky. In instances where actors encounter uncertain risks associated with "small probability" events, a distinct pattern emerges: a propensity for risk preference in pursuit of gains and risk aversion tendencies in response to potential losses. With floods being characterized as events typified by both small probabilities and high potential losses, the resultant reluctance among residents to secure flood catastrophe insurance becomes more comprehensible. This underlying rationale substantiates the dearth of demand for flood catastrophe insurance in such circumstances, shedding light on the observed insufficient levels of interest.

The interaction term “education” in the context of risk aversion introduces a noteworthy dimension to our analysis of the purchase intention of flood catastrophe insurance. When considering the gain area of risk aversion, we observe that for individuals with "edu" values, the regression result of -0.406 suggests a negative relationship between education and the propensity to purchase flood catastrophe insurance. This may indicate that, within the context of potential gains, educated individuals exhibit a reduced inclination to purchase catastrophe insurance, possibly due to a combination of factors such as higher confidence in their ability to mitigate risks or differing perceptions of the potential gains.

However, the dynamics shift significantly when examining the loss area of risk aversion. In this scenario, the regression result of 1.660 indicates a strong positive relationship between education and the purchase intention of flood catastrophe insurance. The significance of this coefficient underscores that higher education levels amplify the influence of risk aversion on the decision to purchase insurance against potential losses. This outcome could be attributed to educated individuals' heightened awareness of the potential financial repercussions associated with catastrophic events, it drives them to be more willing to purchase flood catastrophe insurance. Consequently, this outcome lends support to the validity of Hypothesis 1 proposed in this study.

(2) Risk perception with purchase intention

RP_exper1 demonstrates consistent significance across all three models, characterized by positive coefficients. This indicates a substantial and positive influence of frequent flood disaster experiences on the propensity to purchase flood insurance. Particularly, the pronounced impact of frequent flood experiences on elevating purchase intentions is noteworthy. Thus, Hypothesis 2 is affirmed by this finding. Conversely, RP_exper2's positive coefficients did not meet the threshold of statistical significance, hinting at the lack of a meaningful effect of the possibility of a flood disaster on flood insurance purchase intentions. However, RP_exper3 maintains significance across all models at the 1% level, displaying a negative coefficient. This underscores that the ability to predict a flood disaster exerts a noteworthy negative impact on the inclination to purchase flood insurance. This suggests that those unable to predict flood disasters are more likely to lean towards purchasing flood insurance due to a heightened sense of ambiguity regarding potential losses. Finally, RP_exper4 yielded positive coefficients but lacked statistical significance. This implies that the impact of flooding on larger household property does not significantly affect the willingness to purchase flood insurance.

(3) Insurance awareness with purchase intention

IA_commerce 1 consistently attains statistical significance across all three models, characterized by a positive coefficient. This highlights a substantial positive influence of familiarity with other flood insurance programs on the propensity to consider purchasing flood insurance. Notably, possessing knowledge about other available flood programs emerges as a prominent driver, suggesting that this awareness considerably shapes the inclination to purchase. This finding substantiates the validation of Hypothesis 3 in this study. On the other hand, IA_commerce 2 exhibits positive regression coefficients across all models but falls short of attaining statistical significance. Consequently, the perception of the role of flood insurance seems to lack a statistically significant impact on the willingness to purchase flood insurance. Similarly, IA_commerce 3 displays positive regression coefficients across all models, yet it fails to meet the threshold of statistical significance. This indicates that the belief in insurance companies' performance does not exert a statistically significant effect on individuals' intentions to purchase flood insurance.

(4) Influence of individual characteristics of residents

Family income passed the 5% significance level test on all three models with a positive coefficient. This indicates that knowing that annual household income can significantly and positively influence the occurrence of flood insurance purchase intentions, those with higher annual household income are more likely to have a higher likelihood of flood insurance purchase intentions occurring than those with lower annual household income. Higher annual household incomes and more disposable income will be more able to afford to purchase additional flood insurance. The decision weight passed the significance level test on all three models with a positive coefficient. This indicates that knowing the respondent's decision weight in the household can significantly and positively influence the occurrence of flood insurance purchase intention, and respondents with high decision weight in the household are more likely to have a higher likelihood of flood insurance purchase intention occurring than respondents with low decision weight in the household. The number of family members passed the significance level test on all three models with a positive

coefficient. This indicates that knowing the number of family members can significantly and positively influence the occurrence of flood insurance purchase intention and that people with a high number of family members are more likely to have a higher likelihood of flood insurance purchase intention than people with a low number of family members.

V. CONCLUSIONS AND RECOMMENDATIONS

Using data from a February 2023 questionnaire survey involving Chongqing residents, this research examines their individual characteristics related to flood risk attitudes, risk perceptions, and their interest in obtaining flood insurance. The study then performs an initial analysis to identify factors influencing the demand for flood insurance, with a central emphasis on risk aversion. The primary objective is to provide valuable insights to shape a holistic catastrophe insurance framework, particularly addressing flood risk, and to facilitate the successful execution of corresponding policies in China. Key findings of the study include:

(1) With an escalation in the degree of risk aversion, purchase intentions could potentially decrease. Under such circumstances, consumers might lean towards avoiding the acquisition of flood insurance. However, they might exhibit a heightened likelihood of purchasing insurance when confronted with more substantial potential losses.

(2) Residents' different types of flood risk perceptions have different impacts on flood insurance purchase intentions, in which background perceptions of flood risk significantly and positively influence residents' insurance purchase intentions. The possibility of a flood disaster had no significant effect on willingness to purchase insurance. Experiencing frequent floods and being able to predict floods raises residents' risk perceptions, leading to a greater willingness to purchase flood catastrophe insurance.

(3) Residents with more knowledge of flood catastrophe insurance programs will be more willing to purchase.

(4) The higher the level of education, the more inclined residents are to purchase flood catastrophe insurance.

The empirical findings of this study carry the following policy implications:

(1) Enhancing Risk Cognition and Insurance Awareness:

The research underscores the substantial influence of risk cognition and insurance awareness on the inclination of Chongqing residents to purchase flood catastrophe insurance. Currently, there exists a noticeable lack of awareness regarding flood risks among Chongqing residents, coupled with a significant impact from the perspectives of their peers. To address this, it is recommended that the government employs diverse strategies such as risk education and effective risk communication initiatives. Additionally, insurance companies can play a pivotal role by further refining their insurance systems to heighten residents' awareness of flood-related risks and bolster their comprehension of insurance concepts. Strengthening these facets will contribute to elevating residents' willingness to purchase flood catastrophe insurance, thereby fostering the successful implementation of comprehensive catastrophe insurance frameworks that encompass flood coverage.

(2) Education Level Enhancement for Informed Decision-Making:

A compelling observation from the research is that residents' educational attainment significantly correlates with their predisposition to purchase insurance. The study underscores the potential of higher education levels to foster more objective and informed insurance-related decision-making processes. Considering this, there is an opportunity for the government to play a proactive role in enhancing residents' education levels. Such endeavors can potentially stimulate a proactive shift in residents' willingness to engage in flood catastrophe insurance purchases, ultimately reinforcing the effectiveness of insurance initiatives.

These policy implications gleaned from the empirical findings signify crucial steps that can be taken to enhance residents' insurance-related behaviors and promote a more comprehensive disaster risk management landscape.

REFERENCES

[1]. Chongqing Municipal People's Government: Implementation Opinions of the General Office of the Chongqing Municipal People's Government on Carrying out Catastrophe Insurance [EB/OL]. 08. 2017

[2]. Dennis P, Mayhew S. Risk-Neutral Skewness: Evidence from Stock Options. [J] Journal of Financial & Quantitative Analysis 37(3): 471~493. 2002.

[3]. Hillson D, Murray R. Understanding and Managing Risk Attitude. [M] Aldershot: Routlegge. Gower.:271~272. 2005

[4]. Kahneman D, Tversky A. Prospect theory: An analysis of decision under risk. [J] Econometrical: Journal of the econometric society: 263~291. 1979.

[5]. Kunreuther, H., M. Pauly. Neglecting Disaster: Why Don't People Insurance Against Large Losses? The Journal of Risk and Uncertainty, 28(1), PP. 5~21. 2004

[6]. Johnson, E., J. Hershey, J. Meszaros and H. Kunreuther, "Framing, Probability Distortions and Insurance Decisions", Journal of Risk and Uncertainty, 7, pp. 35~51. 1993.

[7]. Ministry of Emergency Management of the People's Republic of China: The Ministry of Emergency Management released and the basic situation of national natural disasters in 2021 [EB/OL]. Jan. 2021.

[8]. Zhuo Zhi, Duan Sheng. Catastrophe insurance market mechanism and government intervention: an overview[J]. Economist, (12): 88-97. 2010