

A new insurance evaluation system based on Analytic Hierarchy Process and Delphi method under natural disasters

Keyu Han *

Department of Health Economics and Management, Nanjing University of Chinese Medicine,
Nanjing, China, 210023

* Corresponding Author Email: 907628980@qq.com

Abstract. Overall, it is crucial for insurance companies to develop a new insurance model that can effectively handle natural disaster-related compensation. Firstly, in this paper, data related to the losses caused by natural disasters in countries around the world are collected and pre-processed. Secondly, a new insurance evaluation system under natural disasters is established by using Analytic Hierarchy Process and Delphi method. Through the analysis, it is concluded that when the risk factors exceed the threshold, the insurance company should bear the relevant risks. Then, this study analyzes various customer behaviors when insurance companies face the influence of decision. Eventually, in order to propose the final insurance model and improve the accuracy of the new insurance evaluation system, natural disaster data from 146 countries in 2022 were selected. In addition, 35 factor variables related to natural disasters were added to improve the accuracy of parameters estimated by regression equations, resulting in an optimal goodness of fit of 0.99. Through the establishment of a new insurance evaluation system, this paper can provide theoretical support and technical reference for the government to manage the insurance market under natural disasters in a more efficient and effective way.

Keywords: Analytic Hierarchy Process, Delphi method, new insurance evaluation system, Natural disasters.

1. Introduction

1.1. Background

The insurance industry is facing serious challenges in the face of rising risks from climate change. Munich Re recently released a report on the record of natural disaster losses in 2023, showing that in 2023, the global losses caused by natural disasters will total about 250 billion US dollars and cause about 74,000 deaths. Global insured losses were about \$95 billion, close to the recent five-year average.[1]

Insurance coverage gap Insurance plays an important role in the process of dealing with economic losses. But at the same time, from the perspective of insurance companies, insurance companies also face the problem of risk management in the process of underwriting. [2] It is reported that due to the increased risk of wildfires and rising inflation, the United States State Farm Insurance and the United States Allstate insurance company announced that the United States will no longer accept new home insurance applications for California residents.[1] Climate change is exacerbating extreme weather events. In some high-risk areas, if claims increase faster than insurers adjust premium rates, it could cause further instability in the insurance market.

By 2040, according to Swiss Re, losses from weather-related events are likely to spike by 35% to 120% in Australia, Canada, France, Germany, Japan, the UK, and the US, driven by big surges in floods, hurricanes and cyclones, and wildfires. Premiums for primary insurance coverage are rising quickly, with climate change fueling projected increases of 30% to 60% by 2040 (excluding inflation).

In addition, the global insurance protection gap is 57% on average and is increasing.[1] This highlights the industry's predicament - a looming crisis in terms of insurance companies' profitability and the affordability of policyholders. As insurance coverage improves, how to improve the ability of insurance companies to respond to climate risks and ensure their own long-term sound development is an important topic. With the intensification of climate change, not only the ability of

insurance companies to respond to climate risks needs to be improved, but also the ability to regulate climate risks of insurance companies needs to be improved with the times.

In today's insurance landscape, strong predictive modeling for risk-based pricing is essential. Yet many insurers find themselves faced with gaps in scenario and forecasting capabilities, limited asset vulnerability-based risk assessment, and changing correlation patterns across both assets and liabilities. [1] Calls for innovation in catastrophe models requiring next-level industry collaborations and wider local climate management initiatives are on-target, but the ability to execute lies well beyond current modeling capabilities. Just as one senior executive said, "We have consistently underestimated the risks in our models."

So far, more than 1,000 extreme weather events have cost the world more than \$1 trillion. As a result, the costs that insurance companies need to pay rise and the risks must be reassessed. [3] Therefore, the property insurance industry must actively pioneer innovative ways to address climate change challenges and promote sustainable practices to ensure sustainability and long-term health. Additionally, governments need to manage insurance markets more effectively against natural disasters. As a consequence, it's high time that as a part of the world, we had to make awareness of this situation and came up with some corresponding solutions.

1.2. Literature review

Since the severity of climate change, it's urgent for the property insurance industry to actively pioneer innovative ways to address the challenge of it and promote sustainable practices to ensure sustainability and long-term health for its own safety.

As for the definition of weather risk, Zeng Xiaoyan et al. [4] (defined the broad weather risk as the impact of abnormal weather changes (cold, heat, hurricane, blizzard, wind, rainfall, etc.) on human production and business activities, resulting in the safety of property and personnel, or the risk of significant reduction of cash flow or profits in operations). According to the different degree of loss caused by weather risk, weather risk can be divided into weather disaster risk and general weather risk. Weather disaster risk brings huge losses and has the characteristics of sudden occurrence. General weather risk is characterized by high frequency of occurrence, such as high temperature, rainfall and other events occur frequently. Such weather events cause relatively small losses each time, and their impact on the economy is less than that of weather disaster risk.

In 2011, Xie Shiqing and Mei Yunyun [5] demonstrated the primary implication of the harm caused by weather risks. Their research has a purpose for exploring weather derivatives, which can provide a new path and channel for enterprises' risk transfer with a measure of filling the basic fundamental of BP neural network.

In 2011, Feng Wenli and Yang Mei [6] argued that weather derivatives are the main financial instruments to avoid, transfer and limit the threat of weather risks.

In 2011, Zeng Xiaoyan [4] introduced the influence of extreme drought, precipitation, high temperature and low temperature were introduced into the function to analyze quantitatively the influence of extreme climate events on agricultural economic output in our country, indicating that extreme climate factor is granger reason to influence agricultural economic output change in our country

In 2014, J. D. Daron, D.A. [8] argued that index insurance is a means to adapt to climate change, but whether these products themselves can adapt to climate change has not been fully studied. Due to climate variability and climate change, the design results of such products are too dependent on historical climate observations.

To sum up, in the context of natural disasters, there is still a lack of insurance evaluation system using analytic hierarchy process and Delphi method in literature over the years. Therefore, this paper will use the Analytic Hierarchy Process and Delphi method to solve the following problems.

1.3. Research problem

Based on the above background, in order to help insurance companies implement long-term effective operations, this paper will solve the following two problems.

(1) Firstly, examine the circumstances under which insurance companies should underwrite policies and determine when they should assume the associated risks.

Secondly, research what behaviors a property owner does will affect companies' situation.

(2) First, to determine whether insurance companies should write policies in areas with an increased number of extreme weather events, create a natural disaster assessment model for them.

Second, demonstrate the above model using two areas, on different continents that experience extreme weather events.

2. Research method

2.1. Data acquisition and preprocessing

This study collected relevant data from countries around the world, sift ahead of time for reliable and useful data, and selected data related to losses caused by natural disasters in the United States, the United Kingdom, and Japan from 1950 to 2022 for visual analysis, and used the mean value to fill in the missing values in the data.

2.2. Method introduction

This study mainly uses Analytic Hierarchy Process and Delphi method to establish a new insurance evaluation system. According to the nature of the problem and the overall goal, the analytic hierarchy process mainly adopts the idea of first decomposition and then synthesis. First, master the main factors of the decision problem, and decompose them into different levels; Then, according to the relationship between the factors, the weight of these factors according to different levels from the bottom to the top level to form the analysis structure model. The final issue that needs to be determined boils down to the weight of the lowest level criteria factor relative to the overall objective. [7] In general, AHP carries out quantitative analysis on the basis of qualitative analysis and integrates the two ways better, which can put forward a set of systematic analysis methods and provide persuasive basis for scientific management and rational decision-making. [8]

The benefits for Hierarchical analysis are that it provides structural evaluation: The application of AHP for the evaluation process. It provides a structured assessment and makes the decision-making process more transparent by clarifying the relationship model between the various factors. This structured assessment of hierarchical analysis helps decision makers better understand the results and the logic behind the assessment. Additionally, Analytic hierarchy process (AHP) has practical characteristics for users to choose from. Firstly, its basic principles and basic steps are easy to understand and master, and its mathematical operations are relatively simple. Secondly, this method combines qualitative and quantitative methods, and can deal with many practical problems that traditional optimization techniques cannot address.[9]

Furthermore, the analytic hierarchy process (AHP) is systematic and concise. It can take the research object as a system and make decisions according to the idea of decomposition before synthesis, without isolating the influence of various factors on the result, but the setting of weights of each layer will affect the final result. [9] At the same time, it requires little data information, simple calculation and clear results. People with moderate education can understand the basic principles of analytic hierarchy process.

In terms of Delphi method, after nearly 60 years of development and improvement, Delphi method has been recognized and recommended by experts in many fields, and has proved its accuracy and reliability in theory and practice. While the Delphi method has developed rapidly, it has been used in an incredibly wide range of disciplines and topics. [10] Nowadays, Delphi method has become one

of the most popular survey methods to predict or evaluate the law or trend of something in the world, and is widely used in many fields such as business, military, education and health care.

Besides, the Delphi method is a development of expert meeting prediction method. Delphi method enables experts to deal with complex problems systematically, anonymously and with sufficient time using their knowledge level. [9] The Delphi method is a revolutionary innovation to the traditional expert meeting prediction method, overcoming the bias of "following the trend" in the traditional method, enabling each expert to think independently and reach more objective conclusions through multiple rounds of anonymous communication and revision. [10] The Delphi method produces results that are as reliable and accurate as any other scientific research method, such as surveys. Overall, the principle mainly includes the establishment of project evaluation (forecast) leading group, selection of experts, circular consultation, statistical analysis of four steps.[9]

On the other hand, Delph method also has the ability of illegal reduction of subjectivity: The Delphi method reduces the influence of individual subjective factors on the evaluation by hiding an expert vote. This approach helps to achieve a more objective consensus among experts and lays a solid foundation for the credibility and objectivity of the model.

3. Model building and solving

3.1. Catastrophe risk assessment model

First, this paper identifies the influencing factors, namely climate risk data, including historical and predicted frequency and severity of extreme weather events, and use correlation analysis to evaluate the factors that have the greatest influence on insurance companies' underwriting decisions. In order to find out when an insurance company should take risks and when to insure, this study sets up model probability, risk assessment model, financial model and optimization model respectively.

3.1.1. The Establishment of Catastrophe risk assessment model

First of all, the study needs to determine the influencing factors when the insurance company undertakes the policy, and do correlation analysis. Secondly, use the appropriate evaluation model to measure the risk and its own return. Then, the human factor is introduced and the regional evaluation model is used to synthesize various actual, historical situations and verify them. In addition, models need to consider climate risk assessments, property insurance pricing, insurance companies' financial health, and customers' risk management practices. Finally, a comprehensive model is developed by combining all the above factors.

Additionally, the paper needs to develop a comprehensive model to combine all factors, including climate risk data and owner influence, to evaluate insurance companies' decisions to write policies in specific areas. Models need flexible risk assessments based on different input parameters (e.g., climate change scenarios, capital reserve levels, etc.).

When calculating the policy evaluation model, it is necessary to consider each catastrophe separately, the reason lies in that the occurrence probability of different kinds of catastrophes is different. This paper studies flood and storm disasters and make targeted decisions in case the flood catastrophe comes.

Binomial distribution is used when the probability of occurrence of each event is the same, or the total number is not required to know, or the total number is large, and this insurance can be regarded as conforming to the binomial distribution. In addition, when n of the binomial distribution is large and p is small, the Poisson distribution can be used as an approximation of the binomial distribution where λ is np . Usually when $n \geq 10$, $p \leq 0.1$, it can be approximated by Poisson's formula.

Since the probability of extreme weather events is very small, so assume in this paper that all catastrophe events conform to the Poisson distribution.

Step 1: Build a frequency model of extreme weather events, representing the number of times they occur per unit of time,

$$P(X = k) = \frac{e^{-\lambda} \lambda^k}{k!} \quad (1)$$

To be specific, X represents the number of extreme weather events per unit time, λ stands for the average incidence of extreme weather events.

Within the framework of the CAT bond structure and under the case of no trigger CAT events, the investors of CAT bonds receive the principal with face value F and a coupon C upon maturity. The coupon C consists of two parts: risk-free interest rate (R_f) and the CAT bond spread. The CAT bond spread consists of the expected loss (EL) and a load for risk premium p . If the trigger events occur, then both the principal F and the coupon C to investors are deferred or reduced. [11]

A probabilistic disaster modeling approach provides more value than a deterministic approach because it includes all events that could cause harm and generates a detailed analysis of the return cycle based on an advanced risk model. A disaster model can be represented by four basic components or modules: hazard, exposure, vulnerability, and loss. Based on this, buildings also have expected loss and risk premium, and the loss size is positively correlated with the building's disaster resistance index and building value to some extent. As a result, this study can build a building risk model that takes into account eventual losses over time.

Step 2: Establish building risk model. Considering the vulnerability of buildings and infrastructure to disasters, the model was developed to show that building losses are related to structural seismic resistance,

$$L = \beta V I n + \beta_0 \quad (2)$$

Among them, L represents loss of the building, β means loss ratio factor, V stands for building value, I symbolizes disaster resistance index and n represents number of damages per building.

Probabilistic hazard models combine information about the frequency and severity of losses to generate a distribution of expected losses associated with all possible disaster scenarios. Where L_k represents the damage to the building in the event of k disasters, $E(L)$ represents the expected loss of the building, and $P(X = k)$ represents the probability of k disasters.

Step 3: establish a probabilistic risk assessment model, which combines the frequency of extreme weather events with the construction risk:

$$E(L) = \sum_{k=0}^{\infty} P(X = k) \cdot L_k \quad (3)$$

Specifically, $E(L)$ represents the expected loss, $P(X = k)$ is the probability of k extreme weather events, and L_k is the loss caused by k extreme weather events

This paper introduces the risk bearing factor Q , so $Q * P$ represents the risk borne by the insurance company, after deducting the expected loss from its underwriting capacity.

$$Q = \frac{CP - E(L)}{P} \quad (4)$$

To be specific, C stands for insurance company's underwriting capacity parameter, P represents premium.

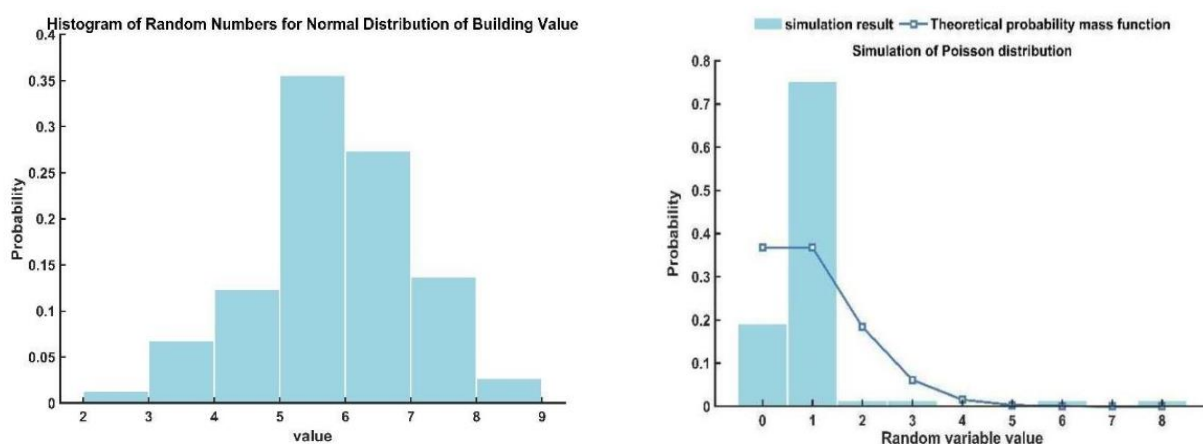
3.1.2. The Solution of Catastrophe risk assessment model

This paper selected the United Kingdom and the United States as the regions for disaster risk assessment and modeling. First, both countries have highly developed insurance markets and strong financial systems, providing rich historical data and diverse insurance products for model building.

Secondly, both the UK and the US are located in regions with diverse geological and climatic conditions, including multiple types of natural disasters such as earthquakes, hurricanes and floods, which makes the model more broadly applicable. At the same time, the two countries also have leading positions in technology and data analysis, and have a wealth of professional talent and technical resources to help build accurate disaster risk assessment models using advanced technologies. Finally, the British and American governments also provide corresponding support in the fields of insurance and risk management, including open data sharing, policy formulation, and promotion of scientific and technological innovation, which provides a positive environment for the construction of disaster risk models. In view of the above considerations, our team chose the UK and the US as demonstration areas to provide a good basis for building a comprehensive and accurate disaster risk assessment model.

Matlab was used to compile the Data from the website Our World in Data.

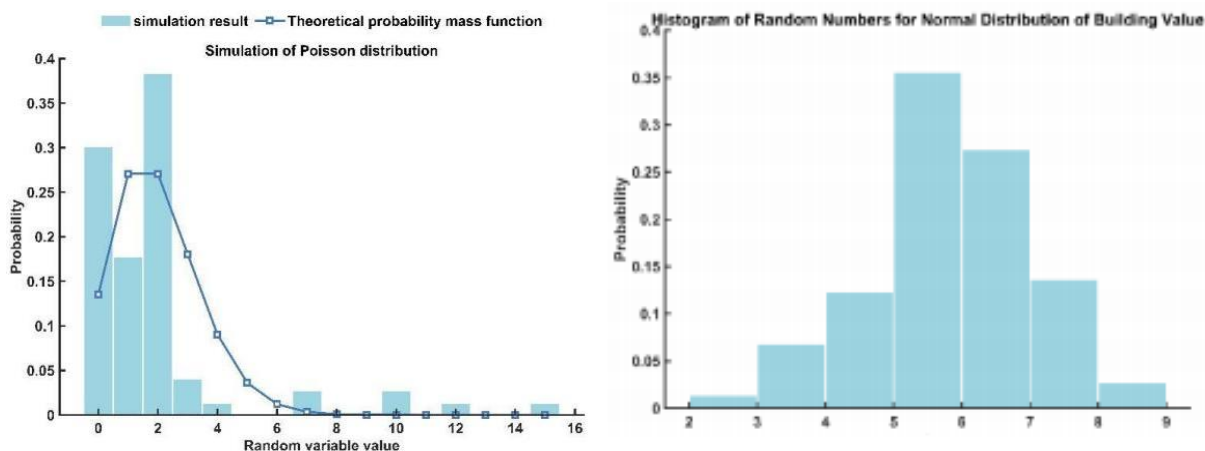
According to the first step in the model,



Poisson distribution of extreme weather events in US (A) and Poisson distribution map of extreme weather events in UK (B)

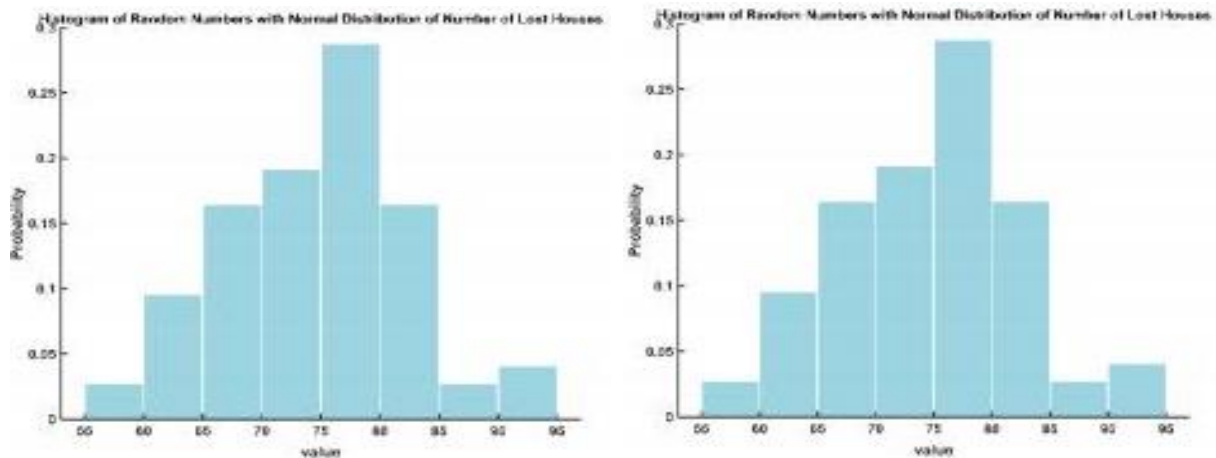
Figure 1. Poisson distribution of extreme weather events

According to Figure 1 (A) extreme weather events in the United States conform to Poisson distribution, and from Figure 1 (B) that extreme weather events in the United Kingdom conform to Poisson distribution as well.



The normal distribution of building values in Britain (A) and The normal distribution of building values in US (B)

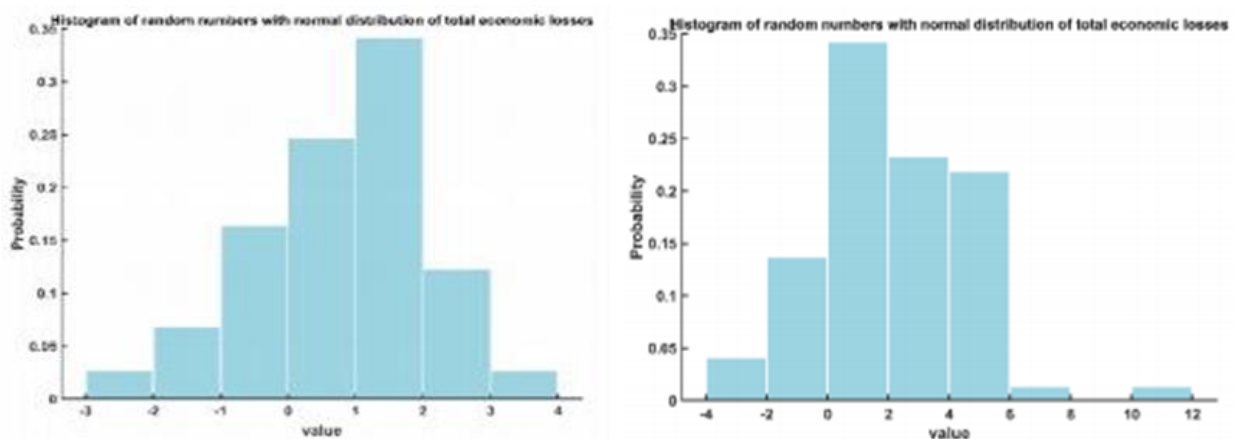
Figure 2. The normal distribution of building values



The normal distribution of lost homes in the US (A) and the normal distribution of lost homes in the UK (B)

Figure 3. The normal distribution of lost homes

In addition, it can be seen from Figure 2 that the building value of the United States and the United Kingdom conforms to the normal distribution.



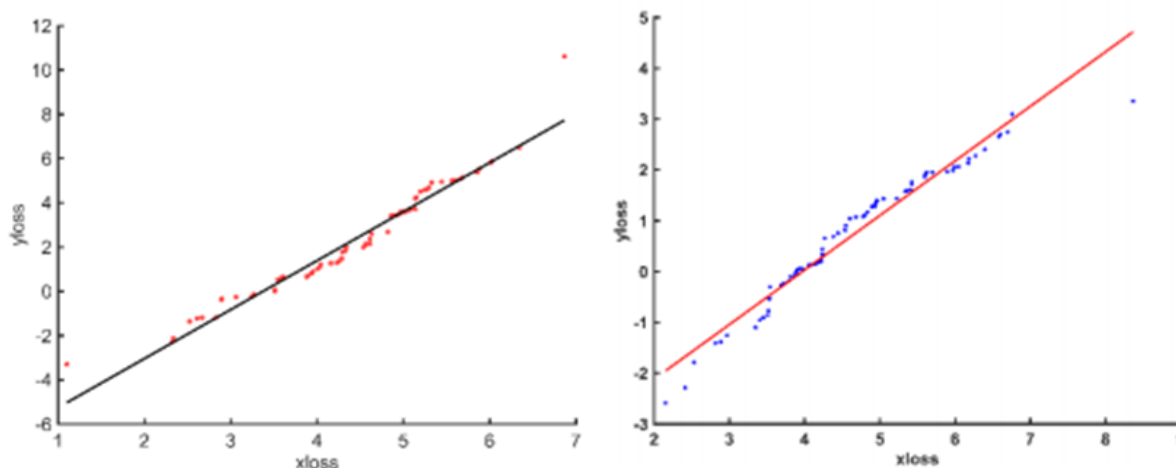
Normal distribution of total economic losses in the US (A) and Normal distribution of total economic losses in the UK (B)

Figure 4. Normal distribution of total economic losses

As can be seen from Figure 3, the number of lost houses in the United States and the United Kingdom conforms to the normal distribution.

As can see from Figure 4, the total economic losses in extreme weather events in the United States and the United Kingdom are in line with normal distribution.

According to the second step of the model, this paper obtained the correlation analysis chart of the total economic losses in the UK and the US in extreme weather.

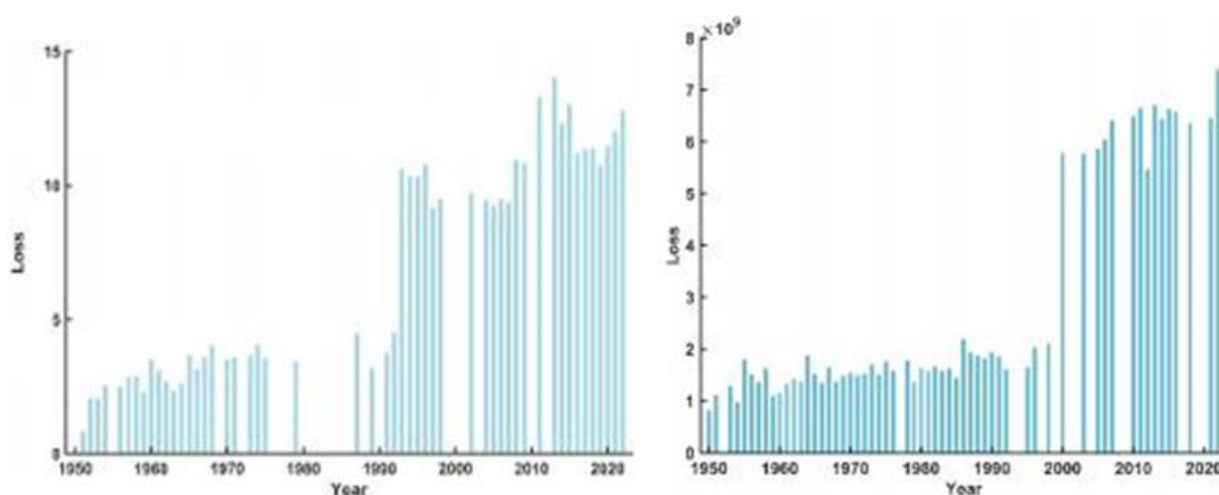


American correlation analysis (A) and UK correlation analysis (B)

Figure 5. Correlation analysis

As can be seen from Figure 5, the correlation of the influencing factors selected is more than 90%, so it is suggested that the insurance company should make a decision

And the total economic losses/building losses since 1950 in both the United States and the United Kingdom.

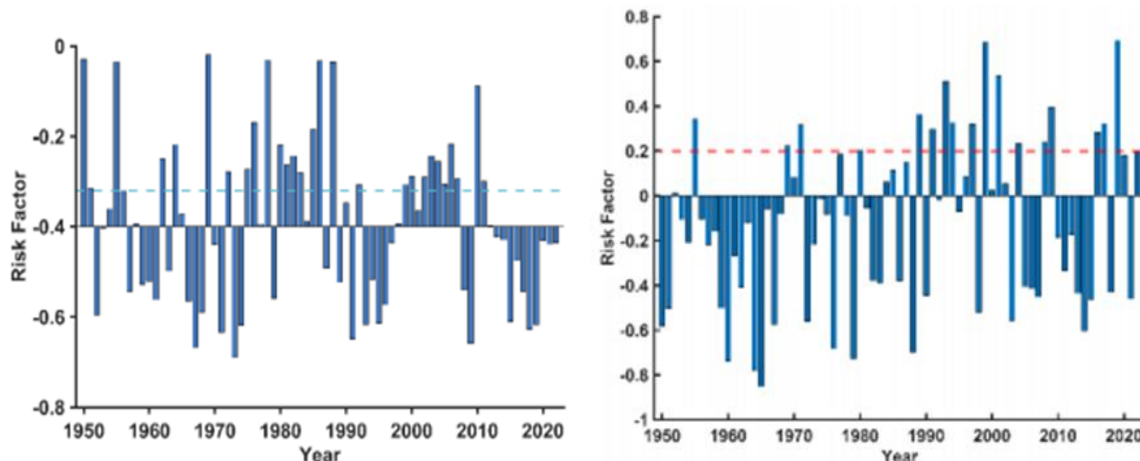


Graph of total economic losses in the United States overtime (A) and Graph of total economic losses in the UK overtime (B)

Figure 6. Graph of total economic losses overtime

As can be seen from Figure 6, the economic losses of the United States have risen sharply since the 1990s and remain high until now, while the United Kingdom has entered this stage slightly later than the United States, but the economic losses have remained high since the 21st century.

The risk factors of Britain and the United States since 1950 are shown in Figure 7 below:

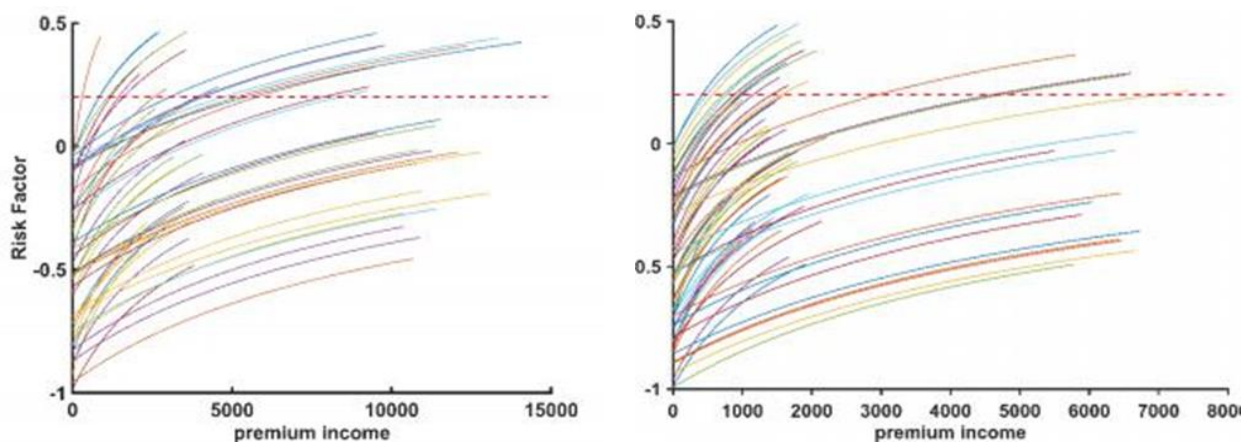


United States risk factor and year chart (A) and United Kingdom risk factor and year chart (B)

Figure 7. Risk factor and year chart

According to Figure 7, both the factor returns of the United States and the United Kingdom are positive and negative, with great fluctuations, and statistically unable to contribute non-zero excess returns. Therefore, this factor cannot generate excess returns, but it can significantly describe certain systemic risks. As a consequence, this factor is a good risk factor. Although benefits can be obtained when the risk factor is greater than 0, in order to ensure the balance of the company's income and expenditure, the insurable standard is set at 0.2 in this paper.

The study calculated premiums and risk factors charged by insurance companies to get the annual risk factors caused by floods in the United Kingdom and the United States as shown in the Figure 8:



The relationship between risk factors and premium income in the US (A) and in the UK (B)

Figure 8. The relationship between risk factors and premium income

Therefore, as can be seen from Figure 8, when the insurance factor is greater than 0.2, the policy can bear this risk. In addition, the greater the risk factor, the greater the insurance company's policy income; on the contrary, the lower the insurance factor, the greater the risk and the lower the income. Therefore, through the modeling analysis in this paper, it is not recommended to write insurance policies in regions where extreme weather events are increasing.

3.2. Improved catastrophe risk assessment model

3.2.1. The Establishment of Improved catastrophe risk assessment model

This paper introduces a dynamic risk threshold. A new insurance model is proposed. Considering the natural, economic and other factors of the region, real estate developers hope to find places with low risk factors to develop real estate. However, due to the demand of some places, real estate developers have to develop real estate. Therefore, this study proposes a dynamic risk threshold, *Qtrends*, to evaluate different regions.

The model of problem 1 is improved.

Step1: Establish disaster frequency model

$$P(X = k) = \frac{e^{-\lambda} \lambda^k}{k!} \quad (5)$$

Precisely, X represents the number of disasters per unit time, λ symbolizes the average incidence of disasters.

Step2: On the basis of the model in problem 1, add environmental and economic factors to build a loss model.

$$L = \beta_0 + \beta_1 V I n + \sum_{i=1}^{35} \beta_i x_i \quad (6)$$

Precisely, L represents the building loss, β symbolizes the loss ratio, V stands for the building value, I represents the disaster resistance grade, and n is the number of buildings damaged per session.

Step3: Probabilistic risk assessment model, combining disaster frequency and construction risk to build this model.

$$E(L) \sum_{k=0}^{\infty} P(X = k) \bullet L_k \quad (7)$$

Where $E(L)$ is the expected loss, $P(X = k)$ is the probability of k disasters, and L_k is the loss of k disasters Risk taking factor Q is introduced.

$$Q = \frac{CP - E(L)}{P} \quad (8)$$

C represents insurance company's underwriting capacity parameters and P is the premium.

3.2.2. The Solution of Improved catastrophe risk assessment model

According to step 1, the paper gets Figure 9, the disaster conforms to the Poisson distribution, so can continue to model the step 2.

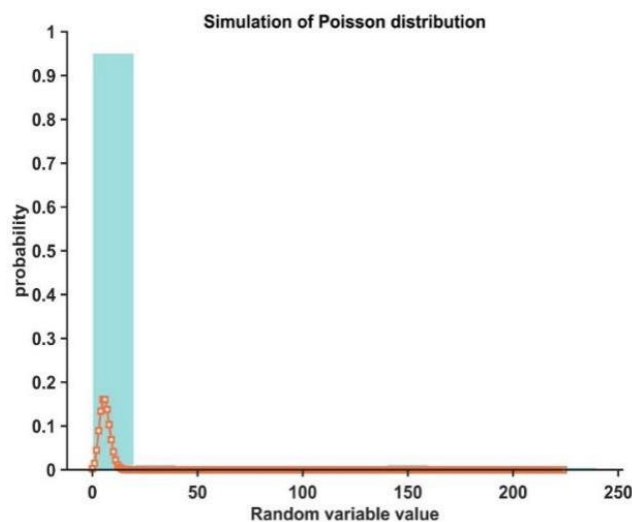


Figure 9. Poisson distribution map of hazards

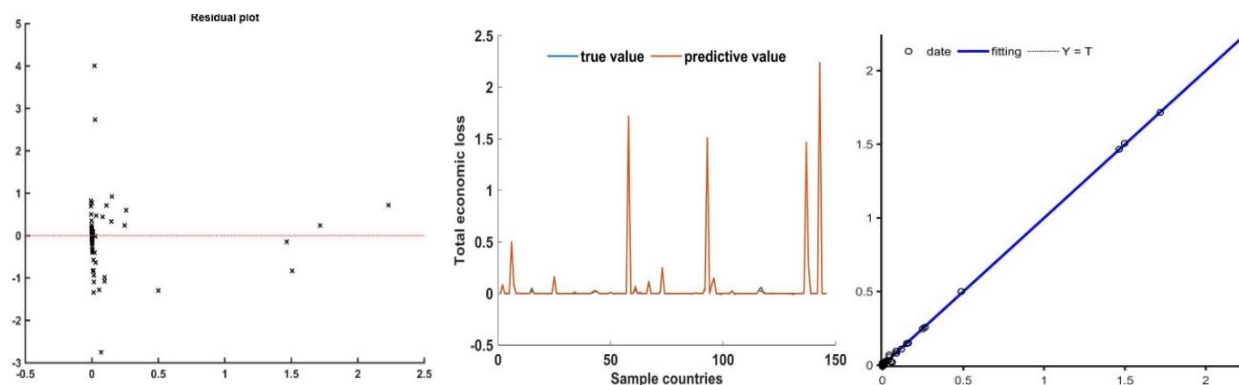


Figure 10. Residual diagram (A) and Comparison chart of calculated loss forecasts (B) and Linear fitting graph (C)

According to the second step, the model is built and the model fit degree is analyzed.

It can be seen from Figure 10 that the residual is almost 0 and the goodness of fitting is 0.99, which has a good effect. It can be seen that the prediction model built can accurately describe the actual data, and the prediction accuracy is high, which can be used for evaluation.

According to Figure 11, the return rate of risk factor is positive in most of the time. Although the fluctuation is large, it still shows that this factor can contribute excess return, but its own fluctuation also brings its corresponding systemic risk.

In the second specific picture number in the upper right corner, the factor yield is positive most of the time and fluctuates very little. This shows that this factor can not only contribute to excess returns stably, but also has a very low systemic risk. This is theoretically the best yield factor.

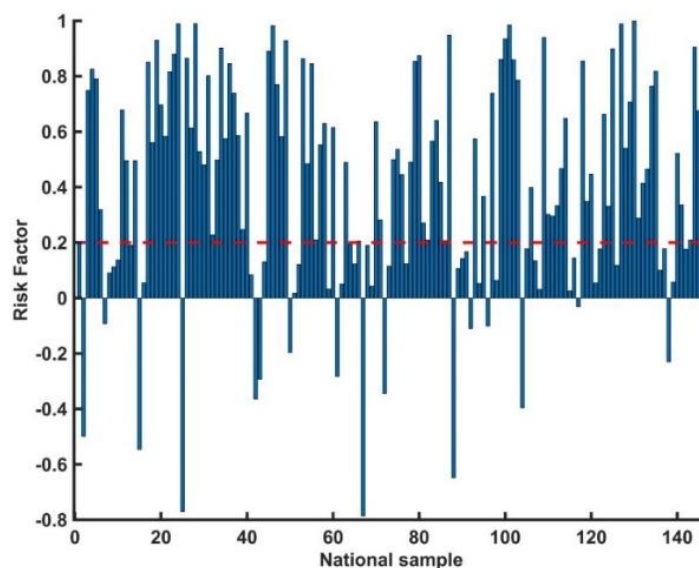


Figure 11. Graph of the relationship between risk factors and countries

Then, classified the dynamic risk factors into five levels, as shown in Figure 12.

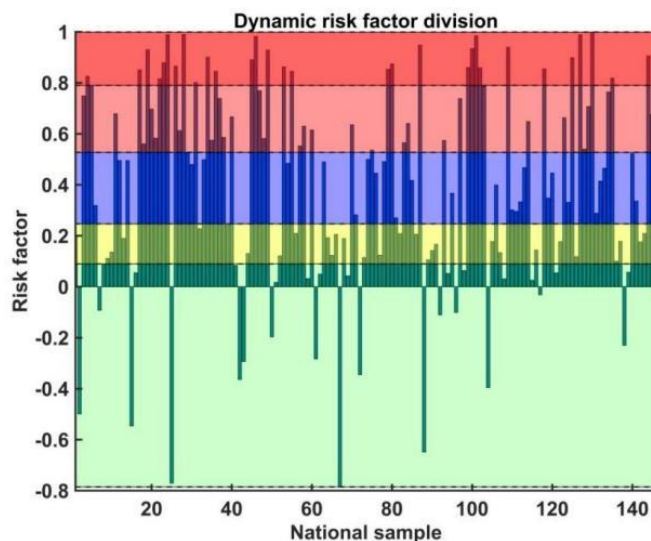


Figure 12. Dynamic risk factor partitioning

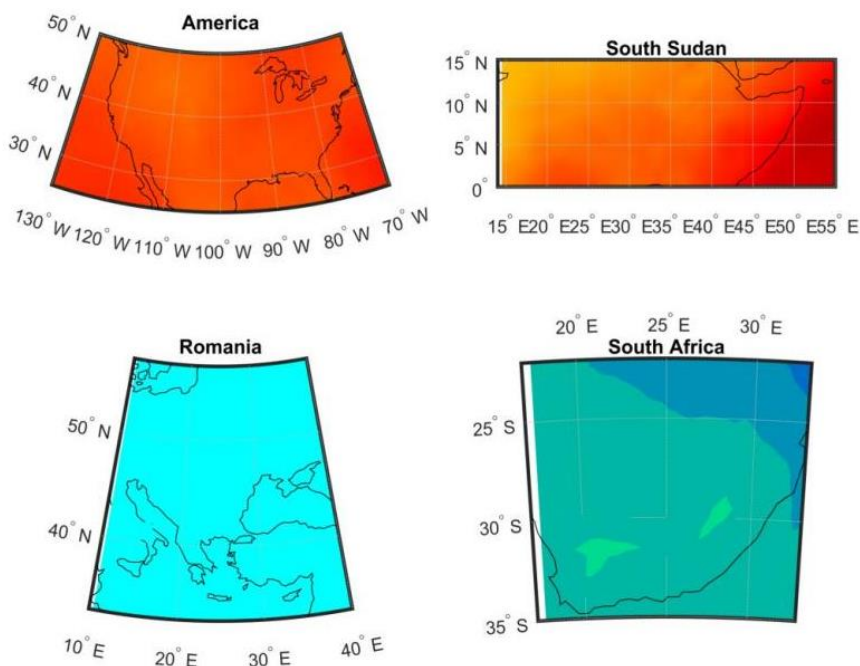


Figure 13. United States, South Sudan, Romania and South Africa region

The study selected four regions: the United States, South Sudan, Rumania and South Africa. As can be seen from Figure 13, the United States belongs to Level II, South Sudan to level I, Romania to level III, and South Africa to Level V.

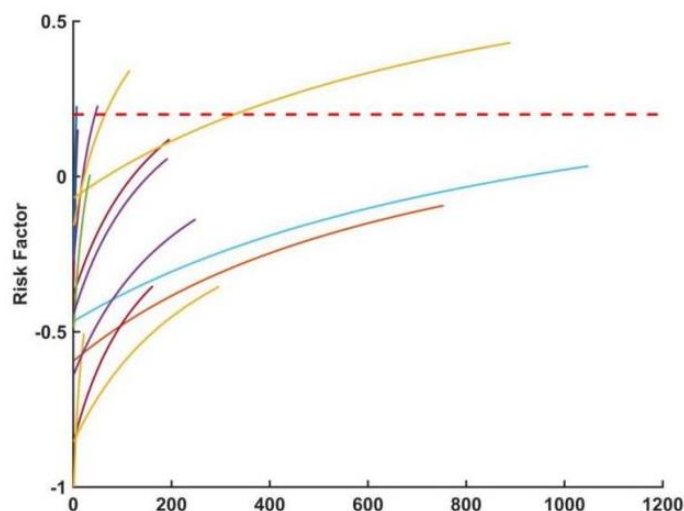


Figure 14. Risk factor

The risk factors are shown in Figure 14, In the new model, insurance companies can establish insurance when the risk factor is greater than 0.2.

According to the model, this study gives the following suggestions:

In the context of climate change and natural disasters, both real estate developers and the insurance industry need to innovate. To better adapt to the risks in different regions. To improve the flexibility of the insurance model. An improved model based on automatic calculation of risk threshold is proposed, which fully takes into account the unique natural disasters and environmental conditions of each region. This innovative initiative aims to provide real estate developers with more flexible and personalized insurance strategies. Ensure that construction projects are more resilient. At the same time, in order to reduce potential economic losses, this paper will also explore the core features of improving the model and provide recommendations to real estate developers for different regions to promote more sustainable and adaptive real estate development:

(1) Risk assessment: Before selecting the construction and development site, it is necessary to conduct a comprehensive risk assessment, taking into account the natural disasters in the region, such as floods, earthquakes, hurricanes, etc., and use the catastrophe risk assessment model to analyze the potential disaster risks to ensure the needs of insurance.

(2) Insurance demand analysis: Study the characteristics of the community, understand the insurance needs of residents, consider the special conditions of the community, such as climate, geology and other conditions, determine the difference in insurance demand in different regions.

(3) Building resilience: In real estate planning, it is necessary to take into account the resilience of buildings and adopt disaster-resistant design technologies to reduce the damage to buildings. Seismic materials can be used to improve the disaster resistance of buildings.

(4) The feasibility of community services to ensure that communities have adequate emergency facilities and services to restore resilience and productivity in emergency situations.

(5) Post-disasters recovery planning: Formulate post-disaster recovery planning, including but not limited to reconstruction, restoration, and protection of residents. Insurance models should take into account the post-disaster economy and the requirements of communities and residents to facilitate rapid recovery.

4. Discussion

The model employed in this study has undergone rigorous verification and demonstrates extensive applicability in practical scenarios, encompassing historical buildings situated across diverse geographical locations and cultural backgrounds. It exhibits exceptional performance in both catastrophe risk assessment and value evaluation, thereby providing decision-makers with a universally applicable and efficacious tool to address multifarious challenges.

This study fully considers the key dimensions of catastrophe risk assessment of historic buildings, including major lines and building structure, geographical location, cultural value, etc. By integrating these dimensions, the model can evaluate historic buildings. More comprehensive, more in-depth, more comprehensive information for decision-making to support the advantages of writing papers or models here

Government departments can use the output of the model as a scientific basis for decision-making knowledge to guide them to make wise decisions in the fields of catastrophe risk management, urban planning and cultural heritage protection, which helps the government better perform its duties and protect public safety and the sustainable development of cultural heritage.

The model in this study has been verified and has wide applicability in practical applications. Historical buildings in different geographical locations and cultural backgrounds. Excellent performance in catastrophe risk assessment and value assessment. This decision maker provides a common and effective tool that can deal with problems in different situations. Additionally, the risk assessment part of venture capital model provides important information reference for venture investors. Through detailed risk analysis, investors can have a more comprehensive understanding of the potential risks in a specific region, provide a more scientific basis for investment decisions, reduce potential risk investment, and improve the success rate of risks.

Due to the high complexity of the model, it is also difficult to explain, and there may be some differences in the understanding and acceptance of the model by different decision makers and stakeholders. To improve the acceptability of the model, consider providing a clearer and more intuitive explanation of the model to ensure that all parties have a consistent understanding of the model.

At the same time, in the field of urban planning, the use of models can help urban planners better understand natural risks. To guide the rational development of the city. By choosing safer areas and developing effective preparedness measures, city planners can improve the overall resilience of cities to disasters. Creating safer and more livable urban environments.

Last but not least, the risk assessment part of venture capital model provides important information reference for venture investors. Through detailed risk analysis, investors can have a more comprehensive understanding of the potential risks in a specific region, provide a more scientific basis for investment decisions, reduce potential risk investment, and improve the success rate of risks.

5. Conclusion

In this paper, AHP and Delphi method are used to construct an insurance model that can effectively deal with the compensation related to natural disasters. It provides a powerful tool for the protection of cultural heritage. Social leaders can use the results of this model to make more scientifically feasible conservation decisions. In the face of catastrophe risk, ensuring that historic buildings are adequately protected and maintained helps to protect the historical and cultural heritage of the community and leave valuable cultural memories for future generations. The success of the model combines the professionalism of the scientific model with a wealth of practical experience, which is one of the key factors of its excellence. The model combines the mutation model with the practical experience of experts, and strikes a good balance between theoretical reliability and practical application. This combination of expertise and experience improves the accuracy and practicality of model evaluation, making it an indispensable tool in decision making.

References

- [1] Sun Rong. Actively exploring insurance risk securitization in response to climate change [N]. The financial times, 2024 - 01 - 17 (012).
- [2] Guo Qing. Improving the risk management and risk reduction ability of insurance companies [J]. Financial Expo, 2023 (12): 13 - 15. Amjady N. Short-term hourly load forecasting using time series modeling with peak load estimation capability [J]. IEEE Transactions on Power Systems, 2001, 16 (4): 798 - 805.

- [3] Liu Yanchunzi. Insurance company how to better climate risk management [N]. The financial times, 2023 - 08 - 15 (008).
- [4] ZENG X Y. Research on financial innovation path of Agricultural weather risk management [D]. Huazhong Agricultural University, 2013. (in Chinese).
- [5] Xie Shiqing, Mei Yunyun. Operational mechanism and actuarial pricing of weather derivatives [J]. Theory and Practice of Finance and Economics, 2011, 32 (06): 39 - 43. (in Chinese).
- [6] Feng Wenli, Yang Mei. Weather index insurance: agricultural catastrophe risk management tool innovation [J]. Journal of finance and economy, 2011, (6): 92 - 95.
- [7] Niu Na. Research on pricing and risk management of weather insurance and weather derivatives based on big data [D]. Yanbian University, 2020.
- [8] Zhong Denghua, Risk analysis method of engineering project based on AHP. Tianjin, Tianjin University, 2004 - 12 - 15.
- [9] Yuan Yunli. Research on risk management of construction projects based on Fuzzy Analytic Hierarchy Process (FAHP) [D]. Chongqing University, 2014.
- [10] Deng F. Using Delphi Method to construct mental health legislation evaluation index framework [D]. Central South University, 2015.
- [11] Wang Chunzhi, Si Qin. Delphi method in the data processing method and its application study [J]. Journal of Inner Mongolia institute of finance and economics (comprehensive edition), 2011, 9 (4): 92 - 96.
- [12] Fu Lingrui, Gan Lu. Natural disaster insurance evaluation [J]. Chinese and Foreign Entrepreneurs, 2014, (14): 34.