International Journal of Natural Resource Ecology and Management
2022; 7(2): 93-98
http://www.sciencepublishinggroup.com/j/ijnrem
doi: 10.11648/j.ijnrem.20220702.14
ISSN: 2575-3088 (Print); ISSN: 2575-3061 (Online)

Natural Disaster Insurance in China: Model Reference, Development Challenges and Suggestions

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To cite this article:
Tao Zhang, Xinyi Ma, Dongyang Wu, Jinping Wang. Natural Disaster Insurance in China: Model Reference, Development Challenges and Suggestions. *International Journal of Natural Resource Ecology and Management*. Vol. 7, No. 2, 2022, pp. 93-98.
doi: 10.11648/j.ijnrem.20220702.14

Received: March 17, 2022; **Accepted**: May 26, 2022; **Published**: June 8, 2022

Abstract: With the warming global climate and the acceleration of industrialization and urbanization, the impact of natural disasters on human beings is becoming increasingly significant. How to reduce the loss of human production and life caused by natural disasters has always been a common problem faced by all countries in the world. As an important tool for dispersing natural disaster risks, insurance is indispensable for enhancing the resilience of economic and social development against risks. Developed countries are constantly exploring and improving related systems and models, as is the case with UK, Japan, the United States, France, represented by different insurance models. The geological survey has played an important role in supporting the development of natural disaster insurance system. There are many types of natural disasters with wide distribution and high frequency in China, but the development of natural disaster insurance lags behind. In addition to such factors as the imperfect legal system and low willingness to purchase insurance, the lack of technical support for natural disasters provided by insurance companies is also an important reason. In order to promote the establishment of a natural disaster insurance system, China needs to learn from the relevant experience of developed countries, strengthen the natural disaster survey, basic geological survey, and promote the formulation of relevant standards for delimitating and classifying insurance types, so as to provide professional technical support for the perfection of natural disaster insurance system.

Keywords: Natural Disaster, Natural Disaster Insurance, Geological Survey, Natural Disaster Insurance in China

1. Introduction

With the warming global warming and the acceleration of industrialization and urbanization, extreme natural disasters occur frequently, and the world is constantly hit by various natural disasters, which seriously threaten the property and lives of residents. Due to the special terrain, climate and other factors, China is one of the few countries in the world where natural disasters occur in highest variety, with greatest intensity, frequency and victims, causing huge casualties and property losses every year. As a means of risk sharing, natural disaster insurance can make up for economic and property losses caused by natural disasters to a certain extent, and can play a certain role in disaster prevention and recovery of post-disaster economy. China's natural disaster insurance system is far behind that of developed countries in terms of legal system, product design and technical support. Given the current development of natural disaster insurance in China, it is of great theoretical and practical significance to promote the construction of China's natural disaster insurance system by analyzing the typical operation mode of natural disaster insurance in foreign countries and the experience in the development of the insurance industry in the field of professional technology.

According to the "State of the Global Climate 2020" report released by the World Meteorological Organization, the global average temperature in 2020 was about 1.2°C higher than pre-industrial levels, and the period from 2011 to 2020 was the warmest 10 years on record. Due to human activities and

emissions of greenhouse gases, the occurrence probability and frequency of global extreme weather, climate events and complex natural disasters have been on the rise. In 2020, a total of 313 natural disasters occurred in the world, causing direct economic losses of US $173.13 billion, affecting a population of 98.967 million and directly killing 15,082 people. In terms of the frequency of disasters, there are flood disasters, storm disasters, landslide disasters, earthquake disasters, drought disasters, wildfire disasters and extreme temperature disasters [1, 2]. Compared with the average value of the past 30 years (1990-2019), the frequency of natural disasters, the number of deaths and affected people have decreased, but the economic losses have increased by nearly 30%. Both global natural disaster losses and insured losses in 2020 were significantly higher than those in 2019, with insured losses of US $82 billion in 2020, a significant increase from US $57 billion in 2019. Due to the unique topography and climate characteristics, natural disasters occur frequently in China with wide distribution. Mountainous and plateau areas, which account for nearly 70% of the country's land area, are threatened by geological disasters such as mountain collapses, landslides, mudslides, and ground fissures. In 2020, the direct economic loss caused by natural disasters in China was 370.1 billion yuan, and 591 people were killed or missing. Among them, the direct economic loss caused by floods and geological disasters was 268.6 billion yuan, and the direct economic loss caused by earthquake is about 1.8 billion yuan [3, 4]. Faced with the complex situation of natural disasters, it is imperative to further improve the natural disaster insurance system, enhance the ability of early warning and forecast of disasters, and boost the motivation of the insurance industry to participate in disaster prevention, disaster reduction and disaster relief, which creates higher demands for the development of the natural disaster insurance system and the technical support for natural disaster prevention.

Whether it is geological disasters such as landslides, mudslides, land subsidence, earthquakes, or natural disasters such as floods, droughts, and storms, they all have a certain relationship with geographical environment and geological conditions where they occur. As a public good and fundamental work, basic geological survey can provide a comprehensively understanding of the geological conditions such as the topography and landforms, geological structure, stratigraphic lithology and other basic geological environmental elements affecting the occurrence of geological disasters, faults, stratigraphic boundaries, attitudes and other geological conditions in the survey area. Moreover, geological elements such as hydrology, rivers, roads, and villages are also involved. Through the basic geological survey data, the risk, occurrence level, distribution range and impact of geological disasters can be evaluated, which lays important foundation for preventing the occurrence of natural disasters and reducing losses caused by disasters. On this basis, further detailed investigation and evaluation can serve as an important basis for insurance companies to formulate premium standards and conduct insurance rating and other benchmarking activities, which is of important practical significance for reducing the risk of insurance companies.

2. Natural Disaster Insurance Models of Major Countries in the World

With their relatively mature financial systems, developed countries have developed relevant insurance products on natural disasters, formulated related legal systems, and formed different models. In addition, relevant geological surveys have been carried out for studying natural disasters, among which models developed by the United States, United Kingdom, France and Japan are more representative [5, 6].

2.1. A Fully Commercialized Operation Model Represented by the United Kingdom

Possessing the insurance industry with the longest history in the world and a sound primary insurance and reinsurance market, the United Kingdom has established a relatively complete market-oriented natural disaster insurance system. Its prominent feature lies in that the government does not participate in the operation of insurance companies, nor does the government bear economic compensation liability in the natural disaster insurance system, and it is completely depends on the market. Taking flood insurance in natural disaster insurance as an example, the insured chooses an insurance company to insure freely, and commercial insurance companies carry out risk reinsurance through reinsurance in the insurance market, and the entire process is adopted throughout the full market commercial operation.

By increasing the investment in flood control and relying on public service departments to release flood risk assessments, disaster warnings, meteorological research data and other related public goods for the society, the government can make flood risks insurable to a certain extent and reduce the operating risks of insurance companies. Among them, flood risk maps along the river and coastal areas, flood risk maps in other areas, and reservoir flood risk maps completed by local flood management and survey agencies have become the basis for flood insurance in the UK, and provide an important reference for flood insurance and reinsurance.

2.2. The Government-Enterprise Cooperation Model Represented by Japan

The most common natural disaster in Japan is earthquake, and a natural disaster response model represented by earthquake insurance has been formed. Japan has built a rescue system consisting of earthquake insurance, reinsurance companies, social assistance and direct government assistance. At the specific operational level of earthquake insurance, personal property is first insured by insurance companies, and then insured by reinsurance companies, and the earthquake reinsurance companies are jointly funded and established by all insurance companies, and the part beyond the insurance scope is borne by the state in the earthquake disaster compensation stage [7, 8]. The government-enterprise cooperation disaster insurance model has promoted the

development of natural disaster insurance industry in Japan. In the 2011 earthquake in Japan, the insurance claim settlement ratio reached 85.5%, which played a very good post-disaster relief effect. [9]

In terms of reducing the risk of insurance companies, the Japanese government has made tremendous efforts in establishing an early warning system for earthquake and tsunami. It has set up more than 3,000 monitoring points across the country to monitor the tide levels and tsunamis in various regions in real time, and automatically release the data on possible disaster impacts caused by earthquakes to the national TV network based on the monitoring results [13]. In addition, Geological Survey of Japan conducts various surveys to provide basic information for mapping the risk of different types of active volcanoes, and to advise government departments and insurance companies on how to respond to various disaster threats.

2.3. The Combination Model of Risk and Capital Market Represented by the United States

As a country frequently hit by natural disasters, the United States has always attached great importance to the sharing of catastrophe losses, and has formulated natural disaster-related insurance systems. One is government-led catastrophe insurance plan, the other is the combination of catastrophe insurance and capital market. Generally, catastrophe insurance can reduce the risk of insurance companies through reinsurance. Supported by the sound capital market and strong market demand in the United States, insurance companies can diversify risks through the capital market, and financial derivatives such as catastrophe futures and catastrophe bonds have emerged. Since the formation of catastrophe securitization, insurance companies began to raise capital in the secondary market to solve the financial problems in the insurance market. In addition, in terms of technical support for natural disaster insurance, USGS has developed the "Risk Research and Application Program", initiated and operated a program dedicated to natural disaster research and application relying on its core capabilities in tool and product development, comprehensive research, geological survey and other aspects. In addition, USGS has established advanced and practical scientific models of ground deformation and slope damage, compiled a national inventory of known and other ground damage disasters, and provided support for the prevention of natural disasters and the construction of related insurance systems. [10]

2.4. The Compulsory Natural Disaster Insurance Model Represented by France

In 1982, France issued related systems of insurance compensation for natural disasters, claiming that the natural disaster insurance system should cover earthquakes, subsidence, landslides, floods, tsunamis, volcanic eruptions, storms and other types of insurance. According to the law, insurance companies in France should provide natural disaster insurance services according to the rate guided by the government, and all property insurance insured must purchase additional insurance related to natural disaster according to the government requirements, which fully reflects the enforceability of disaster insurance [11]. At present, the natural disaster insurance system adopted by Norway, Spain, Sweden, Turkey and other countries is compulsory insurance model. The local government in French appropriates funds and relies on business organizations to compile 1:10000 Urban Risk Prevention Plan and 1:25000 rural Risk Prevention Plan respectively, and updates them regularly, in order to reduce the losses caused by natural disasters and reduce the business risks of insurance companies through planning.

3. Analysis of Problems and Causes of Natural Disaster Insurance in China

After years of continuous exploration and practice, natural disaster insurance pilot program in China has achieved tangible outcomes and accumulated rich experience in pilot programs. Among them, Yunnan Province and Shenzhen City of Guangdong Province have explored their own disaster insurance to address natural disasters such as earthquake, typhoon and floods, and developed insurance products and systems. However, compared with commercial insurance in developed countries, the proportion of compensation amount in direct economic losses from disasters is still quite low, and the supporting system is not yet perfect.

3.1. Main Problems Faced by China

3.1.1. Inadequate Capacity to Effectively Underwrite Natural Disaster Risks, and Lack of Motivation Among Insurance Companies

In light of the current claim payment and post-natural disaster risk compensation in China, government financial support and social donation serve as main forces, while commercial insurance is not employed as the main means of compensation for natural disaster loss. Factors such as low social insurance rates, insufficient insurance products, and lack of insurance awareness lead to compensate only a small part of property losses through insurance after major natural disasters. From the perspective of reducing the risk taken by enterprises, commercial insurance companies have insufficient ability to undertake natural disaster risks with high risks that require large compensation amounts. Even if commercial insurance companies could undertake relevant insurance, their compensation level and scope of assistance are relatively limited [12-14].

3.1.2. Lack of Natural Disaster-Related Insurance Products and Limited Compensation Capacity of Insurance Companies

Almost all the risks underwritten by insurance companies in China exclude catastrophic natural disasters such as mudslides, earthquakes, landslides and typhoons, so as to avoid their own business risks and reduce their companies' losses. Even if the

insurance company bears losses related to natural disasters, it also sets relevant constraints in the insurance compensation clauses, and the final compensation can only cover a very low proportion of the losses. In addition, there is a lack of insurance types specifically designed for various disasters, coupled with the relatively strict insurance claim standards and procedures, which seriously weakens its protection capacity.

3.1.3. Low Rate of People's Insurance and Small Insurance Coverage

In China, people's perception of insurance has not reached a high level and their awareness of risk prevention is relatively weak. Also, due to economic constraints, there are fewer individuals and enterprises participating in insurance, which leads to a low insurance rate and insurance coverage.

In addition, for a long time, the public has relied heavily on the government for disaster relief, which has hindered the development of natural disaster insurance in China to a certain extent.

In 2008, the Wenchuan earthquake caused a direct economic loss of 845.1 billion yuan, and only over 2 billion yuan of insurance compensation was provided, accounting for only 0.2%. The average level of natural disaster insurance loss ratio in the world is 36%, and it reaches 60% in developed countries. In this regard, China's insurance industry has not yet played its due role in the compensation of natural disaster losses.

3.2. Main Reasons

3.2.1. Insurance Companies Lack Professional Technical Support, and There Are Difficulties in Designing Natural Disaster Insurance System and Disaster Assessment

Since the operation of natural disaster insurance involves multi-disciplinary professional and technical knowledge such as geology, geography, meteorology, and civil engineering, the technical threshold and input cost are relatively high. Relatively speaking, insurance companies are unable to accurately assess and predict the losses that may be incurred by various natural disasters, resulting in fewer types of natural disaster-related insurance products designed and developed by insurance companies. There is also a lack of scientific basis for the determination of natural disaster insurance types and rates, consequently, the insurance companies tend to take a conservative attitude to carry out natural disaster insurance business [15, 16].

3.2.2. Insurance Companies Have Weak Underwriting Capacity and Have Not Yet Established a Multi-level Natural Disaster Insurance Sharing Mechanism

China's reinsurance market is underdeveloped. There are currently only 11 reinsurance companies in mainland China, of which 6 are foreign-owned branches. Also, China's reinsurance market lacks capital market instruments such as catastrophe bonds and catastrophe futures. The development of the reinsurance market is seriously insufficient, and the level of internationalization is very low. It is impossible to diversify risks on a global scale, which limits the development of natural disaster insurance. For natural disaster insurance, although insurance companies can reduce some of the losses through reinsurance, most of the losses still need to be covered by the insurance companies themselves. In 2020, the original insurance premium income of China's insurance industry was 4.5 trillion yuan, of which the property insurance business premium income is 1.2 trillion yuan, while the direct economic loss from natural disasters in China reaches 370 billion yuan, which cannot meet the compensation needs caused by natural disaster losses.

3.2.3. The Insurance System Is Not Perfect, and the Coverage of Natural Disaster Insurance Is Not Extensive

At present, the people's awareness of natural disaster insurance in China is not profound enough, and the insurance-related supporting legal system is not perfect, which makes the promotion of the concept of natural disaster insurance difficult. In recent years, although China has successively formulated relevant laws and regulations on flood control, meteorology, earthquakes, emergencies, etc., there are still wide gaps in the laws and regulations specifically targeted for natural disaster insurance, which makes natural disaster insurance lack strong legal support [12, 17, 18]. Moreover, the functional organization addressing natural disaster risk are scattered, and there are great obstacles in communication and coordination among them. The reinsurance system is not yet perfect, and it cannot solve the problem of natural disaster insurance only by its own repayment. [19, 20]

4. Suggestions

4.1. Carry out Natural Disaster Risk Survey to Understand the Distribution and Characteristics of Natural Disasters

Carrying out natural disaster risk survey serve the fundamental effort to improve the ability of natural disaster prevention and control, and is also an important basis for the formulation of relevant standards and systems of natural disaster insurances. Through special geological survey, the distribution, impact degree and characteristics of various natural disasters such as earthquake disasters, geological disasters, meteorological disasters, flood and drought disasters, marine disasters, forest and grassland fires and other natural disasters can be thoroughly investigated and evaluated. As a result, different types of zoning maps are formed for key areas and major disasters, providing authoritative information for governments at all levels to improve their emergency response capabilities in case of natural disasters, improve the modernization level of governance capabilities, and provide scientific decision-making basis for governments to formulate supporting management policies and insurance systems.

4.2. Strengthen Basic Geological Survey and Research

Most natural disasters are caused by surface and geological changes. Basic geological survey is a basic means to improve the understanding of natural disasters, and it is also important in identifying, analyzing and identifying various risks and improving monitoring and early warning capability. In areas prone to geological disasters, systematic regional geological, disaster geological and geological surveys with remote sensing have been carried out to strengthen geological disaster investigation and monitoring so as to provide geological information services for disaster prevention.

Efforts should be made to carry out surveys and draw a series of maps such as geological disasters and hidden danger distribution maps, pattern maps explaining geological disaster causes, susceptibility evaluation maps, risk evaluation maps and risk zoning maps. These maps are for the government to carry out grid management of natural disasters, check the hidden dangers of disasters and accidents, and propose targeted remediation measures to reduce the risks of disasters and accidents as much as possible. Therefore, these maps can provide scientific basis for designing insurance products related to natural disaster and the reducing disaster loss [14, 15].

4.3. Build a Full-Coverage and Multi-Level Natural Disaster Sharing Mechanism

China's Fourteenth Five-Year Plan clearly states that it is necessary to improve the national emergency management system and develop catastrophe insurance to enhance disaster prevention, mitigation, resistance and relief capabilities. At the international level, there are rich experience and relatively mature operation models on natural disaster insurance. China should draw on the experience of the developed countries and establish and improve its own catastrophe insurance system as soon as possible. For catastrophe insurance such as earthquakes, volcanoes, floods and other natural disasters, it should further promote the development of capital market, improve the participation of market in the form of catastrophe bonds and catastrophe futures issued by secondary market, and increase the ability to compensate for natural disasters losses. It should also explore the adoption of joint industry insurance, mutual insurance and other methods to accelerate the development of the reinsurance market, expand the scale of domestic reinsurance, and cultivate reinsurance consortia. Taking advantage of the development of the modern financial industry, the method of selling catastrophe bonds, catastrophe futures and other derivatives in financial markets such as securities and futures will contribute to diversifying and resolving the risk of catastrophe losses [21].

5. Conclusion

Due to its unique topographical features, China is hit by almost all types of natural disasters, of which 70% of mountainous and plateau areas are threatened by mountain collapses, landslides, debris flows and ground fissures. After years of piloting work and exploration, although great achievements have been made in the development of natural disaster insurance, constrained by the lack of professional technical support, the imperfect system, and the weak underwriting capacity of insurance companies, natural disaster insurance-related products are insufficient and coverage is small. In addition, the motivation of insurance companies is not high, and the social insurance rate of natural disasters has been low, which fails to meet the demand of social development. The United States, the United Kingdom, Japan, France and other countries have taken natural disaster insurance as an important means to reduce the loss of natural disasters, and have formed their own models, each of which is closely tied with the professional technical support provided by the geological survey agencies of various countries. The development of natural disaster insurance in China also needs to learn from the experience of developed countries, strengthen geological survey and research work, and carry out a natural disaster risk census at national level. Building on all these efforts, China can create geological disaster risk zoning maps and classify the risk level of different types of disasters, so as to provide reference for the product design and rate formulation of insurance companies.

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