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Research on the Impact of Climate Change on Insurance Companies

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Abstract: The global climate is changing with more and more extreme weather, including typhoons, extreme temperatures and other disasters. Climate change has an extraordinary impact on the insurance industry. However, according to research, a third of insurers are not paying enough attention to the impacts of climate change. This paper analyzes and demonstrates the impact of weather changes from two parts of non-life insurance and life insurance through cases. Taking the typhoon as the cut-in perspective, the impact on the climate is analyzed from three aspects: strong wind, storm surge and heavy rain. Additionally, this article offers some advice to insurers on how to benefit from global events. The findings suggest that insurers should recalculate all catastrophe risks and rebuild risk models. Catastrophe bonds can also help businesses raise capital. Insurers need to recognize how far-reaching climate change will affect the insurance sector, and how risks present opportunities.

Keywords: climate change, catastrophe risk, typhoon

1. Introduction

1.1. Research Background

Since the industrial revolution, global production ability has been greatly improved. Therefore, energy requirement also boosts dramatically, and the fossil fuels humans usually use are coal and petroleum, mainly used in power plants, transportation, operating industrial facilities, etc. Burning non-renewable sources release carbon dioxide and methane, called greenhouse gases. Due to the emissions, meteorologists noticed world average temperature had raised 1.2℃, which caused melting ice in the polar region. Scientists announce global warming results in the earth's atmosphere; it collects and drops more water making wet areas wetter and dry areas drier, which changes the weather pattern [1]. Climate change leads to rising sea levels, growing desert areas, more frequent and intense storms, and heat waves.

Besides, it negatively influences many sectors like agriculture, tourism, forestry and fisheries—those seriously threaten world health. Humans have made the Paris Agreement to reduce greenhouse emissions by restricting highly polluted sectors' activities to avoid disaster. As a result, any sector relative to discharge greenhouse gas also will receive a crushing blow.

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1.2. Literature Review

On a superficial level, climate change is not associated with other fields. However, some industries will also be affected, like insurance areas. This is because, along with disaster, there will also be casualties and property loss. Hurricane Harvey caused more than $100 billion in economic damage to the US. Australian bushfires killed incomputable animals. Not just lives are lost in this, and numerical forest source is destroyed. According to statistics, there is more than $4.4 billion in damage. In 2011 Thailand suffered the worst flood in several decades. The flood destroyed numerical houses and farmlands, 366 people died, and the natural adversity hit 2 million residents. This causing $45 billion economic damage, leading to US$12 billion in insurance claims [2]. This article may find that the insurance covers only a quarter losses. Again, the insurance coverage rate in Asia is much lower than in developed areas, especially in North America. If the flood happens in insurance's entire covered region, it will bring significant loss for unprepared insurers. Not every insurance company has prepared well against the risk. A large number of firms suffered substantial losses in this catastrophe. A third insurer said they didn't know how well they prepared to deal with the influence of climate-related risks on financial stability and whether their current model fitted the climate-related risks. This is because most insurance corporations have not recognized the massive impact of climate change and are not freeing up more men and more time to research relative areas and make plans to solve it. The insurer must change their mind and prepare this as early as possible. Besides, only a few companies know how to respond to the disaster, including altering premiums, decreasing risk through reinsurance corporations, and deeply searching for each catastrophe's influence [3]. At first glance, it seems that the insurance companies will compensate higher; the opportunity for the insurance sectors is large enough and will allow their scale boost in the next forty decades. This is because the value at stake from climate-induced hazards could, conservatively, increase from about 2 per cent of global GDP to more than 4 per cent of global GDP in 2050 [4].

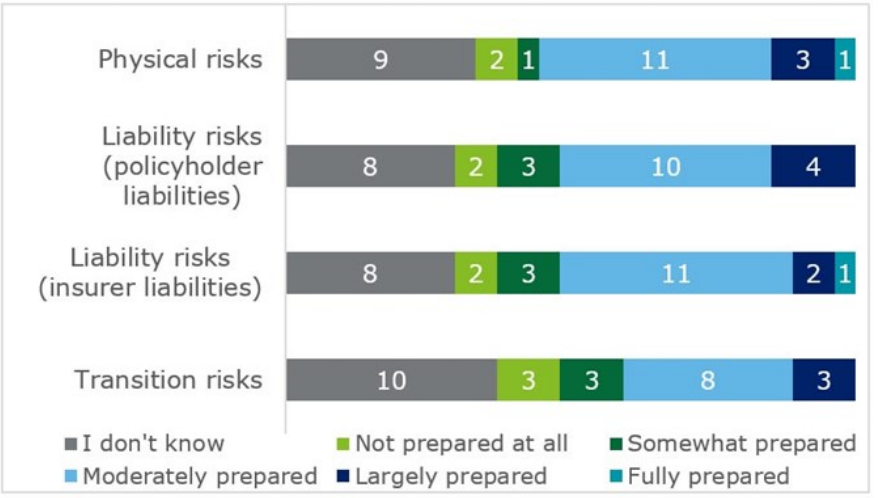

Figure 1: Insurance regulator state of climate risks survey, Deloitte Center for Financial Services, 2019.

1.3. Research Significance

There are essays telling people about each disaster they will face. Still, this article will use a case study to illustrate the dangers of insurance companies they will meet, discuss non-life insurance parts, and analyze a little life assurance. In the beginning, discuss the potential value of climate change (not only threat but also opportunity). Secondly, analyze several main entity risks of the typhoon by giving

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different examples to demonstrate the significance of preparing early, because catastrophes have a chance of making even international insurance companies go bankrupt, and providing some possible ideas of how they could solve the specific problem, like changing the risk model and increasing the premium level. As the life assurance parts are complex, this article will analyze the extreme temperature.

2. Analysis of the Impact of Climate Change on Insurance Companies

2.1. Perspective on Natural Hazards

For non-specialists, climate change is big bad news for the insurance industry. Insurance firms must raise the premium to avoid going bankrupt. Even higher premiums cannot stop the loss because they may have a chance of meeting unexpected catastrophes they cannot afford. It is widely known that increasing the price leads to a decrease in demand. Most people underestimate the risk and will consider not buying insurance products because of high pricing. The opposite is true. First, with climate change worsening, natural hazards bring much more financial losses. Those losses can become part of the insurance business and could get the insurer and the policyholder more benefits against the extreme weather. Insurance coverage against climate risks is still meagre, with only 30% of global losses from climate disasters over the past decade covered by insurance. The remaining gap is about $1.7 trillion, but the actual hole is much more significant. Compared with the mature market of the developed country, the penetration rate of developing countries' insurance market is lower. For instance, from 2010 to 2019, Chinese insurers accounted for 4 per cent of losses from significant typhoons and floods, far less than Japan's 67 per cent [5].

Due to natural hazards, there will be an uncountable economic loss. Some of those disasters are highly harmful, like hurricanes and extreme temperatures. Those disasters are catastrophic because they cause severe secondary damage. For instance, typhoons provide the rainstorm with sufficient moisture, which may trigger flood or debris flow. Cyclones or hurricane landings damage coastal cities and ships at sea. Parts of coastal areas' industries will be influenced. Harbours, airports and other transportation must be closed to reduce accidents. The fishery must be stopped, and this weather may also damage coastal agriculture. Crops would be destroyed by wind and intense falls. When adding these economic losses, typhoon damage is non-negligible, especially in some island countries. Typhoons or hurricanes influence nationwide for them. For instance, the Philippines is located in southeast Asia and encounters Typhoons several times a year. Storms cause a 1% short-term reduction in future economic activity for some frequent but limited harm. Those losses usually occur because of the building and transportation system break. For example, due to the destruction of the roads, daily economic activity may be interrupted. Moreover, rarer storms are the financial killer, reducing at least 2% long-term effect in the Philippines. For orchardists, their fruit trees are growing for years to be ripe enough to produce fruits. Storms will destroy those perennial trees, leading to severe financial damage [6].

A typhoon or hurricane's effect could be divided into three parts: high wind, storm tide and rainstorm. The wind speed usually is 20 metres per second, and for rarer storms, the wind speed may be greater than 60 metres per second. Winds and waves can hurl a ten-ton ship into the air and break it, and they can also push big ships inland. Moreover, typhoons can damage or even destroy buildings, Bridges, and vehicles. Especially in areas where buildings have not been reinforced, the damage is more remarkable. High winds can also blow debris into the air, dangerous outdoor conditions. The second disaster brought by the typhoon is storm tide due to the strong wind and low pressure of the cyclone. The storm surge of an intense hurricane can raise coastal water levels by 5 to 6 meters. Suppose the storm surge meets the high tide level of the astronomical spring tide. In that case, a high-frequency tide level can be generated, resulting in the overflow of the wave, the failure of seawalls,

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the destruction of houses and various construction facilities, and the flooding of towns and farmland, resulting in a large number of casualties and property losses. However, It's not as bad as it looks; most of the conditions could have been avoided if typhoon warnings had been issued in time. Ships are not allowed to sailing, and residents should stay at home or in a more solid place. Besides, with the earth's climate worsening, the government will not stand idly by. Building standards will rise, and only solid and anti-typhoon architecture can be built. The government will also complete climate warnings and invest in big projects like coastal breakwater to reduce losses.

The remarkable thing for insurers is that the frequency and range of claims will increase significantly. They need to recount the risk model, and they could issue the close bonds to supplement insurance capacity. The frequency and influence of typhoons will undoubtedly increase if the tendency of worldwide carbon dioxide levels does not fall and even rise. Then, the risk model should contain the current probability of typhoons occurring. Furthermore, the prediction of future occurrence probability is more significant. To get this data, the actuaries should research and understand how often storms or hurricanes happen and how severe the cyclone is in the decades of climate change. By using the data, they can get the expectation of future disasters' probability and reprice the insurance products in their hands. However, those efforts cannot stop them avoid being bankrupt. Some unexpected catastrophes will bring insurers unable to afford them. As a result, catastrophe bonds appear to solve the problem. A catastrophe risk bond is one of the products of catastrophe risk securitization. The primary purpose of product design is to transfer catastrophe risk. By issuing bonds related to catastrophe losses, the capital market and insurance market are closely linked so that the funds in the capital market and insurance market can circulate better [7].

An intense fall is the most dangerous disaster caused by a typhoon. When a hurricane lands, the rainfall center can drop 100 mm to 300 mm, even 500 mm to 800 mm of heavy rain in a day. Accompany by a rainstorm, parts of the region will occur secondary disaster. The flood caused by typhoons and rainstorm is fierce and destructive. As we mentioned before, a fifty-return period rainstorm caused the surge in Thai, which destroyed uncountable buildings and farmland, bringing massive economic losses. Besides, the actual financial losses are much higher than expected. This is because severe flood damage forced more than 10,000 consumer electronics, textiles, and buildings to be impassable when automotive products are closed, transportation breaks down, and machinery unable to operate. Not only did this severely impact the Thai economy, but it also disrupted the global supply chain for many businesses such as Sony, Nikon and Honda who relied on machinery components from these manufacturers, resulting in either reduced or delayed productions [2]. This means ten years return period or more rare typhoon rainstorm is catastrophic.

Moreover, in July 2021, Zhengzhou, China, met the worst rainstorm in 100 years, relative to Typhoon In-fa. It is worth mentioning that Zhengzhou is far from the sea, at more than 500 kilometers. More than 380 people died in this rainstorm, and economic loss is higher than 17 billion dollars. The heavy rain brings secondary disasters, including landslides and debris flow. In addition, houses, Bridges and mountains are washed and soaked by floods for a long time in the typhoon. Even if there is no collapse, after the hurricane and flood recede, houses and bridges are prone to collapse due to the above reasons. For an insurance company, this kind of rain is a disaster. Once they meet such an event, they bring numerical claims. 90% of the city's vehicles are soaking in the water and becoming depreciated submerged cars. Insurance companies afford the devalued part. In addition to the methods mentioned above, insurers can have explicit indemnity clauses. Telling the policyholders what the products can cover to avoid unsustainable risk. Besides, enhancing the education of the applicants can reduce claims. For example, if policyholders have a higher chance of being threatened by floods. Then, let them know before the flood whether there are signs of disaster and where to go if the floods come.

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2.2. Perspective from Human Beings

Climate change has an impact on human beings. It will slowly harm people's health. For actuary, climate change will slightly alter the life table. On the whole, global warming is bad news for life assurance. According to Doctor Zhou's research (2016), climate change will cause a list of issues, including heat stress, air pollution, diseases carried by mosquitoes and ticks, malnutrition, etc. [8]. Different issues all contribute to the climb in death rate. The relationship between temperature extremes and mortality is well documented. Exposure to extreme heat is associated with death from cardiovascular, respiratory and cerebrovascular diseases, especially in the elderly. This is because the need to regulate body temperature in high temperatures puts extra strain on the cardiovascular and respiratory systems. Zhang (2018) has done research showing that the mortality risk and the corresponding mortality rate of the elderly are 9~28 times higher than that of the young [9]. Among them, the rate level of the high-temperature heat wave is inversely proportional to the level of social and economic development; that is, the rate level of regions with higher economic development levels is lower. In addition, cold is also a risk factor for death, although the effects are usually delayed. Moreover, susceptibility to lung infections may increase [10].

On the whole view, climate change has a negative influence on both policyholders and insurers. For recognize, a high chance of being ill is uncomfortable news; even though there will be compensation from an insurance company, no one wants to suffer the pain from illness. Further, people will not recognize the potential effect of climate change, so the demand for life insurance products will increase inconspicuously. In the context of increased risk, not having a significant enough premium to support claims is dangerous for insurance firms. The insurance companies could solve this through education from the government and the people themselves. This kind of publicity wastes time and money. Another way to solve this is using bonds, which reduces the risk of more and more claims." bonds and other risk-linked securities are innovative financial vehicles that have an important role to play in financing mega-catastrophes and other types of losses" [11]. These instruments are essential because they provide direct access to capital markets, exponentially expanding risk tolerance beyond the limited capital of insurers and re-insurers.

3. Conclusion

This article finds climate change has huge impact on the insurance industry, but the influence is different for non-life insurance and life insurance. If the insurers prepare well, climate change will benefit non-life fields. This is because, more and more people will find it is risky if not buy catastrophe insurance in the context of increasing extreme weather, which means the demand from the market will boost. Therefore, the insurers have more funds to against the risk. Moreover, they could prepare well by changing the model, which reducing the uncontrollable risk. Besides, catastrophe bonds are also a good choice for insurance firms, which Increasing their capital pool and transferring catastrophe risk. For life assurance, part of this doesn't apply. The policyholders' average mortality will rise through more dangerous environment like extreme temperature. However, most of the residents cannot recognize this and will not buying the insurance. With insufficient fund, the insurers may have higher probability of not enough money to pay. This has hit the insurance industry hard and created a vicious circle. This article helps insurers recognize how serious climate change is. The insurance company should start as early as possible to recount the underlying data. This article is not establishing suitable risk model, so some other researchers may do this.

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