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Research on Natural Disasters' impact of China's Economic Growth and Loss Compensation mechanism

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ABSTRACT.: *Natural disasters happen frequently in China, with a wide range and a large impact. The results of the panel data regression model show that total natural disasters do not have great influences on China's economic growth. However, the impact of specific types of different disasters on economic growth is more obvious and has large differences. There have been various types of severe losses caused by natural disasters in China but with a downward trend in recent years. The reason is that China has made breakthroughs in pre-disaster defense and post-disaster emergency response. It's important to start with improving the loss compensation mechanism for a further solution of reducing its economic impact.*

Keywords: *natural disasters; economic growth; loss compensation.*

1. Introduction

Nowadays, there is a growing concern over the issue of natural disasters on economic development according to economics research. In the face of sudden natural disasters, will the social economy be stagnant or even backward, or will it be unaffected and stabilized, or will it accelerate the pace of development? What kind of pattern will emerge in the social economy when facing natural disasters is a question worthy of deep thinking.

Natural disasters include climate disasters dominated by floods, droughts, snowstorms, and typhoons, as well as geological disasters dominated by earthquakes and volcanic eruptions. In modern society, the population is shifting to cities on a large scale, productivity levels are rising, meantime the social economy is becoming more vulnerable to disasters. At this time, it is the joint participation of the government and the market that will play a key role. The compensation mechanism for various disasters also determines the range of negative impact of natural disasters and the recovery level of economic conditions.

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2. Overview of natural disasters in China

2.1 Causes of natural disasters in China

The reason for the formation of natural disasters in China is that China's topography and geological structures are very complex and are located between the two major seismic zones in the world. In addition, the types of landforms in China are diverse, especially in areas with yellow landforms, landform disasters occur frequently. Moreover, most of China's territory is located in a climate-stable zone under the control of the monsoon, often invaded by tropical storms and cold waves.

2.2 Data

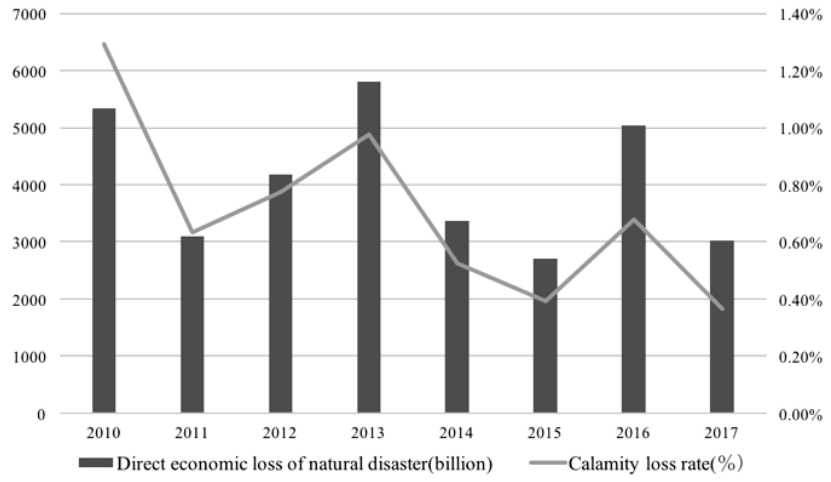

Figure 1: China's natural disaster losses and their share of GDP in 2010-2017

(Source: China Statistical Yearbook of the National Bureau of Statistics.)

China's average calamity loss rate (natural disaster losses as a percentage of GDP) between 2010 and 2017 is around 0.7% (see Figure 1). According to estimates, during the 20-year period from 1991 to 2009, China's average calamity loss rate reached 2.44% (data taken from Yang Xia. Research on natural disaster risk transfer [J]. Wuhan Finance, 2010.). It can also be seen that the average calamity loss rate in China has fallen sharply in recent years.

In the past eight years, about 10%-35% of the population in the country has been affected by natural disasters (see Table 1), but the proportion of the affected population has a clear downward trend. In the years with heavy disasters, such as the cold wave in Xinjiang and the earthquake in Qinghai in 2010, the disaster-affected

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population and calamity loss rate reached the highest.

Table 1：The number of people affected by natural disasters in China in 2010-2017

(Source: China Statistical Yearbook of the National Bureau of Statistics.）

Year	Total population(ten thousand)	The affected population(ten thousand)	The rate of affected populationÎ Î Î
2010	134091	42610.2	31.78%
2011	134735	43290.0	32.13%
2012	135404	29421.7	21.73%
2013	136072	38818.7	28.53%
2014	136782	24353.7	17.80%
2015	137462	18620.3	13.55%
2016	138271	18911.7	13.68%
2017	139008	14448.0	10.39%

There has been a downward trend of China's average calamity loss rate and the rate of affected population in recent years. The reasons for the analysis are as follows: 1. China's GDP growth rate is relatively fast. 2. In terms of pre-disaster prevention, the government's investment in infrastructure construction (hardening dams, remediation of farmland, etc.) has improved China's defense capabilities against natural disasters. 3. In terms of the post-disaster response, the government improved the emergency response mechanism, including the establishment of high-quality flood prevention teams, earthquake rescue teams, etc.

3. The impact of natural disasters on China's macroeconomic growth

3.1 Previous research

What will happen to the macro economy when natural disasters occur? There are two different perspectives in the economics world. In the first view, Dercon (2004) argues that natural disasters have long-lasting negative effects on household consumption, and that the economy in the region cannot be restored to pre-disaster levels. Rasmussen (2004), Noy (2008) and other scholars believe that after the occurrence of natural disasters, the national income and tax revenue will be reduced in the short term, and the deficit level will be raised. The long-term post-disaster reconstruction will cause fiscal imbalance and further reduce economic growth. In another view, Toya and Skidmore (2002) have shown that long-term post-disaster reconstruction promotes advanced science and technology development, leading to higher productivity and thus higher economic growth. In addition, Okuyama (2003) believes that when natural disasters occur, old equipment is more vulnerable, and replacing these old equipment will have a long-term positive impact on overall economic growth and productivity development.

3.2 Econometric model

To further explore the relationship between natural disasters and China's economic growth, we conduct regression analysis on panel data of different disasters

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and economic growth variables in China's 31 provinces from 2005 to 2015, with per capita GDP growth rate as the dependent variable and natural disaster as the independent variable. In addition, we also measure the impact of specific natural disasters such as droughts, floods, storms and freezes. In terms of the choice of other variables, we select a country's degree of openness (total import and export/GDP), government financial burden (total government expenditure/GDP), education level (high school enrollment rate), birth rate, and investment growth rate. Use the following measurement model to test:

$$y_{it} = c_1 + c_2 D_{it} + c_3 O_{it} + c_4 E_{it} + c_5 B_{it} + c_6 F_{it} + c_7 I_{it} + \varepsilon_{it} \quad (1)$$

Where y_{it} represents the per capita GDP growth rate in the i region, D_{it} represents the degree of natural disaster impact on the economy, O_{it} indicates the degree of openness, E_{it} indicates the education level, B_{it} indicates the birth rate, F_{it} indicating the government financial burden, and I_{it} indicates the investment growth rate, c_n (n =1, 2, ..., 7) is the regression coefficient, and ε_{it} is the error term.

3.3 Results and analysis

Table 2: Panel data regression results

Explanatory variable	Explained variable				
	Model 1 (GDP growth)	Model 2 (GDP growth)	Model 3 (agrigrowth)	Model 4 (indusgrowth)	Model 5 (servgrowth)
Disaster	0.0990				
Drought		-0.0567	-0.0980	-0.0845	0.0846
Flood		0.0115	-0.1044	0.0791	0.0353
Storm		-0.0656	0.0765	-0.1031	-0.2547
Freezing		0.0247	-0.2517	0.3634	-0.0289
Open	0.4324	0.4121	0.3429	0.0038	-0.0749
Education	0.0654	0.0895	0.6568	-0.5011	0.0594
Birth rate	-0.0325	-0.0598	0.0978	-0.0665	-0.0465
Debt	-0.1599	-0.1730	-0.1129	-0.1726	-0.1373
Investment	0.3626	0.3450	0.0496	0.2183	0.2290
Constant	0.0504	0.0739	-0.0049	0.6913	0.3711
Sample size	310	310	310	310	310

The regression results are shown in Table 2. Models 1 and 2 report the impact of different variables on per capita GDP growth. Models 3, 4, and 5 report the impact of different variables on growth rates in the agricultural, industrial, and service sectors, respectively.

From the regression results, the coefficient of openness and investment growth rate is significantly positive, indicating that a more open trading environment and more investment in fixed assets can promote a country's economic growth. The regression coefficient of the government's financial burden is negative, and it is more obvious, indicating that a larger financial burden is not conducive to economic growth.

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In terms of the impact of natural disasters, when we study the total impact of natural disasters (model 1), we can see that the impact of natural disasters on economic growth is positive but not obvious. However, when we study the economic impact of different types of natural disasters (model 2), we can find that different disasters have different effects on economic growth. Droughts and storms have a negative impact on economic growth, while floods and freezes have a positive impact on economic growth.

From the regression results of the sub-economic sectors (models 3, 4, and 5), the negative impact of drought on GDP growth rate is mainly achieved through the impact of agricultural expenditures, which in turn affects industrial expenditures.

The storm has a positive effect on agricultural economic growth. The possible explanation is that the storm brings precipitation, which is beneficial to alleviate the drought, and the storm will bring up the nutrients from the bottom of the river and bring the fish to gather on the water surface, thus increasing the fishing. The storm has a serious negative impact on the service industry. It may be explained that when the storm comes, people will reduce their outing activities, so the service sector will have less output.

The reason why freezing has the greatest negative impact on agricultural production is that China has less research on low-temperature disaster prevention technology and its practical application ability is weak. On the contrary, freezing has an obvious effect on industrial production due to infrastructure such as railways and power grids damaged by freezing. In the process of post-disaster reconstruction, the demand for manufacturing materials has increased, thus increasing the growth rate of output of the industrial sector.

4. Loss compensation mechanism

Noy's (2008) study shows that the impact of natural disasters is nationally different and has no obvious adverse effects on developed countries, but has an obvious negative impact on developing countries. The essential reason is that developed countries can deal with natural disasters more effectively. It can also be seen that a perfect loss compensation mechanism is important for mitigating the economic impact of natural disasters.

Table 3 shows the sharing of natural disaster losses in China in recent years. In the face of natural disasters, the victims are accustomed to relying on limited government subsidies and social donations, and rarely share the risks before the disaster, so the proportion of losses they bear themselves exceeds 90%. This is not only bad for the economic recovery work after the disaster, but also brings huge economic burden to the victims.

According to the 2018 global natural disaster insurance rate data released by Munich Reinsurance Company, North America is 64.63% and Japan is 47.06%. However, in the past few decades, the natural disaster insurance rate in China has only been 1.5%. In terms of frequent disasters, increasing the coverage ratio of

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insurance is an effective way in China to avoid risks and ensure the protection of the victims.

Table 3: 2013-2017 China Disaster Loss Sharing

Year	Relief fund	Direct economic loss of natural disaster (billion)	Losses that victims bear (billion)	The rate of losses that victims bear
2013	163.4	5808.4	5645.0	97%
2014	178.7	3373.8	3195.1	95%
2015	124.4	2704.1	2579.7	95%
2016	148.5	5032.9	4884.4	97%
2017	156.1	3018.7	2862.6	95%

(Data source: The direct disaster loss data comes from the China Statistical Yearbook of the National Bureau of Statistics, and the disaster relief expenditure data comes from the China Civil Affairs Statistical Yearbook)

Japanese earthquake insurance model is a perfect example. The implementation model is: the insurance company will distribute the premiums from the insured to the reinsurance company (JERC), and JERC will distribute the premiums to the government and the insurance company in proportion. Under this mechanism, the government, the insurance company and the reinsurance company cooperated to share the losses, which greatly reduced the difficulty of the insurance company's payment and the government's subsidy pressure, and also ensured the post-disaster economy.

Regarding China’s loss compensation mechanism, I have the following suggestions. Firstly, constructing a risk-bearing body composed of commercial banks and the government can reduce the operational risks of insurance companies and the government itself. Secondly, while raising public awareness of natural disaster prevention, China can extend natural disaster insurance models in laws if necessary. Under the protection of laws, insurance companies can implement insurance claims more conveniently, and the economy after the disaster can also be guaranteed.

5. Conclusion

On the basis of the analysis above, we may confidently come to a conclusion that total natural disasters in China have a small impact on economic growth. However, the impact of specific types of natural disasters on economic growth is more obvious and has large differences. Different types of disasters will have different effects on the economic growth of agriculture, industry and services. In recent years, various types of losses caused by natural disasters in China are still serious, but a downward trend. To further reduce China's sensitivity to natural disasters and protect the economic interests of the people, it would be a good solution to learn the foreign advanced damage compensation mechanism and improve an effective post-disaster security system that belongs to China itself.

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