Conditions of Agricultural Catastrophe Risks in China and Establishment of Agricultural Risks Protection Systems

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Abstract Agricultural risks in our country have been introduced: firstly, disasters are multiple and frequently happened; secondly, widely affected and seriously suffered. Features of risks also are introduced: the first is the agricultural risk unit is large; the second is the agricultural risk is strongly regional; the third is the agricultural risk is universally half revival. The paper discusses the limits of the agricultural risks management, pointing out that in the management systems of agricultural risks, government finance is strongly burdened, compensations on the catastrophe is small in region, low in level. Based on the above analysis, the protection systems of agricultural risks have been constructed: the first is to establish the reassurance systems of agricultural risks; the second is to establish the risk funds of single agricultural item; the third is to transfer the catastrophe risks through stocks; the fourth is to construct multi leveled countermeasures of agricultural risks.

Key words Catastrophic risks, Natural insurance, Reinsurance, Risk funds of catastrophe, China

China is a large agricultural country with agriculture dominated in national economy. Meanwhile, China is a country with frequent natural disasters facing serious natural disasters. The disasters are greatly damaging, widely affected, resulting great economic losses in agricultural generation and threatening seriously the daily life of people. Therefore, the agricultural risks protection systems suitable for our country should be constructed. The author analyzes the limitations of agricultural risks management at present stage of our country based on the conditions and features of agricultural risks, puts forward countermeasures and suggestions in construction the agricultural risks protection systems.

1 Conditions and features of agricultural risks insurance of China

1.1 Conditions of agricultural risks insurance

1.1.1 Multiple kinds of disasters, frequently happening. Widely affected flood, strong wind, snow and drought happen frequently in our country almost every year. Floods frequently happen around Songhua River, Nen River, central of Huanghai River basin and Yangtze River and south of Pearl River Basin; Storm mostly occurs in coastal areas, which often cause landslides, collapses and other secondary disasters; while droughts and sandstorms frequently attacked the north. In the 40 years from 1951 to 1990, averaging 24.5 heavier disasters happened in our country per year; since 1990s, because of human beings destroying behaviors resulting warm climates and increment of green gas, natural disasters even more frequently happen and face much greater loss.

1.1.2 Widely affected and seriously suffered. According to statistics, in 1990s, the direct economic loss by natural disasters annually reaches to 174.7 billion Yuan, covering 3% in GDP, the areas of agricultural affection covering respectively 20% and 50% in seeding areas[1] and all the affected areas; recently, loss of disasters are even more without reduction. The ever most serious Yangtze River and Nen River floods in 1998 affected 29 provinces or districts all over the country, the total affected area is 21.2 million hm^2, with 223 million people suffered and 240 billion yuan. Seriously happened strong wind in Zhejiang, Shanghai, Jiangsu, Shandong and Guangdong caused thousands of people suffering with direct economic loss of hundreds billion yuan. At the beginning of 2008, in southern areas snow disasters caused direct economic loss of 151.6 billion yuan, widely affected and many suffered[2]. In the southern part this year continues a wide range of heavy rain, resulting floods in provinces without happening for hundreds of years. According to ministry of Civil Affairs statistics, until 23rd June, the floods have caused 29.395 million people suffered in Zhejiang, Fujian, Jiangxi, Hubei, Hunan, Guangdong, Guangxi, Chongqing, Sichuan and Guizhou; the suffered area of crops is 1.618 7 million hm^2, with 277.8 thousand hm^2 having nothing harvest; 215 thousand houses collapsed, 594 thousand destroyed; the direct economic loss by the disaster is 43.3 billion yuan. The following happened disasters in Jiangxi are even more serious, with even much greater loss.

1.2 Features of agricultural disasters of our country

1.2.1 Large risk unit of agricultural disasters. Risk unit refers to the possible damage range of insurance objects caused by disasters. The insurance objects in the same unit, the disposition and happening chance are the same. Therefore, the disas-

Received: July 26, 2010 Accepted: August 9, 2010
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trous events of the same insurance objects are completely relative or highly related. In agricultural disasters, a risk unit has thousands of insurance units, including floods, droughts and typhoon and so on. Agricultural risk is a risk unit composed by the same insurance objects in disastrous areas[3]. Therefore, agricultural risks insurance is not in fact an operational insurance which cannot be disposed with the general insurance way.

1.2.2 Strong regional. Agricultural risks are strong regional, which can be classified into 2 aspects: the first is the risks distribution, in other words different regions have different disasters. Because different areas vary with geological structure, landforms and climates, types of disasters and degrees are regionally different. For example, floods are frequent in southern parts in China, droughts in north, while typhoon is always in coastal areas and so on; the second is the disasters types and degrees of demolishment are regionally different. Because of different geological structure and climates, crops are different in different regions which have different resistance to disasters. For example, rice suffers from different kinds of disasters both in north and south. Facing the same kind of disasters, the resistance of rice is different in the north and in the south. So the degrees of disasters are different. Therefore, the management of agricultural risk insurance should be varied in areas and types.

1.2.3 Universal association of agricultural risks. The association of agricultural risks refers that the happening of a disaster may cause a kind or kinds of other disasters, bring larger damage. For example, typhoon is always accompanied with floods which may generate debris flow and so on; in floods, high temperature may cause diseases and pests. The association features of agricultural risks not only cause secondary disasters with greater loss, but also bring greater difficulties to the management of agricultural risks insurance.

2 Limits of agricultural risks insurance management

For a long time, the compensation on the loss of agricultural disasters mainly depends on national financial aids and social donations which are charged by the governmental department. The limits of this kind of management become more and more apparent. Firstly this kind of method generates great burden to the government finance. The aiding capital is mainly from the financial income. The aids are usually constrained by the abilities of the government which may cause abrupt burden to finance. Secondly, the compensation through this way is small regional and low leveled. Costs on the disasters compensation usually cover only a small part. In practice, the costs on the compensation may surpass the budget, while other costs are irrevocable and fiscal deficit target also constrained by the economic stability; finance used on the compensation is relatively low in fact. The government only aids the suffered people with the lowest range. Social donation is random in time and quantity. Therefore, compensation of the both is small scaled and low leveled.

According to statistics, in 1980s, the aids afforded by government are averaging only 935 million Yuan per year, only covering 1.35% of damage. In the 1990s, the relief funds by the government are about 1.8 billion Yuan, covering 1.8% of the damage. Table 2 displays the damage of disasters from 1998 to 2008 and the expenditures on aids. From Table 1, the direct economic loss caused by the disasters is great and shows a rising trend; the second is that the rate of compensation on disasters by the government to the direct economic loss is very low, mostly not covering 2%. The most is in 2004 3.1%. Based on this, compensation depending on state finance is only drop in the bucket. Therefore, in order to tackle the agricultural risks insurance, the establishment of agricultural risks insurance systems is necessary.

3 The construction of agricultural risks insurance in China

3.1 Establishments of agricultural catastrophe risks reinsurance systems As the insurance of insurance, reinsurance is an important way to distract and share the burden of the risks of the original companies. It works as a role in making the company strengthen the risks management, improve ensured ability and strengthen sustainable development. Because of the specialty and complexity of agricultural risks, the establishment of the reinsurance is a key to the development of agricultural insurance. The developed countries afford supports through reinsurance or in forms of establishing catastrophe risks funds. Because reinsurance markets in our country are weak, under the present conditions, the reinsurance support may be firstly afforded by the state's reinsurance groups to agricultural insurance companies. Then according to views of the State Council on the Development of the insurance industry Reform, gradually construct the national, local financial supported insurance systems. The first is that reinsurance groups of China make reinsurance contracts with insurance companies managing agricultural insurance or the insurance collections, affording reinsurance support. The second is that aiming at the stable development of agricultural insurance, the reinsurance groups of China sign a package of loss ratio excess of loss reinsurance contract with insurance companies, taking charge of compensation abilities on the loss rate in the agreed range to balance the annual expenditure and income of the insurance companies to keep their long steady. The third is to strengthen the international cooperation, looking forward national reinsurance supports, making use of the mature reinsurance markets of the developed countries to distract or share the loss of the insurance markets at home which is difficult to bear.

3.2 Establishing single agricultural catastrophe risks funds To those special catastrophe risks insurance, the catastrophe funds managed by government should be constructed. For example, to those serious catastrophes happening every year in China such as floods, droughts, formulates National Flood Insurance Program similar to America's. *America's National Flood Insurance Program* is in fact a national insurance collections managed by governmental departments, insuring the floods areas by force. The funds are mainly from the pro-

tection fees and investment benefits. When the loss surpasses to some degree, it is the government who take responsibilities to loan or lend special loans, in other words the government take the risks to some degree. From a national view, there are 2 modes of catastrophe risks management, the first is the single catastrophe risks funds, and the other is the comprehensive catastrophe risks funds. Because China is a country full of natural disasters with multiple types and unbalanced in geography. Therefore, start from our practical situations, according to catastrophe features of different regions, the establishment of single catastrophe risks funds is suitable for our country, which is not only convenient to operate, but also it is beneficial to accumulate experience in comprehensive catastrophe funds to conduct the steady management of agricultural catastrophe risks. According to international experience, catastrophe funds may come from 4 aspects, including financial loans, protection fees, social donation and investment bonds. While our country is special in practical situations, insurance business is not developed, the disposable incomes of peasants are low, so, funds should mainly depend on financial loans and social donations. Make the original, irrevocable funds used in disasters supporting become catastrophe risks funds which may be accumulated for a long time and improve the management ability and protection levels of agricultural catastrophe risks. The funds management of catastrophe risks is the operation core of management systems. Funds should be accumulated, specially used and independently calculated, managed by specific department.

Table 1 Damages of natural disasters and financial expenditures from 1998 to 2008

Year	Direct Economic Losses Caused by Natural Disasters $\times 10^8$ Yuan	Expenditures of State Financial relief $\times 10^8$ Yuan	Percentage of State Financial Relief Expenditures in Direct Economic Losses//%
1998	3 007	52.32	1.7
1999	1 962	34. 05	1.7
2000	2 045	28.73	1.4
2001	1 942	35.17	1.8
2002	1 637	32.93	2.0
2003	1 884	55.71	3.0
2004	1 602	48.99	3.1
2005	2 042	52.90	2.6
2006	2 528	49.40	1.9
2007	2 363	50.39	2.1
2008	11 752	1 603.00	1.4

Note: Data comes from the published statistics of the financial department and department of civil affairs.

3.3 Distracting agricultural catastrophe risks through securitization Risks securitization is the efficient way to solve catastrophe risks. Risks securitization is the combination of agricultural risks with capital markets, collecting money in forms of stocks in capital markets to distract loss of agricultural catastrophe risks. Because of multiple types of catastrophe risks, wide distribution and greater loss and so on, especially under the situation that insurance is not developed in China and requires other forces to distract the pressure outside the insurance markets. In 90s last century, the western developed countries succeed in distracting agricultural risks through securitization and gained good effects. The first is the contingency reserve bonds, which can have an extra of money after catastrophe as a financial arrangement. Investors put capital into a credit account and entrust others to buy treasury bills. The investors may gain the additional bonds after some catastrophe besides the bonds of treasury bills. The insurance companies have the rights to publish the contingency reserve bonds to replace the treasury bills in credit accounts to gain the contingency capital, which in fact are the loan rights bought by the companies when catastrophe happens. The second is the catastrophe bonds, which makes the insurance companies transfer the catastrophe risks to a credit account. The investors deposit all capital into this credit account and entrust others to buy treasury bills; if the loss of disasters reach to some degree, the insurance company may gain parts of the total bonds in credit account without paying back to investors, but insurance must add an additional, market deciding interests to satisfy investors' risks interests. This is a kind of most successful and most popular catastrophe bonds at present. The third is to exchange the tradable bonds. Standardized contracts authorizes the insurance companies to have the rights of collecting capital from investors on the condition that the loss of catastrophe reaching to some degree. If in agreed time, there is no catastrophe, then investors may have rights to get back capital from insurance companies. What insurance companies buy is the requirements of paying abilities when catastrophe happens. By securitization of catastrophe risks and dissolving the agricultural catastrophe risks are the efficient ways in managing the modern agricultural catastrophe risks.

3.4 Constructing multi leveled countermeasures of agricultural catastrophe China is a country full of natural disasters. Agricultural disasters threaten the developments of agriculture and rural economy and normal production and life of people. According to some statistics, the destroyable degree of floods and droughts to agricultural production upgrade every 10%, the ratio of poverty generation increase by every 2% to 3%. Among those poor families, 55% suffers from natural disasters. Among which, 16.5% suffered half loss of harvest from disasters and 42% are 2-year suffering from natural disasters. Therefore, the strengthening of agricultural catastrophe risks management has special significant meaning in Three Issues solution. Because of its large area and complex geography, agricultural risks show apparent regional differences. Meanwhile, the regional development of agriculture is greatly different and the development of industrialization and modernization of agriculture is not balanced. Therefore, the single management cannot meet the practical needs and multiple risks management methods should be combined together[4]. The first is to strengthen the management of disasters resistance. The disasters resistance includes mainly different projects and measures on different risks, for example the construction of agricultural irrigation projects to lower the degrees of floods; researches on new pest-resistance technology to lower the damage degree on crops and so on. These measures help farmers and agricultural industries upgrade the pest-resisting abilities from

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up the opportunity of developing other agricultural intangible asset. The possible profit from successfully developing other agricultural intangible asset is the cost of developing existing agricultural intangible asset, it is called the opportunity cost of this agricultural intangible asset. In the same way, opportunity cost exists in the process of assignment of agricultural intangible asset. Some agricultural intangible assets, for example, proprietary right, patent right and *etc.*, will cause intensifying competition after assignment. It brings loss to its primary owner such as decrease of market share and operation revenue. These losses are the opportunity cost of assigning this agricultural intangible asset. The significance of opportunity cost in appraising agricultural intangible asset is: it is conducive to taking full consideration of all influencing factors and seeking the best appraised value of appraised agricultural intangible asset. The opportunity cost of agricultural intangible asset can be determined by the following two design foemula:

$$F = \sum_{i=1}^{n} \frac{R_i}{(1+r)^i} \qquad \text{Formula 1}$$

$$F = \sum_{i=1}^{n} \frac{\Delta R_i}{(1+r)^i} \qquad \text{Formula 2}$$

Formula 1 is the appraisal formula of opportunity cost of developing agricultural intangible asset. Formula 2 is the appraisal formula of opportunity cost of assigning agricultural intangible asset.

In the formulas, F is the opportunity cost of agricultural intangible asset; r is discount rate; n is remained service life; R_i is the profit from the abandoned development program of agricultural intangible asset in the i-th year; ΔR_i is decreasing amount of profit caused by assigning agricultural intangible asset in the i-th year.

4 Conclusion

At present, relevant research of appraisal of agricultural intangible asset is imperfect, and the relevant content of appraising agricultural intangible asset by cost method has yet to improve. Therefore, in-depth study of basic theory and practice of agricultural intangible asset appraisal has a very high academic and practical value. Because agricultural intangible asset has the same cost characteristics with intangible asset, such as imperfection, weak correspondence, virtuality and so on, thus in the appraisal of agricultural intangible asset by cost method, determination of replacement cost is a difficult point. In actual application, it is necessary for evaluators to synthetically analyze combining with the type, source and characteristics of agricultural intangible asset, in order to ensure the objectivity and fairness of appraisal value of agricultural intangible asset.

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substantial technology, which has become a dispensable part of agricultural risks management. At the same time, we should make good use of high-tech weather equipment, construct the disasters prevention systems and carry out artificial rainfalls and prevent hail to improve the disasters prevention abilities. The second is to make good use of agricultural insurance. At present, the development of agricultural insurance becomes scaled. In 2009, the incomes of agricultural risks insurance is 13.39 billion yuan, affording risks assurance 381.2 billion yuan, the insured families are 133 million, which are respectively 33.8 times, 17.8 times and 11.6 times of 2004. Agricultural insurance is the efficient method of agricultural risks management, an important agricultural protection measure under WTO Green Box policies. The agricultural insurance has become the important tool in many countries in supporting the agricultural development and stabilizing farmers' incomes, which is highly considered in many countries in the world. Our country should accelerate the transfer of the traditional agricultural risks management methods, viewing the agricultural insurance as the main methods of agricultural management. The third is to have the traditional disasters supporting and social donation as the subordinate methods, including mainly government sending aiding materials to suffered people, affording beneficial loans and substantial aids aiming at help farmers recover the normal agricultural production and normal life. The essence of agricultural aids is kinds of moral compensation measures of government on agricultural manager when they suffer from disasters. Disasters prevention and reduction, agricultural insurance, disasters aiding and supporting are the integrity of agriculture management, which depend on each other[5]. Disasters prevention and reduction are the premise and basis, agricultural insurance is the main body and importance, while aiding and supporting are the supplementary.

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