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ASSESSING THE DEMAND FOR WEATHER INDEX INSURANCE IN SHANDONG PROVINCE, CHINA

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ABSTRACT OF THESIS

ASSESSING THE DEMAND FOR WEATHER INDEX INSURANCE IN SHANDONG PROVINCE, CHINA

Shandong Province, renowned as China's greatest agricultural province, is dominated by smallholders growing rain-fed crops and vulnerable to severe weather shocks that can increase poverty rates. Weather index insurance, an innovative agricultural risk management product, may be an effective mechanism to address vulnerability to catastrophic weather risk in rural regions of China, including Shandong. This project evaluated current household livelihood and risk management strategies and farmer interest in weather index insurance. Data from 174 participants were collected using a methodology that included focus groups, questionnaires, and personal interviews. Despite limited access to formal financial services, Shandong farmers generally employ informal, well-diversified income strategies and rely on no-interest informal loans from community members to manage adverse impacts of natural disasters, such as drought. Households sometimes rely on reducing consumption as a risk coping strategy; however, unlike many regions of the world, Shandong farmers do not tend to sell livelihood assets to manage weather shocks. A majority of interviewed participants were interested in weather index insurance after they understood its basic concept; however, participants expressed concerns regarding basis risk and program implementation.

KEYWORDS: Shandong, Poverty Trap, Agricultural Risks, Rural Livelihood Strategies, Weather Index Insurance.

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December 18, 2008

ASSESSING THE DEMAND FOR WEATHER INDEX INSURANCE IN SHANDONG PROVINCE, CHINA

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THESIS

Lisha Zhang

The Graduate School

University of Kentucky

2008

ASSESSING THE DEMAND FOR WEATHER INDEX INSURANCE IN SHANDONG PROVINCE, CHINA

THESIS

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Science in the
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By

Lisha Zhang

Lexington, Kentucky

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2008

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When I conducted this research in Shandong, the magnitude 8.0 Wenchuan earthquake occurred in Sichuan, China. With deep condolences to the victims, I value even more that my field of research focuses on alleviating adverse impacts of natural disasters on rural well-being. My primary appreciation goes to my thesis chair, Dr. Jerry Skees, who led me to this research field, offered research opportunity to me to work in my home country, trusted and encouraged me when I encountered challenges, and provided the insightful direction to my research.

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CHAPTER 1
PROBLEM STATEMENT AND OBJECTIVES

1.1 Introduction

The economic development literature demonstrates how risk constrains small households in developing countries (Barrett and Carter, 2001; Ray, 1998). While small rural households face many risks, natural disaster risk is one of the largest problems for households engaged in farming and farming-related activities. Yet formal agricultural insurance is essentially non-existent in developing countries such as China, which has the largest agricultural population in the world.

The lack of efficient strategies to manage risks associated with agriculture is a major impediment to improving the well-being of rural residents in China. The gap between the impact of the risks that farmers experience and their existing, but less efficient risk management strategies creates a potential for markets to transfer agricultural risks, supplying a demand for more effective financial products.

Traditional agricultural insurance programs used mainly in the developed countries of North America and Europe, cannot be applied to developing countries such as China, where the small farm size makes it cost-prohibitive to market and service insurance products. In addition, developing countries lack institutions with the resources to administer insurance markets, and governments cannot afford subsidizing such programs. Finally, developing countries also have limited access to global reinsurance markets.

Since the mid 1990s, the World Bank and others have been working to introduce a new, simpler, and less costly form of agricultural insurance in developing countries, index-based weather insurance, which holds some promise as index insurance addresses many of the problems associated with traditional agricultural insurance (Skees, 2008). The indemnity payments for index insurance are based on an index instead of individual loss. The index acts as a proxy for loss, and the insurance product is written on an objective measure of a major weather event such as shortage of rainfall that exhibits a strong correlation with the variable of interest, e. g., crop yields. The design of an index product eliminates the high administration and transaction costs associated with delivering traditional agricultural insurance at the household level because no household

information is needed and the indemnity rates and payout rates do not have to be individually tailored. Other high costs that result in higher premiums and limit the agricultural insurance market in developing countries such as the costs of monitoring the information asymmetry common to traditional agricultural insurance (e.g., adverse selection and moral hazard) are also reduced. Since the indemnity payment of an index insurance product is solely based on the index measured by an objective third party (e.g., rainfall level measured by the weather station), moral hazard is alleviated, and because these products can be designed to control for adverse selection, administration costs can greatly be reduced. In addition, the standard that the payments trigger as long as the index measured reaches the redefined level simplifies the payment procedure, lowering the transaction costs.

In general, government experience in providing agricultural insurance has been quite poor. Hazell (1992) documents how the subsidies provided in numerous crop insurance programs have exceeded the farmer-paid premiums by several fold and he raises questions about the social cost/benefit ratio of such government interventions. Also, such subsidies generally favor wealthier farm households and thus erode poverty objectives. Even targeted premium subsidies rarely work as planned. For long-term sustainability of insurance markets, it is best if the role of government is one of facilitator and not direct deliverer of insurance products. This role includes establishing an appropriate enabling environment and providing certain public goods. More specifically, a government or donor can support such things as:

- Improvements in the legal and regulatory environment;
- Improvements in data systems and data collection;
- Educational efforts about the use of weather insurance;
- Product development; and
- Access to global markets.

In some cases, governments or donor agencies may choose to provide financing for catastrophic losses (Skees et al., 2006). Still, it is potentially useful to transfer weather-related risks out of the country when possible. Global reinsurers are starting to see that index insurance might be a way for them to enter the market in developing countries.

Index insurance pilots are attracting more and more prefeasibility and feasibility assessments such as is performed in this study.

This study follows the prefeasibility demand assessment work that has taken place before the more detailed demand assessments and pilots were introduced in countries such as Ethiopia, India, Mexico, Mongolia, Nicaragua, Peru, and Vietnam. The potential demand for weather index insurance is investigated in Shandong Province, a major agricultural province of China. To evaluate the demand, a "Demand Assessment Survey" was designed based on the premise that for the most common agricultural crises affecting rural households' livelihood strategies and current coping strategies, weather index insurance with its lower transaction costs and easy implementation procedure can fill the gaps between the economic shocks suffered by farm households in Shandong and the coping mechanisms that they use to overcome these risks.

The survey was carried out in May, 2008 with focus groups discussions, a questionnaire, and individual interviews in 20 rural locations across Shandong Province. The interviewer introduced the basic concepts surrounding index-based weather insurance, exchanged ideas with participants, and recorded their responses. This approach combining the use of these three survey instruments can more effectively offer insights into the potential interest in index-based weather insurance among small farmers in Shandong.

1.2 Background

"Shandong" is translated, "east of the mountain." The province is located east of the Taihang Mountains on China's east coast in the lower Yellow River Valley. Shandong Province has enjoyed significant and long-term economic growth over the last decade. The recent growth rates remain above the reported 13.2 percent average between 2001 and 2005, maintaining growth momentum.

1.2.1 Agricultural Economy

Agriculture has always been regarded as the fundamental domain for economic development in Shandong, and it is renowned for the greatest agricultural production value in the country. Recognized nationwide as China's Agricultural Champion,

Shandong is famous for a variety of agricultural products such as grain, cotton, peanut, vegetable, and fruits. Shandong Province is well-known for grain production and has recorded an annual yield of over 40 million tons of grain for many years. Enjoying a long history of growing cotton, it has been a major producer of cotton in China. Shandong is also the number one peanut grower in China, and more than half of the total exported peanuts from China come from the province. In recent years, as one of major vegetable suppliers to Beijing, Shanghai and other large cities, the province has made vegetables the second dominant agricultural product, earning Shandong a name as the biggest vegetable basket in the nation. It also leads the nation in fruit production, such as high quality apples, pears, peaches, apricots, grapes, and watermelons.

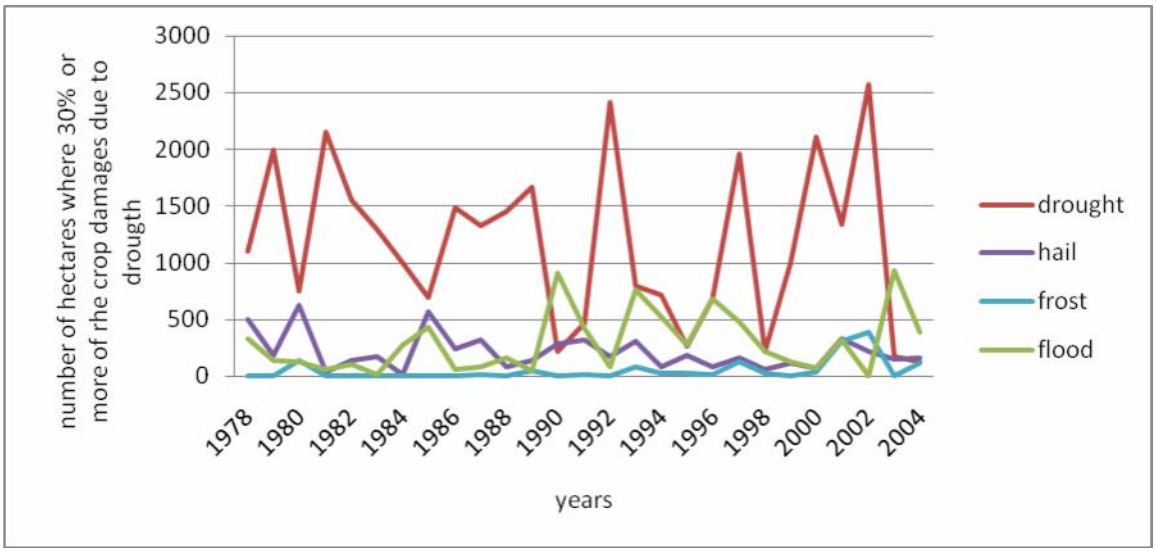
With a long history of stock raising and as a main producer of grain and other crops of economic value, Shandong provided an ensured development of husbandry breeding with abundant fodder, straw and other resources The high risk of agriculture insurance results in few insurers.

1.2.2 Agricultural Risks

Farm households are vulnerable to various risks associated with agriculture, such as prices changes of crops they grow, poor quality of agricultural inputs, and severe weather shocks. Among them, weather shocks have the most extensive impacts. Unlike the price and input quality risks whose effects are more likely to be limited to particular crops and local regions, adverse weather events can destroy large areas of different crops within large areas. As a result, many farmers suffer from the losses at the same time.

The primary weather shock in Shandong is drought. Figure 1.1 summarizes the number of hectares where 30 percent of more of the crop damages due to drought, hail, frost and flood from 1978 to 2008. It is obvious that historically drought contributes more crop damages than other weather risks. Therefore, in the following chapters, we give more attention to drought and its impacts.

Figure 1.1 Hectares in Shandong Where 30% or More of the Crop Loss Is Due to Natural Disasters



Data Source: Various Statistical Year Books of Agriculture in China

1.2.3 AGRICULTURAL INSURANCE

Recognizing the important weather impact on agriculture, financial products that can transfer weather risks could be useful to protect farmers from these risks. As a province of great economic scale and a large population, Shandong is favored by insurance companies both at home and abroad who are competing fiercely for a share of a market that is diversifying and growing rapidly. The insurance market against weather shock, however, is largely absent in Shandong. PICC Property and Casualty (PICC P&C) began offering insurance in 1982. Since that time, its annual premiums have decreased from over 100 million yuan (US$12.48 million) to less than ten million yuan (US$1.25 million) with an average loss ratio of greater than 117 percent. Crop insurance expenses account for 2 to 15 percent of PICC P&C's total expense in Shandong, far higher than that of other property insurance, but its customers are mostly poor farmers who can't afford high expenses.

There are four major characteristics in Shandong agricultural insurance market. First, regions covered are relatively limited. Among the 14 insurance companies in Shandong, only PICC P&G offers agricultural insurance products. Among its 16 branches in Shandong, only 13 of them currently have the agricultural insurance programs. Second, the premiums are relatively low. From 2003 to 2005, the premium incomes from

agricultural insurance were CNY 6.5, 5.7 and 6.3 million, respectively. Third, the types of agricultural insurance products are limited. Although there are 22 agricultural related insurance offered PICC P&G, the premium income are mainly from hail insurance for wheat, fire insurance and forest insurance, all of which account for 80% of all agricultural insurance income. Farmers do not have sufficient choices to transfer their weather risks. Finally, the premium income from planting is 9 times greater than premiums from the livestock insurance, which is not dependent as much as on the weather.

From 2006, Shandong government initiated subsided agricultural insurance, implemented by PICC P&G and China United Property Insurance Company, Shandong branch. The current pilots have extended to 20 counties as of August, 2008. The target insured crops include wheat, corn, vegetable, cotton, and apples. In addition insurance is being supported for cattle and pigs. The subsided ratios vary among regions. In the better-off counties, the ratio of premiums paid by provincial, local governments and policy holders is 20 percent, 30 percent, and 50 percent respectively. In the poor counties, the ratio is 50 percent, 30 percent and 20 percent and for other counties, it is 30 percent, 30 percent, and 40 percent. The current government budget for promoting subsided agricultural insurance has increased up to CNY 25 million. At this stage, there is no data or reports indicating the performance of subsided insurance.

1.3 Objectives and Organization of the Thesis

To identify the "missing market" in rural Shandong, the following questions need to be answered in the following chapters.

- What are the key risks and vulnerabilities related to agricultural facing farmers in Shandong?
- What are the impacts of these risks on farm households?
- How do farm households respond to and cope with these risks?
- How effective are these responses?
- What are the gaps between the impacts of the risks and farmers' coping strategies?
- Do farmers understand the concepts of agricultural insurance?
- Are farmers willing to purchase properly designed index weather insurance?

1.3.1 CHAPTER SUMMARY

The material is organized in Chapters 2–5 as follows: Chapter 2 addresses the conceptual framework for understanding the importance of weather risk for small rural households in developing countries. A severe shock can result in the poverty trap. Chronic poverty in developing countries is compounded by the lack of efficient financial institutions to transfer weathers risks and smooth income. Adverse selection, moral hazard, and high transaction costs contribute to reasons for failure of traditional agricultural insurance products used to transfer risks. Index-based insurance products, whose indemnity payments are solely based on the valued obtained from an index, alleviate the problems caused by asymmetric information between potential policy holders and insurers.

Chapter 3 introduces the research and sampling methodology adopted in this study. The integration of Focus Group Discussion (FGD), Questionnaires and Individual Reviews improved reliability and objectivity of data collected. Then demographic, economic, and political information on Shandong is provided with the emphasis on the agricultural sector and insurance industry.

Chapter 4 summarizes the descriptive results from the survey. The livelihood strategies imply that rural households have been well diversifying their income sources and agricultural income is less and less important in rural Shandong. In general, drought is the primary weather risks that concerns farmers in Shandong. To cope with risks, rural households primarily cut their consumption below expenditures of the past, agricultural insurance was the least important strategy in the past, but it was ranked the most important future strategy.

Chapter 5 provides conclusions by comparing the findings from Shandong project and the classic conceptual framework for poverty traps that is presented in chapter 2. In this case, it does not appear that drought and other weather shocks contribute to poverty traps in Shandong. Rural households normally choose to smooth consumption, instead of asset, as a means of coping with risks.

The lack of the accessibility to efficient financial institutions such as savings, lending, and insurance also appears to be a primary reason why households must smooth income when they face shocks from weather risk. Consistent with economic theory about risk taking, these behaviors and the lack of financial markets likely is a constraint to economic growth for small households.

CHAPTER 2
CONCEPTUAL FRAMEWORK FOR UNDERSTANDING THE IMPORTANCE OF WEATHER RISK FOR SMALL RURAL HOUSEHOLDS IN DEVELOPING COUNTRIES

2.1 Weather Risk—Major Risk for Farm Households, Especially in Low-Income Countries

Farming is risky business. Most people in the world whose livelihoods are tied to farming live in rural areas. They and their rural communities are vulnerable to farming's intrinsic risks. According to Anderson (2002, p. vii), "The primary activity of the great majority of rural households, agriculture, is an intrinsically risky activity. The risks faced by rural residents depend on the local farming systems, climate, economic and the policy and institutional settings." Given that nearly 75 percent of the world's poor live in rural communities and most of them obtain their livelihoods from agriculture, a discussion about the effects of agricultural risks cannot be separated from poverty.

Farm households attempt to plan for the risks they face, yet many of the risks associated with farming, are outside of the farmer's control and they cannot plan for these events with any sureness, e.g., the variability of crop prices. At the time they make their planting decisions, farmers cannot predict the actual price they will receive for their crops. Other factors affect the ability of farmers to make long-term planning decisions such as abrupt changes in the regulations on trade or rules for land tenure. Alderman (2006) shows that in low-income countries the incentive for farmers to invest in making improvements can be diminished by such factors. "In many low-income countries, property rights are vulnerable to seizure by government or local authorities, a risk that reduces agricultural investment." (Alderman, 2006)

However, among agricultural risks, the weather shocks associated with extreme weather events—e.g., droughts, floods, hurricanes, typhoons—are agricultural risks of primary concern, especially in low-income countries. While the number of natural disasters has risen sharply worldwide over the last decade, the biggest rise has been in low-income countries, which have suffered an increase of disaster incidence at twice the global rate (IFRCRCS, 2004). These severe and unpredictable natural disasters impact rural households both directly and indirectly.

The immediate effect of a disaster is that the major source of household income is damaged. Weather-related disasters can destroy sources of current income such as existing crops. Even more devastating, they can also destroy household assets such as livestock and farming equipment, investments that have accumulated over years and that are needed to generate future income. Although some farm households diversify their income, not relying on either crops alone or a single crop, in many lower income countries their other income sources are most likely tied to agriculture. For example, they may earn day wages assisting their neighbors and better-off households at different stages of the farming season or working in small businesses that rely on agricultural products. When a household's crop yields are destroyed by natural disaster, their other sources of income will consequently decrease or cease. Therefore, the immediate loss these households suffer after an adverse weather event is usually more than crop damage.

Beyond the immediate effects, weather-related disasters have prolonged effects on rural economies. Since agricultural households will most often choose low-risk, low-return activities to avoid or minimize exposure to weather risks, the riskier activities such as investing in equipment or newer technologies that could improve the income of the rural household and, in turn, the local economy, are avoided. People who are risk averse (especially the poor) prefer to have a certain, expected returns on the value of their portfolio rather than face an uncertain prospect that the returns can be either more or less than that expected value with fairly even chance. People who are risk averse are more willing to receive a compensation that is guaranteed yet lower than the expected return rather than risk uncertain gains. Risk aversion is particularly important when trying to understand how the poor make decisions as with the following example:

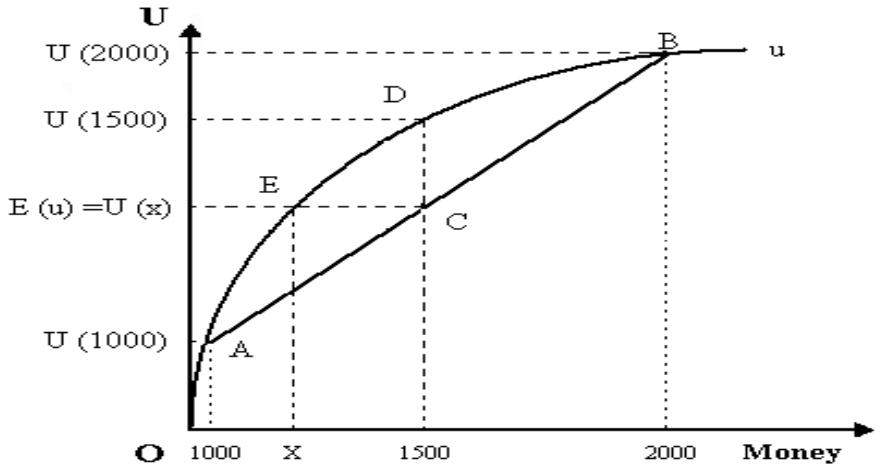
Wang, a Chinese farmer, is about to decide on purchasing a piece of new farm equipment that will produce one of two possible incomes. If there is no severe weather event in the next five years, the new equipment can make a maximum profit of $2000 on average per year. However, if there is a severe weather event during this time that destroys both his crops and his productive asset (the new equipment), he can only make a profit of $1000. Wang is a bit of a worrier and he thinks there is a 50/50 chance of a disastrous weather event and asks himself what would be the minimum compensation for which he would be willing to give up the rights to purchase this new equipment.

The mathematical expectation of the profit to this investment is

0.5*$1000+0.5*$2000=$1500

which is the weighted average of the two possible outcomes. A risk-averse person would be willing to accept the amount of compensation which is somewhat less than $1500 to avoid this investment (see Figure 2.1).

Figure 2.1 Risk Aversion of a Farmer Deciding to Buy New Equipment



Source: Author

Risk aversion can be equated with the concept of a diminishing marginal utility of money: for risk-averse people, the absolute utility of losing one unit of money is greater than the utility of one unit gained, and their utility function is therefore strictly concave as is shown in Figure 2.1. Point A shows Wang's utility when his profit is $1000, and point B shows the utility of a profit of $2000. The expected utility under these circumstances is halfway between A and B. The height of point C therefore represents the expected utility of this investment that Wang is contemplating.

Because the utility function is concave due to Wang's risk aversion, point C must actually lie below the utility function. Point D is the utility of the expected value of the investment ($1500 in this case). In the graph point D is obviously higher than point C. The meaning of this graphical representation is that the expected utility of the gamble is lower than the utility of expected value of the gamble. This is just a way of saying that Wang is risk-averse; he likes the uncertainty less than he likes receiving the expected

value of the gamble. This means that an amount of money smaller than the expected value will be enough to compensate him for foregoing the risky venture. To find this amount on the graph, we need to find the sum of money whose utility equals the expected utility of the gamble. Point E has the same utility as point C. The sum of money corresponding to this utility is the required amount, which is X in the graph. We can note that X falls short of the expected value. In one sense, the difference between X and the expected value represent a risk premium that Wang is giving up by making foregoing the investment.

It therefore follows that exposure to weather risks can significantly lower profits both due to the shock itself and due to the risk averse behavior that Wang exhibits. In other words, risk-averse farm households that are highly vulnerable to shocks often manage risk by engaging in activities characterized by low risk but also low expected return. This decision reduces the financial risk but limits growth potential and investment incentives. While low-risk strategies such as crop diversification and supplemental off-farm employment may have less income variability, the prospects for economic growth can also be significantly lower than would be the case if the household were investing in more profitable activities (Sebstad, Cohen, and McGuinness, 2006). For example, farmers in riskier environments in South India choose asset and technology portfolios that are less sensitive to variation but also less profitable (Rosenzweig and Binswanger, 1993). In this study, the risk premium that India farmers were paying was roughly equal to 30 percent. In conclusion, risk aversion is typically negatively related to growth and wealth. In the presence of potentially destructive weather risks, the poor are more likely to select livelihood strategies for risk avoidance purposes.

Another prolonged effect of natural disasters is that financial institutions may restrict lending to rural households in risky environments. Both formal and informal lenders worry about the default—they cannot get their loan back. One characteristic of natural disasters is that it does not just hit the individual, but also the entire community. So when weather –related disaster strikes, all members of the community are likely to experience hardship and loss. Financial institutions will have difficulties getting their loans back. “When a large percentage of borrowers are exposed to correlated natural hazards that either destroy household assets or severely reduce cash flow, loan defaults can spike

following a natural disaster." (Skees and Barnett, 2006). For example, in the northern region of Peru, following a major flooding in 1998, default rates on microfinance loans increased from a rate of 8 percent to nearly 18 percent in the department of Piura (Skees et al., 2006). Therefore, the poor in risky environments are more likely to have difficulties borrowing money for investments.

Finally, the long-term impacts of natural disasters can also decrease potential investment opportunities in rural areas. For financial institutions and other enterprises, places beset by weather risks are not always the best choices for investments, although such places may have great potential for growth and development. Thus, there is a social interest in extending financial services to the poor in these areas. Without such markets, development is greatly hindered.

In conclusion, climate shocks have both short-term and long term impacts on rural economies. It immediately reduces farm households' income and destroys the productive assets. In the long term, the poor, recognizing the potential weather shocks, choose the low-risk, but low-return livelihood strategies which trade off their development and wealth accumulation opportunities. In addition, both lenders and investors are cautious to make investments in rural places beset by potential weather shocks.

2.2 The Poverty Trap—The Most Severe Long-Term Impact of Weather Shocks

Climate shocks can usually result in transitory poverty: after a natural disaster. The poor experience hardship and income losses which may push them below an inherently arbitrary poverty line where they remained trapped unable to recover. While some may recover, it is likely that many will never recover. Once the poor fall below the poverty line, they remain poor for an extended period and cannot recover after an extreme weather event. In other words, they are trapped in persistent poverty. This persistent poverty is known as a poverty trap (Barrett and Carter, 2001).

Poverty traps are long-term and chronic periods of poverty. "A poverty trap can be defined as a critical minimum asset threshold, below which families are unable to educate their children, build up productive assets, and improve economically over time. Poverty traps are most likely to be problematic in areas where markets are thin or weak and families are unable to borrow against future earnings to build up their assets" (Carter et

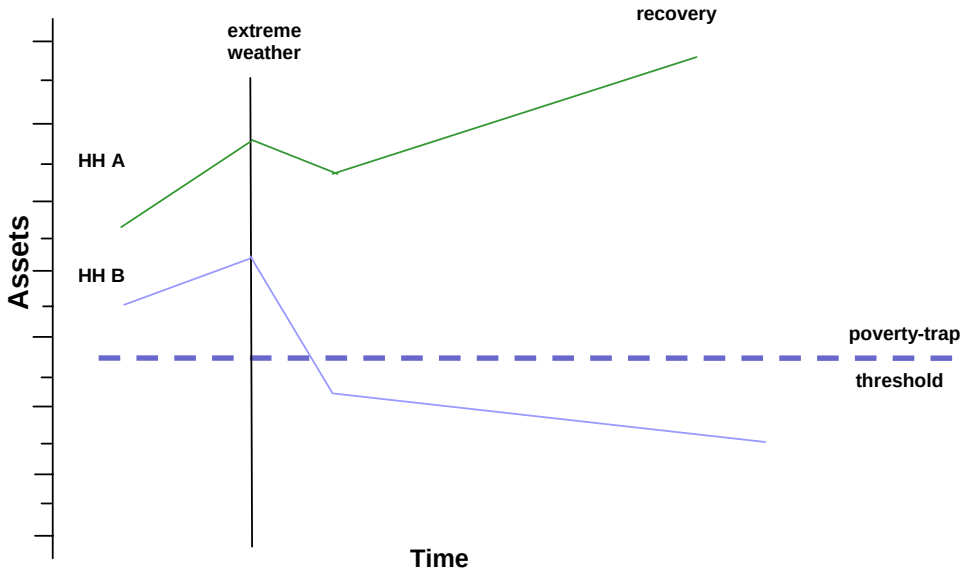
al., 2005, p.1). The basic idea of poverty traps requires the existence of multiple dynamic equilibria, at least one of which lies below a standard poverty line. This idea is characterized by at least one critical threshold above which the expected dynamics of the system are characterized by asset accumulation (i.e., growth and improvements in standards of living) and below which decumulation of assets prevails (Barrett et al., 2007).

The position of either transitory or persistent poverty is determined by asset holdings after climate shocks. Households losing productive assets are more likely to fall below the poverty line because they do not have enough assets to generate future income and improve their economic well-being. In contrast, households who can retain their assets may only experience short time hardship and their remaining assets can help them accumulate new wealth and eventually recover.

Figure 2.2 shows the different asset positions for two hypothetical households A and B. At the beginning, the two households both experience upward growth in their asset level, although B is closer to the poverty line. After a catastrophic weather event, both households may experience an immediate decline in their assets and income. Household A keeps more productive assets and is therefore able to recover in a short time. Household B, however, loses the most assets during and after the shock. In part this can be due to the initial position of Household B relative to Household A. The depletion of assets for Household B pushes the household below the poverty line and, in this case, the household does not recover.

In the presence of a critical threshold, natural disasters can lead to a permanent -poverty trap, which is the most severe long term impact of catastrophic shocks. Recognizing that the loss of assets may trap them in chronic or persistent poverty, why do people still choose to smooth assets rather than income and consumption? What factors contribute to their destructive decision of smoothing assets? In the following section, the reasons for asset smoothing are explained. This adds more to the conceptual understanding of poverty traps.

Figure 2.2 Economic Impact of a Natural Disaster on Households with Different Asset Positions



Source: Carter et al., 2005

2.3 Fundamental Reasons for Poverty Trap

2.3.1 Failure of Income Smoothing

Income smoothing includes risk management (*ex ante* strategies) and risk coping (*ex post* strategies). For the rural poor who are close to poverty trap, savings (an *ex ante* strategy) are not in the form of cash or a savings account. Rather, savings is in the form of productive assets such as livestock (Dercon, 2005). When a severe weather event occurs, these assets can be destroyed, or as in the case of livestock, the forced sale of large numbers of livestock at the same time can significant reduce their value (Dercon, 2005). Thus, existing strategies rather than use of a savings account can exacerbate the poverty trap phenomena. If the poor had access to financial markets such as savings, borrowing and insurance there would be greater opportunity for income smoothing and less vulnerability to weather shocks.

In wealthy countries, "A market exists to permit people to insure against shocks ex ante, or to borrow ex post so as to achieve quasi-insurance through ex post loan repayment (rather than ex ante insurance premium payment), these adverse effects of risk should be attenuated" (Barnett, Barrett, and Skees, 2008, p.4). Unfortunately, in many developing countries, the poor do not have access to savings and insurance before the shock or to

loans after the shock. Again, the fact that these markets are missing contributes to the failure of income smoothing.

The three most important factors that contribute to insurance market failure are: covariate risk, asymmetric information, and high transaction cost. Insurance is based on the statistical law of large numbers which implies that, for a pool of uncorrelated observations, the variance of the pool decreases with the number of observations (Priest, 1996). Catastrophic shocks are widespread and cause farm households' losses during the same time in the same region. In other words, unlike the independent risks like health and property for each household, catastrophic risks are spatially correlated. When an extreme weather shock takes place, policyholders' claims can exceed the reserves of the insurer, leaving unsuspecting policyholders unprotected. The correlated characteristic makes the catastrophic shocks harder to insure against.

The principal-agent literature identifies two primary types of asymmetric information problems: adverse selection (or hidden information) and moral hazard (or hidden action). Adverse selection occurs when potential insurance purchasers know more about their risks than the insurer, leading to participation by high-risk individuals and non-participation by low-risk individuals. Because the potential policyholders have more information about their risk exposure, they are more inclined to purchase the insurance products if their risk rating classes are misclassified. In response, the insurer may increase the premium rates for all classes. As a result, this will create a gap between the real premium and the acceptable premium.

Moral hazard refers to the careless, irresponsible, and even fraudulent behaviors of the insured after they purchase the insurance. Under moral hazard, the insured individuals engage in riskier behaviors because they have insurance, which increases the probability of adverse outcomes. Moral hazard increases policyholders' risk exposures and leaves the insurer exposed to higher levels of risk than had been anticipated when premium rates were established (Barnett, 1995).

Asymmetric information contributes to high transaction costs associated with underwriting and monitoring, and loss adjustment. For example with a traditional multiple peril crop insurance, it is not easy to determine the policyholder's expected yield

since expected yields vary tremendously across regions, even among farms in the same region. Second, crops damaged by natural disasters are hard to assess. Third, insurance delivery costs can also be quite high in rural places, particularly in remote and isolated areas. The transaction cost of selling and servicing insurance is largely independent of the amount of the insurance protection purchased. Therefore, for policies involving small amount of issued values, the transaction cost of insurance per currency unit is extremely high.

Beyond the incomplete insurance market (risk management), the incomplete credit market (risk coping) also contributes to the failure of income smoothing in lower income countries. Following a loss event, households may borrow money to smooth consumption or replace lost productive assets. However, many of the poor in lower-income countries simply cannot borrow because formal financial services usually require credit history or collateral, which are not available for the rural poor. Especially after extreme weather shocks which can destroy their productive assets, the poor cannot provide even the farming assets as the collateral.

Compared to formal financial services, informal loans are more accessible in rural places. Informal loans made by relatives, other members of the community, or money lenders are another common way in which households can access cash. But following a natural disaster, the informal loans are still problematic due to the following reasons. First, the interest on informal loans is often much higher than a bank rate. The high cost of smoothing future income will extend the time of recovery. Second, natural disasters are widespread—a great number of people suffer at the same time and in the same area. The social networks that could be relied upon for assistance may be unable to offer support because informal lenders may also experience hardship.

2.3.2 Painful Choice between Smoothing Consumption and Smoothing Asset

In the presence of a critical threshold and the absence of financial services providing income smoothing, the poor households face a cruel choice in coping with the adverse shocks: either to sell their assets to sustain consumption (consumption smoothing) or to reduce their consumption in order to defend assets (asset smoothing).

For some families, the level of consumption is already very low before a typhoon or drought. The reduction of consumption seems impossible. The poor households therefore are forced to sell off their assets which they rely on to maintain their initially low level of consumption in the aftermath of adverse shocks. But eventually this strategy will push the family into the poverty trap because their asset level is lower than the threshold required.

On the other hand, other families, with the fear of being trapped in long term destitution, adopt another strategy: reduce the already-low consumption to protect assets. For example, they may just take one meal per day, reduce meat consumption (which is relatively more expensive in developing countries), or withdraw their children from schools and put them to work full-time. Indeed, the marginal return of low level asset accumulation is relatively low, which means that saving requires more than patience and more sacrifice in terms of long term costs. With less caloric intake, the children of the families will not grow appropriately. Illiteracy will also become a major block in the children's future achievements. In other words, the destructive strategy via consumption reduction is paid with a heavy cost in the form of lost human capital, both physically and mentally. The shock therefore will extend into following generations, and this cost is eventually paid and realized in the future.

2.3.3 Importance of Financial Markets in Alleviating the Persistence of Poverty Traps

In the presence of financial markets, households should not need to cope with risk by smoothing their consumption and assets. Insurance allows households to make ex ante investments in instruments that protect income streams against weather shocks. Borrowing allows households to acquire the assets required for economic enterprises that promise higher returns. However, in rural areas of many low-income countries, access to insurance is extremely limited due to covariate risk, asymmetric information, and high transaction costs. A lack of credit history and collateral also contributes to the limited availability of credit market.

A dearth of financial market instruments compounds the problems of ineffective and inefficient ex ante and ex post strategies to manage and cope with climate risks and shocks in developing countries. The poor households have to either reduce their current

consumption or sell their productive assets used to generate future income. Although the reduction of current consumption can avoid persistent poverty, the explicit and implicit costs are very high. The sale of productive assets can lead poor households to a poverty trap with little prospect to recover.

The limited availability of financial services also contributes to the destructive decision to sell assets. The depletion of assets, in turn, may push the household below the poverty line. Therefore, one fundamental reason for poverty traps is the lack of access to financial services. The uninsured asset losses and inadequate loans possibly cast the poor into a poverty trap from which they have a difficult time emerging. The improvement of access to rural finance is increasingly acknowledged as a means to help alleviate the persistence of poverty traps in low-income countries.

2.4 Problems of Traditional Agricultural Insurance

In the previous sections, we identified that the primary reason for poverty traps is the limited access of financial mechanisms in terms of insurance and credit markets to smoothing income. There is a significant need for effective and efficient mechanisms for transferring natural disaster risks that negatively impact livelihoods and assets of small – unit farming households in lower income countries (Barnett, Barrett, and Skees, 2008). Innovative insurance mechanisms for transferring correlated weather and natural disaster risks out of rural areas of lower income countries are an important component to address the needs to smooth income over time. But traditional agricultural insurance products are problematic in many ways and not effective and efficient to transfer climate risks. In the following sections, we will address the problems inherent in traditional agricultural insurance.

2.4.1 Conditions for Insurability

Catastrophic risks are different from other risks we face daily. Before discussing the reasons why they are hard to insure, it is important to review the conditions for insurability. Rejda (2001, pp. 23–24) presents idealized conditions for a risk to be insurable.

"There must be a large number of exposure units." Pooling involves the grouping of a large number of roughly homogeneous, independent exposure units so that the law of large numbers can provide an accurate prediction of average future losses. If a classification system cannot be found that results in relatively similar risk exposure units, adverse selection will result, and only the higher risk members of the classification will participate in the pool.

Accidental and Unintentional Losses. Losses must occur as a result of chance rather than a result of management. If, as a result of purchasing insurance, management decisions are made that significantly alter the probability of loss and /or the extent of loss, moral hazard will exist. Moral hazard increases the likelihood that policyholders will collect insurance indemnities and ultimately results in prohibitively high insurance premiums.

Determinable and Measurable Loss. Loss must be determinable and measurable within an acceptable level of reliability. "This means the loss must be definite as to cause, time, place and amount." (Rejda, 2001, p. 23)

No Catastrophic Loss. If losses are positively correlated across insurance units, the law of large numbers does not apply in regions collectively affected by the loss. Annual losses for the insurance pool will be extremely variable. The loss in any given year may be large enough to threaten the solvency of the insurance pool.

Calculable Chance of Loss. To develop a premium rate, one must be able to estimate both average frequency and average severity of loss. Low-frequency, high-consequence catastrophic risks present serious challenges in premium rate making.

Economically Feasible Premium. Premiums must be affordable. The chance of loss must be in a range that does not result in extremely high premiums. At some high level of probability, the loss becomes a standard business expense instead of a risk to be transferred. When a risk has a high frequency and low severity, the transaction cost will be so high that the insurance premiums will not be economically feasible.

In the classical sense, many risks with catastrophe components, especially crop yield against adverse weather shocks, are not insurable because 1) catastrophic risks are correlated as explained earlier; 2) adverse selection is a common problems associated

with crop insurance against weather shocks. Farm households possess of more information on what can determine crop yields, like their farming experience, inputs used and conditions of their land and farming machines; 3) moral hazard is another problem due to asymmetric information. Farm households may under supply their labor or other inputs if their crops are insured. It is fairly hard for the insurer to assess the amount of losses caused by "act of human management"; 4) it is equally difficult to calculate the crop loss due to a disaster; Many reasons can contribute to low crop yields and it is not easy to identify an amount of crop losses caused by an extreme weather event; and 5) catastrophic risks are typically low-frequency and high-consequence, which result in a challenge in developing premium rates.

2.4.2 Traditional Agricultural Insurance

Most traditional agricultural insurance makes an indemnity payment when the farm household incurs a loss. "To pay indemnities, the insurance provider must make estimates of loss for each farm household that makes a claim" (Skees et al., 2006, p.9). Crop insurance is the major type of the agricultural insurance.

There are two dominant crop insurance: 1) named peril, and 2) multiple peril. Name peril insurance involves assessing losses based upon a specific risk or peril. For example, drought insurance is the crop insurance against drought. If the reduction of the crop yield is caused by a drought, the insurer will pay the indemnities. Hail insurance is the most common named peril insurance. "For well over 100 years, hail insurance has been available mostly in North America and Europe. Hail damage is easily identifiable and special procedures have been developed to make field assessment of the degree of damage." (Skees et al., 2006, p.9)

Multiple peril crop insurance covers losses due to more than one risk. Implementation of multiple peril crop insurance inherently involves the problem of asymmetric information that creates the twin problems of adverse selections and moral hazards. If one is insuring for multiple perils, it is hard to first identify the specific weather shock that created the losses and then perform a loss assessment that are used to separate the actual loss by this weather event versus loss that may occur from poor management. Therefore, policyholders have more information on what result in the losses than insurance providers.

If insurers do not have adequate information about the potential policyholders, the insured may take advantage of insurer before they get insured (adverse selection) and after they get insured (moral hazard).

Multiple peril crop insurance is also problematic in dealing with the correlated losses. For multiple peril crop insurance, crops are insured against more than one weather risk. Indemnities for a single severe weather shock can exceed premiums accumulated in several years. In some risky environments beset by more than one dominant weather risk, two weather shocks in successive years can deplete all reserves and leave both policyholders and insurers unprotected. It therefore requires careful planning to ensure that adequate capital is available when major events create claims that exceed premiums.

The transaction costs to implement multiple peril crop insurance are also considerable. First, to control adverse selection, information is needed to ensure individuals are correctly classified and the information required is costly. Second, to avoid moral hazard problem, monitoring systems should apply. Third, after a weather shock, loss adjustment, which is an attempt to exclude losses caused by management, is time-consuming, requiring more labor efforts. Finally, it is expensive to send sales agents to the countryside to attempt to convince individuals to purchase a weather insurance product. In principle, these transactions costs for multiple peril crop insurance are quite large relative to the premium. There is a significant need for weather insurance that can alleviate problems of asymmetric information, correlated losses, and transaction costs.

2.5 Index Insurance for Weather Risk

2.5.1 Definition of Index-based Weather Insurance

Index-based Risk-Transfer Products (IBRTPs) are a class of financial instruments designed to transfer correlated risks created by severe weather events. IBRTPs can be structured as options, bonds, derivatives, or insurance products. In low income countries, where derivative markets are unlikely to properly regulated, thus far, the major pilot programs that have been implemented have classified IBRTSs as insurance products (Skees and Barnett, 2006). Regardless, the characteristic feature of IBRTPs is that the payout on the instrument depends on realized values of a specifically designed measure, or index, correlated with the risk of concern (Skees and Barnett, 1999). The unique

characteristic of index weather insurance that distinguishes it from traditional crop insurance against weather risks is that indemnity payments are based on valued obtained from an index that serves as a proxy for losses rather than upon the individual losses of each policyholders (Skees et al., 2006, p.9).

The index used for proxy losses must be correlated with actual crop losses caused by weather shocks. The index is an objective measure obtained by the third party. For example, an official weather station can measure cumulative rainfall for weather insurance against drought within a specified time period. In this way, the amount of payments only relates to the index value measured and it is independent of individual losses, and consequently, it is also independent of poor management from an individual.

The implementation of index-based weather insurance is much simpler than traditional agricultural insurance. Threshold and limit are reestablished to define the ranges of index values. Threshold marks the point at which payments begin and the limit marks the point where maximum payment is made. Once the threshold is reached, the payment increases incrementally as the value of the index approaches the limit. Regardless of the actual losses sustained by the policyholders, indemnity payments that the insured receives will only depend on the real measured index and amount of liability purchased.

The following example illustrates how index insurance works. Suppose you are worried about the drought during the stage of plant flowering and pollination. An index insurance against drought during this period may work for this risk. Before making the purchase decision, you would like to make clear the technical terms in the contract. For example, it may be that for rainfall levels during this period that are less than 100 mm of rainfall the crop will begin to experience loss. Thus, the threshold would be established at 100 mm during the specified period. You will get payment as soon as the real accumulate rainfall measured by your local weather station is lower than 100 mm during the flowering period. Further, suppose that once the level of rainfall reaches a low level of 50 mm during this period, you can expect to have a complete crop failure. Thus, the limit on the index insurance would likely be set at 50 mm of rainfall. At this level, you would get the maximum payment. No further payments are provided, even if the actual realized value of the index is lower than 50 mm. Further if you have estimated that your crop value is

about $50,000 you would select a liability at $50,000. This is total value of the insurance. Your indemnity payment therefore depends on four factors: threshold, actual value, limit, and total liability. The equation of indemnity is:

Indemnity payment = (threshold-actual value) / (threshold-limit)*liability

Only when,

Actual value < Threshold value

For example, if the actual realized value of the index is 120 mm, you will not get the payment because it is higher than the threshold.

If the actual realized value of the index is 80 mm, you will get the payment of $20,000

(100-80) / (100-50)*$50,000 = $20,000

If the actual realized value of the index is 50 mm, you will get the payment of $50,000

(100-50) / (100-50)*$50,000 = $50,000

If the actual realized value of the index is 40 mm, you still get the payment of $50,000 because 40 mm is lower than the limit.

2.5.2 Advantages of Index-based Weather Insurance

Compared to traditional agricultural insurance where indemnities payments are made based on individual losses, index-based weather insurance has advantages in low transaction costs associated with asymmetric information and administration costs as well as simple standard and transparent structure. Moral hazard should be low as the insured should not be able to influence the outcome of the index. Indemnity payments for index based insurance are independent of the individual case, and therefore free of management inherent in the traditional agricultural insurance. Furthermore, adverse selection should be much lower as it is not necessary for insurer to have a great deal of information about risk exposures for the individual policyholders, and individual risk exposure does not impact their risk classes. Finally, since there is no loss adjustment the transaction cost should also be lower if there are existing systems to establish the basis of the index payments. All of these factors should lower the administrative cost of the insurance

versus a traditional insurance. Insurer can save a significant amount of costs in obtaining information, monitoring policyholders, assessing individual losses.

Other advantages of index insurance include the simplicity of contract and the transparent structure. Insurance products with simple terms may be more readily accepted. Further, to the extent that the contract is explained well and the insured can trust the measurement of the index, this may help as well.

Still, losses from weather shocks in a same region are correlated. Without other assistance or protection, an extreme weather event may deplete all reserves of local insurance companies. An access to external financial markets is efficient to transfer local weather risks. Reinsurance is insurance purchased by primary insurers to offset the risk present in their business (Skees and Barnett, 2006). Reinsurance providers can be multinational firm, government or other parties. Index-based insurance can also be used as the reinsurance products that are relatively easy and less costly to implement.

2.5.3 Limitations of Index-based Weather Insurance

While properly constructed index-based weather insurance is largely free problems that limit the development of traditional agricultural insurance, it is not a perfect insurance product. Basis risk may be the most serious limitation of index insurance. Basis risk refers to the possibility that indemnity payments are not consistent with the actual losses. The payment of index-based weather insurance is solely based on the index, not on what really happens to the insured's individual losses. On the one hand, this payment system greatly controls the problem of asymmetric information in terms of adverse selection and moral hazard. On the other hand, the real payment may not match the real losses. Some policyholders may get more money than their actual losses while some may get less payment than their actual losses. There is a trade-off between increased basis risk and lower moral hazard.

Another limitation of index insurance may be the availability of weather reliable and accessible weather data. Insurers generally require more than 30 years of weather data, which may not be available developing countries. In addition, data needs to be reliable. If data used for the index cannot be trusted or are not accurate, the system will fail.

Education can also be a limitation in the acceptability of index insurance. The structure of index-based insurance is different from other insurance products whose indemnity payment is based on the individual losses. To understand concepts of index insurance, more education may be required for local insurance providers and potential policyholders.

Finally, access to reinsurance markets by insurers in developing countries can be quite limited. Thus, transferring the correlated weather risk from a portfolio of index-based weather insurance can still be a problem. Without reinsurance market, the development of index-based insurance may not be sustainable.

2.6 Conclusion to Chapter 2

In many developing countries where there are limited accesses to transferring risks, the severe weather shock can trap the rural households in the chronic poverty. Although there are demands for insurance products to cope with weather risks, the supply are limited due to the following reasons. Catastrophic risks are correlated and have high consequences—huge losses occur at the same time. The existence of asymmetric information between insurance companies and potential policy holder results in the higher transaction and administration costs. As a result, the higher premiums due to these reasons are not affordable for poor farmers in the developing countries.

Compared to traditional insurance products, the indemnity payment of index-based insurance is not individual basis. Rather, it depends on an index measured by the third party for proxy losses so that the individual losses are not verified. Therefore, the asymmetric information is not big impediment to develop agricultural insurance in the case of index-based standard. This simpler implementation procedure also reduces the administration and transaction costs, making premium much affordable. The alleviation of problems associated with traditional insurance creates the potential opportunity for index-based insurance to fill the gap between demands and supply for agricultural insurance products in developing countries.

CHAPTER 3
METHODS AND SURVEY INSTRUMENT

3.1 Methodology

This chapter introduces the research methodology describing how and why three survey techniques were used. The intent is to improve the reliability and objectivity of data collected. After describing these procedures, the background of Shandong is provided in terms of demographic, economic, and political information, as well as the agricultural sector and insurance industry. Based on this information, the surveyed cities were chosen according to the considerations of geography, crops and rainfall related natural disasters.

Focus groups were used to assemble from 7 to 10 farmers at one time. First, a Focus Group Discussion (FGD) was conducted with all of the farmers. This allowed for presentation of some of the new concepts that were being introduced and an opportunity for the group to interact and provide feedback on these ideas. After the FGD, an individual questionnaire was given to each of the participants. Finally, each participant was interviewed to provide clarification of any questions on the questionnaire. Thus, this project generally employs three survey instruments: Focus Group Discussion (FGD), the Questionnaire,[1] and the Individual Interview. Applying these three methods together should significantly improve the reliability and objectivity of the data. In the following subsections, each instrument is compared and explained in terms of its own advantages and disadvantages. Next, the discussion turns to how integrating these tools can strengthen their advantages and offset their disadvantages.

3.1.1 FOCUS GROUP DISCUSSION (FGD)

FGD is a qualitative research instrument used to collect information in the form of a group interview. A facilitator guides participants' discussion and instead of asking each person to respond to a question, participants are encouraged to talk to one another, exchange ideas, and ask questions of the researcher. Individual ideas as well as general points of view from the group are identified through discussions, agreements, and

[1] See Appendix A for a copy of the Questionnaire used in this project.

disagreements. This interactive process is particularly useful in understanding what individuals in the group think and, to some extent, why they think that way.

In the process of conducting an FGD, unexpected questions and concerns may be raised by participants that can help researchers rethink and modify their strategies. In addition, individuals who are not comfortable with reading and writing can equally participate in the discussion and respond to questions. Through group interaction, individuals can also explore and clarify their views in ways that would be less easily accessible in a one-on-one interview.

The disadvantages of FGD are first, individuals may not receive equal attention from researchers and some important points may be overlooked; second, the open-ended format can let the discussion wander off–track to unrelated topics; and finally, FGD is not the proper instrument to obtain quantitative data for statistical analyses.

3.1.2 THE QUESTIONNAIRE

Questionnaires are lists of research or survey questions designed to extract specific information from individual respondents. Questionnaires can be designed to gather either qualitative or quantitative data and its flexible nature provides the researcher with the opportunity to gather more information.

Questionnaires are also a less expensive way to reach more people, including people at some distance. Because it is not necessary for researchers to meet all respondents and assist them to finish the questions, both time and money can be saved. In addition, respondents can usually answer questions in a familiar or comfortable environment like their homes or workplace. The response quality can also be high because respondents may obtain the information needed to respond well.

Nonetheless, there are considerable disadvantages to developing and administering a valid questionnaire that properly assesses the issues important to the researcher. First, without the presence of the researchers, participants may not fully understand questions, especially when the questions require the respondent to have certain background knowledge. Participants are less likely to make the effort to answer all questions, and only answer those questions they understand. Therefore, the information gathered can be

biased and incomplete. Second, without proper controls, the questionnaire's validity is reliant on the honesty of the respondents, who may not give accurate information, e.g., income levels, when answering questions. More elaborate design and/or administration of a questionnaire can provide more objective data, but the costs of developing and administering such a questionnaire can be much higher and offset their economic advantage. Finally, the response rates from questionnaires can be quite low if a proper experimental design is not used.

3.1.3 The Individual Interview

In the Individual Interview, the researcher questions the respondent, typically face-to-face, or by telephone or computer-aided means, such as instant messaging. The researcher can give full attention and equal consideration to the individual participant. Moreover, the researcher can take more time to explain and target the questions to the individual participant and adjust the interviewing style to encourage the respondent's participation.

Individual interviews are both expensive and time-consuming to conduct, especially when the research requires a large number of participants. If more than one researcher is engaged in the research process, their different interviewing and questioning styles may bias the responses. Having too few interviewers, however, makes carrying out a large research project based on individual interviews more difficult.

3.1 4 How the Three Research Tools Were Applied in This Project

The methodology used in this project consists of two steps: First, farm households in 7 villages of Shandong Province in eastern China, a largely agricultural province, were chosen to participate in the FGD.[2] The farmers first discussed topics (introduced by the interviewer's questions) such as their risk concerns, livelihood strategies, and existing risk management and coping mechanisms. After getting the group to focus on their livelihoods strategies, the risk that impact their livelihood strategies, and the current systems of risk management and risk coping, the focused turned to new systems for addressing risk. Most importantly, the farmers were given basic ideas of index-based

[2] More details about Shandong and the villages are presented in Chapter 4.

weather insurance, and of index-based products bundled with agricultural inputs, and were then encouraged to give their responses. During this process, participants as a group exchanged their ideas, raised questions, and in the end demonstrated a basic understanding of the concept of index-based weather insurance.

Second, all participants were asked to fill out individual questionnaires that included many of the questions already discussed in the FGD. Participants were asked to answer these questions based on individual cases regardless of conclusions reached in the FGD. Participants with difficulty in reading or writing were assisted by the interviewer in the form of individual interview. The interviewer also asked the questions in different ways than they were written in the questionnaire to make the questions understandable to the individual. Also, the interviewer helped the participants record their responses in the questionnaire if they were having further difficulty due to their reading and writing skills.

The FGDs allowed the interviewer to identify new questions and concerns raised in the group discussions. The interviewer could then make some adjustments to how the topics were introduced and to focus on the issues of importance to the group, which varied slightly in the different locations. The results of individual questionnaires could then be compared with the group discussions. With a good understanding of index-based insurance, participants' responses regarding demand should be more reliable. The final instrument, the individual interview, was used to validate each participant's responses on the questionnaire, and also be used as a basis for future study.

The integration of these three research methods allows the research process to be more individually tailored. During the filling out of the questionnaires, interviewers gave more attentions to those participants who had difficulties reading and writing. This individually tailored design also limited the probabilities of ineffective answers resulting from the participants' misunderstanding of the questions.

3.2 Sampling Strategy

To avoid the probability that group discussions would be dominated by a few participants, whose opinions could mislead the discussion, or other unexpected situations, two participant groups were organized in each survey location. Ten survey locations were chosen, with 20 groups in total. To evaluate the differences in responses in the same

prefecture (city), two villages are chosen from the same prefecture. Because there were two discussion groups for each village, then there were 4 groups in each prefecture. In total, 12 group discussions were conducted in 3 cities. In another 4 cities, one village was chosen from each city, and therefore there were 8 discussion groups conducted in total among these 4 cities. Each group consists of 8 to 10 people who represented the following criteria:

- Poor, average, and better-farmers
- Big farmers and small farmers
- Male and female farmers (However, male farmers are preferred because in rural Shandong, males usually make the major decisions for a household.)
- Farmers with incomes solely from the agricultural sector and farmers with incomes from non-agricultural sectors
- Households with agricultural income from crops and livestock
- Farmers covered by subsided agricultural insurance are preferred

According to the above criteria, two pretests were made in two villages in Shandong before the formal research started in order to observe the effectiveness of questionnaires and questions in the FGDs. Based on the feedbacks from participants, further improvements were made so that questions were more understandable for farmers and suitable for local conditions in Shandong. In order to meet the criteria, participants in each village were selected by a person who was usually familiar with their economic and social backgrounds. Dr. Chen[3] contacted a resident in each village, usually his student's families or relatives, to organize the participants whose backgrounds met the criteria. By seeking more specific information about potential participants, the farmers selected by the organizers were more representative.

[3] The author gratefully acknowledges the assistance of Dr. Shengwei Chen, the associate professor in Shandong Agricultural University. Dr. Chen arranged all the logistics, organized the participants, and gave valuable suggestions on the final questionnaire design.

3.3 Background to Shandong Province

Lying on the East China seaboard where the Yellow River empties into the sea, Shandong Province forms a part of the large peninsula that constitutes the Bohai Bay economic region. Table 3.1 summarizes the economic, demographic, and geographic information of Shandong Province. Among 23 provinces in China, the GDP in Shandong ranks second and income per capita ranks seven. The population is above 93 million, only secondary to Henan province. Shandong's agricultural population exceeds the non-agricultural population. Also, Shandong is China's number one agricultural province

Table 3.1 Shandong Province, China, General Background

Capital	Jinan
Area	156,700 km²
Population (2006)	93,090,000 (ranked 2nd)
Population Density	592 /km² (ranked 5th)
Agricultural Population (percentage)	65
Nonagricultural Population (percentage)	35
GDP (2007)	CNY 2.59 trillion (ranked 2nd)
Income (per capita)	CNY 27,723 (ranked 7th)
Prefectures	17
Counties	140
Townships	1932

Data Source: Shandong Statistics Year Book 2006

3.3.1 The Political Hierarchy in China

In the context of political divisions of China, a *province* is the first level in the administrative hierarchy. The *prefecture* is the second level, and most cities are at the prefecture level. *Counties* are at the third level and *townships* the fourth level in the administrative hierarchy and thus, a township official is the lowest-level ranked official in the government hierarchy.

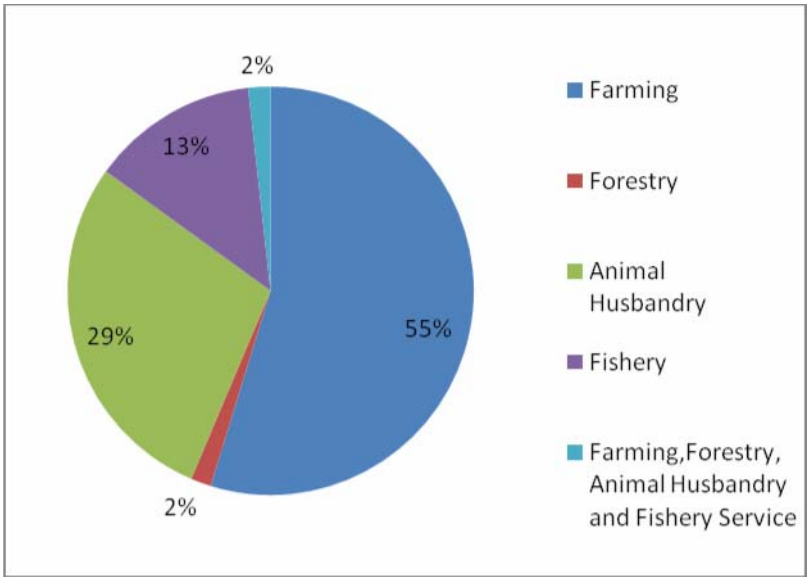
A lower level to this hierarchy system is the *village* level, although a village is not administrated under the formal hierarchical governance system. An understanding of this hierarchy is relevant when considering that this research was conducted at the village level, yet the villages were chosen at the prefecture level—in 7 of the 17 prefectures (cities) of Shandong. The population in each village varies from roughly 1400 to 2000. In

each village where the research was conducted, two groups participated in the research and as the two villages in the same prefecture (city) were not near to each other, we could expect differences in findings.

3.3.2 AGRICULTURE IN SHANDONG

The major activity of Shandong's agricultural sector is farming. Farming crops accounts for 55 percent of the gross output values in Shandong (See Figure 3.1). The second largest activity in the agricultural sector (29 percent) is animal husbandry. The services related to agriculture are only 2 percent of output value, which implies that there are few job opportunities related to agricultural services and that it would be difficult for farmers to get a part-time agricultural service job during the slack season.

Figure 3.1 Distribution of Gross Output Values of Agricultural Activities in 2006, Shandong Province



Data Source: Shandong Statistics Year Book 2006

Table 3.2 lists the six major crops of Shandong, and their national-level ranking in terms of output. Shandong ranks first among all provinces in China in the production of wheat, corn, vegetables, and fruit and is the second largest producer of peanuts and cotton, respectively.

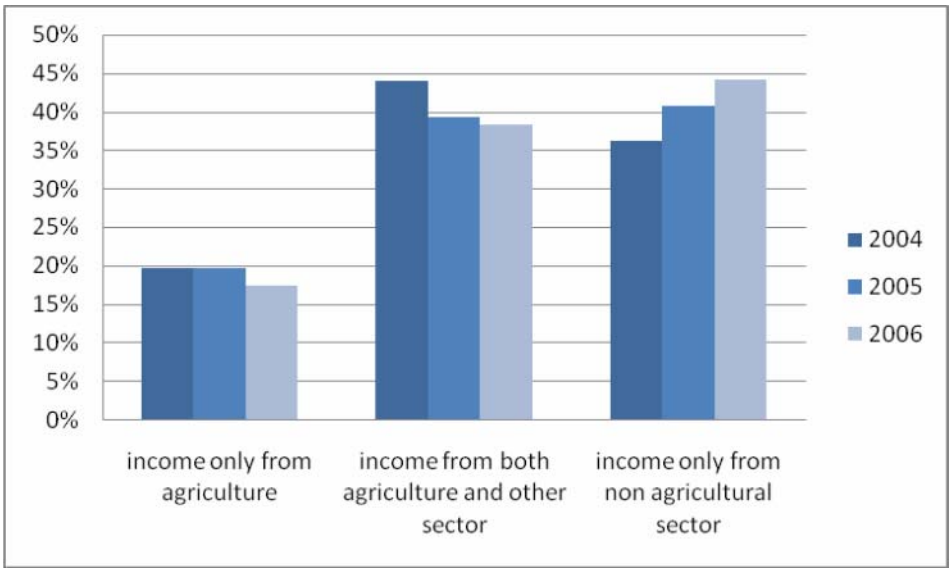
Table 3.2 Output and National-Level Rank of Six Major Crops, Shandong Province, 2005–2006

Crop	Rank at Nat'l Level	2005			2006			Total Output from 2005 to 2006 (%)
		Sown Area (ha)	Total Output (ton)	Output per Hectare (kg)	Sown Area (ha)	Total Output (ton)	Output per Hectare (kg)	
Wheat	1	3278667	18005349	5492	3354520	18897900	5634	5.0
Corn	1	2731440	17354081	6353	2753585	17612805	6396	1.5
Peanuts	2	884806	3598959	4068	857900	3550092	4138	-1.4
Cotton	2	846260	846300	1000	929753	1023100	1100	21
Vegetable	1	1847690	86069793	46582	1738186	83093182	47805	-4
Fruit	1	767903	12014767	15646	694492	12588158	18126	4.8

Data Source: Shandong Statistics Year Book 2006

The agricultural sector accounts for 65 percent of whole population; among this population, less than 20 percent rely completely on agriculture for their livelihood. More than 80 percent of these people have other non-agricultural sources of income. In 2004, both farm and off-farm employment was higher than employment in the non-agricultural sector. This changed in 2006 as a higher percentage of the population were employed in non-agricultural labor. Figure 3.2 shows the trend of increasing income from the non-agricultural sector and suggests that as they diversify their sources of income, agriculture is increasingly a less important source of income for the people living in these rural areas.

Figure 3.2 Income Distributions for Rural Households from 2004 to 2006, Shandong Province

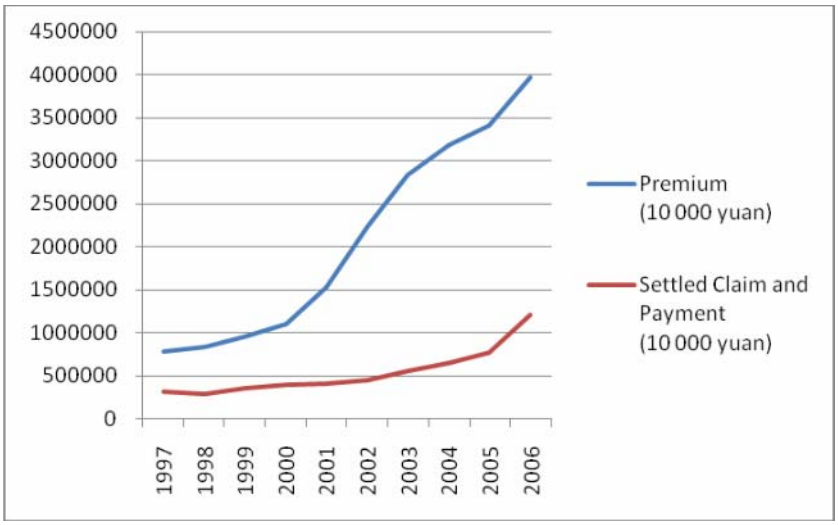


Data Source: Shandong Statistics Year Book 2006

3.3.3 Background on Insurance in Shandong Province

The insurance industry in Shandong Province has grown rapidly since 1999 and as shown in Figure 3.3, aggregate premiums increased significantly. However, from 1999 to 2006, the gap widens between premiums and payments. Table 3.3 itemizes the major insurance products and their aggregate premiums and payouts in 2006 and shows life insurance comprising the largest proportion of premium, followed by property insurance. The premiums collected for agricultural insurance is the lowest number for the identified insurance products sold in 2006.

Figure 3.3 Aggregate Premiums and Payments for Insurance, Shandong Province



Data Source: Shandong Statistics Year Book 2006

Table 3.3 Major Insurance Products, Premiums and Payments, Shandong Province, 2006

Category	Premiums	Payments	Loss Ratio
	(CNY 10,000)		Payments/Premiums
Life Insurance	2900116	523048	0.18
Property Insurance	1062087	686030	0.65
Motor Vehicle and Third Party Liability	865013	533728	0.62
Enterprise Property Insurance	101132	83527	0.83
Accident Injury Insurance	35290	16728	0.47
Freight Transport Insurance	22783	9863	0.43
Liability Insurance	20256	10014	0.49
Ship Insurance	19492	11992	0.62
Family Property Insurance	9384	2382	0.25
Credit Insurance	9308	2293	0.25
Guarantee Insurance	6238	27924	4.48
Special Insurance[4]	3753	182	0.05
Project Insurance	3451	2557	0.74
Health Insurance	3282	1516	0.46
Agriculture Insurance	723	375	0.52
Other Property Insurance	548	1185	2.16

Data Source: Shandong Statistics Year Book 2006

[4]These are over-the-counter products for special or industry-specific risk (e.g., the operations of satellites) that are high-risk products and require insurance companies have a good degree of knowledge about the insured and thus, the premiums are usually very high.

3.4 Survey Locations Chosen in Shandong Province

Locations were selected based on characteristics of crop, geography, and rainfall-related natural disasters (See Table 3.5). Locations chosen based on areas where wheat, cotton, corn, peanut and fruits are the dominant crops. Since most vegetable crops in Shandong are grown in greenhouses, a weather index based on rainfall is not an appropriate standard to measure loss for these crops, and therefore those locations that have vegetables as the dominant crop were not considered.

Table 3.5 Seven Cities in Shandong Province Selected as Survey Locations

City and Location	Total Population	Land Area (sq.km)	Income per capita (CNY)	Average Annual Rainfall 2000–2006 (mm)	Major Crops and Rank at the Provincial Level		Number of Surveyed Villages	Number of Surveyed Groups
Dezhou (NW)	37.5	748	3704	470	Cotton Wheat Corn	2 2 1	1	2
Liaocheng (W)	73.2	960	3359	521	Corn	3	1	2
Binzhou (N)	63.1	1357	3692	539	Cotton	3	1	2
Heze (SW)	149.7	1969	2936	665	Wheat Cotton	1 1	2	4
Taian (Central)	136.2	1933	4205	731	No Dominant Crop	N/A	1	2
Linyi (S)	118.9	1800	3584	858	Peanut	1	2	4
Yantai (E)	62.8	2016	5640	577	Fruit	1	2	4

Data Source: Shandong Statistics Year Book 2006

Similarly, it was required that the survey sites to be in different geographic regions of Shandong to represent geographical differences. Because index-weather insurance designed for this research is against water-related shocks, average annual rainfall was chosen as a crude approximation in estimating the type of natural disaster in corresponding locations.

As previously discussed, weather shocks do not only affect farm income, but also other livelihood strategies. Assessing the demand for index-based weather insurance from people whose incomes are mainly from non-agricultural sectors would also be helpful in

discovering another potential market for index-based weather insurance where household decision makers may recognize that adverse weather affects many crops at the same time or also may affect other livelihood strategies. Taian, which has no dominant crops, may provide some limited insights on this issue. The core selection involved 7 prefectures or cities where villages within those prefectures were then selected. Of the 7 prefectures, Heze, Linyi, and Taitai included two villages each for a total sample of villages that equaled 6. Given that two groups were interviewed in each location, there were 12 groups interviewed in these three villages. In the other four prefectures, only one village was selected and a total of 8 groups were interviewed.

3.5 Conclusion to Chapter 3

The integration of FGD, questionnaires and individual interview distinguishes is a unique approach to collecting data and a contribution of this study. This should significantly improve the reliability of the data. The background information suggests that as rural households have been increasingly diversifying their sources of income, agriculture is becoming less important as a source of income. Still, agriculture remains a dominate activity in Shandong and there are significant weather risk. Thus, despite the finding that agricultural insurance ranks at the bottom in terms of specified insurance products, there should be a demand for properly designed agricultural insurance as a means for risk management for rural households in Shandong province. The next chapter provides the detailed results from these surveys and addresses the potential of agricultural insurance in more detail.

CHAPTER 4
RESULTS FROM THE FOCUS GROUPS AND QUESTIONNAIRE

4.1 Background Summary of Research Participants

The demand assessment for this project consists of a summary of the results from both the focus group discussions and questionnaires in the form of a descriptive narrative that addresses the questions raised in Chapter 1 with regard to livelihood strategies, major weather shocks, risking coping and management strategies, and summarizing the responses to interest in an index-based insurance product as well as demand for other insurance products.

The activities of this project—conducting focus group discussions, administering questionnaires, and interviewing individuals—involved the participation of 174 people from 10 village-level locations in 7 prefectures (See Table 4.1)[5]. A majority of the participants are the financial decision makers for their households, and most of them have more than 7 years' education and 14–29 years of farming experience.

Among the participants, 76 percent are male. Except for Liaocheng Prefecture and one location in Heze Prefecture, each group has more male than female participants, which implies that these males, who are the predominant laborer in the household, were not engaged in agricultural activities in their villages, at least during May when the interviews were conducted. They may migrate to towns or cities for full-time work, or have temporary part-time jobs near their villages, which would result in less male participation.

The population in each village represented by the participants ranges from 1,200 to 3,000. It is not surprising that Heze, the prefecture with the densest population in Shandong, has the largest average number of family members and accordingly, has the smallest average number of farm parcels per person among all the research sites.

[5] The initial number of participants was 176. Two questionnaires were omitted since the interviewer determined the questionnaires of two participants to be least likely reliable.

Table 4.1 Background Summary of Participants in Each Research Village Site

Village and Prefecture	Number of Participants	Number of Males	Averages					
			Age	Years of Education	Years of Farming	Family Members	Household Farm Parcels	Farm Parcels per Person
Laozhao Zhuang (Liaocheng)	17	8	40	7	18	4.2	6	1.4
Guanzhuang Cun (Dezhou)	19	10	46	9	23	4	9	2.3
Zhangyi Cun (Binzhou)	17	13	47	9	22	4.1	11	2.7
Jinzhuang (Heze)	16	6	48	6.	26	4.4	4	1
Duzhuang Cun (Heze)	19	15	48	8	21	4.8	7	1.4
Yanzi Guan Zhuang (Linyi)	15	15	35	7	14	3.5	5	1.3
Tanglin Cun (Linyi)	18	15	44	9	24	4.1	7	1.8
Chengjia Zhuang (Yantai)	18	17	43	9	20	3.2	50	15.6
Zhaili Cun (Yantai)	18	17	48	9	27	3.3	5	1.4
Yangti Cun (Taian)	17	16	51	8	29	3.7	5	1.4

Source: Author

Local farmland distribution policy varies in each village. Historically, rural residents have land use rights rather than ownership. Farmland was distributed according to the number of people in each household residing in the village. Based on this principle, because household occupancy can change in a relatively short period of time as the result of births, deaths, and marriages, the frequent changes as to who has the land use rights restrict long-term investment and consequently limit rural economic growth.

In 1998, a 30-year land use policy law was adopted, the Land Management Law (LML), with the idea that 30 years of land use is a sufficient amount of time for farmers to make long-term investments. However, the LML has not been administered in all regions. For example, the two villages in Heze prefecture that took part in the research, Jinzhuang and Duzhuang Cun, have different land rights distribution policies. In Jinzhuang, farmland has not been redistributed since 1996. By contrast, the village committee of Duzhuang Cun redistributes land use every year, based on changes in population, on Mid-Autumn

Day (the 15th day of the 8th lunar month of the Chinese calendar, mid- or late September). Therefore, in Shandong, the number people in a household may not be a good indicator of the number of their farms parcels.

4.2 Livelihood Strategies and Household Income: Perspectives from Focus Group Discussions

Increasingly, the percentage of income from agriculture accounts less for the farming households' overall income in the research sites. These rural households grow wheat and corn primarily for their families' consumption and sell the surplus. Except for households farming large parcels, the ordinary rural household does not rely on wheat and corn for their income. In addition, farming is not the only economic activity in most of the research sites. Almost every group reported that an income only from agriculture was not sufficient for their families' expenses, and these households employ many strategies to diversify their income.

4.2.1 Agricultural Income

Agricultural income may be the major source of income if households grow higher-return crops such as vegetable, cotton, garlic, or fruits, rather than wheat and corn. Because the cost of self-consumption is too high, almost all respondents said that rather than consuming their vegetable, cotton, garlic, or fruit crops, they either buy cheaper vegetables or eat the inferior ones they grow.

To some degree, the decision of which crop is grown determines the income source of a family. Three factors contribute to how a participant's household decides which crops to grow. The primary factor is tradition—some participants said that most often they grow crops their neighbors grow, or crops they themselves are accustomed to growing. They are unlikely to change to another crop, even if they have suffered loss as a result of the past few years of weather or market shocks. The second factor is that households are limited in their choice of what crop they can grow by local environmental conditions of water, soil, and temperature. The third factor, the household's distribution of labor, also has an impact on the type of crops that households decide to grow. If most family members work in cities or participate in other non-agricultural casual (part time, seasonal, or temporary) work, the household is more likely to grow the less time consuming crops,

wheat and corn. By contrast, if all family members can participate in farming, they are more likely to grow the more time consuming crops that have higher economic returns.

Some participants indicated their households raise livestock as another source of income. Rural households raise poultry and pigs as a method of saving rather than consumption. As with consuming their crops, the participants regard the costs of consuming their livestock are too high and so they sell their livestock when the market price is good or more cash is needed.

4.2.2 Non-Agricultural Income

Casual work is a significant source of income in the research sites, and most casual work is not related to agriculture. Many household members migrate to towns or cities and work as masons, porters, carpenters, and construction workers and their incomes are usually higher than what they could earn from farming, with daily wages ranging from CNY 30 to CNY 60 (approximated USD 4–8). (Rather than on a daily basis, wages for hired farm laborers are paid based on the work done, for example, cotton farmer pay laborers based on the number of kilograms of cotton picked.) They may return home during planting and harvesting times. The time of their stay (3–8 months) depends on their crop types—if wheat and corn are their dominant crops, they can spend more time working off-farm, if they grow cotton, vegetables, fruit trees, they are less likely to work off-farm for long stretches of time.

In rural Shandong, there are only few part-time job opportunities related to agriculture. First, household parcels are usually small enough to be fully managed by its family members. Households with large farms or who have less family members involved in farming may need to hire laborers during the farming season. But households with large parcels or with small parcels but not enough family members to manage them only account for a small percentage of households in rural Shandong. Second, traditionally, it is uncommon to charge money for assisting other households in one’s village with their farming activities. Mutual aid is usually freely given to others in the village during the farming seasons. Finally, the time periods that one can labor, assisting with planting, harvesting, and other farming activities, are much shorter than those of non-agricultural jobs and the potential income is much lower.

Males are more active than females in pursuing casual work in rural Shandong, because most of these jobs (e.g., carpentry) require more physical strength than activities related to farming. It is not uncommon to observe only females and/or the elderly doing the farming. For example, an 83-year-old man and woman working on their farm near one of our interview sites indicated that all of their family members work in other places with a better income than they would make growing crops. “Farming is not hard and we do the easiest work,” they said.

Unlike rural casual laborers, both females and males from the rural areas take full time jobs in towns or cities, but most of them are young people. In general, young people working in towns or cities contribute less income than rural casual laborers because, traditionally, as unmarried young people are considered dependent children they are not responsible for their families’ income. In addition, living expenses are much higher in big towns and cities, making the ability to save money much more difficult. Higher living expenses also result in another phenomenon: a majority of these young people will quit their city jobs and return to their village after they are married. Some of the young participants, who spent over a year working away from home, indicated that the opportunities for employment in big cities are few, and low-rent living conditions are much worse than at home. Employment in big towns and cities for young people from rural areas does not seem to be a practical long-term undertaking, especially for those lacking the education required for jobs offered in cities.

4.3 Livelihood Strategies and Household Income: Perspectives from the Individual Questionnaires

The most significant sources of income vary across the ten villages. Although 53 percent of respondents of the questionnaire indicate that their agricultural income is still more than income from non-agricultural work, more and more farm households are diversifying their livelihood strategies.

4.3.1 Agricultural and Non Agricultural Income

Wheat, corn, cotton, and fruits are the dominant crops grown in Shandong (see Table 4.2). However, these crops are rarely the major source of the household income, as indicated by respondents to the questionnaire. Only 8 out of 174 respondents (5 percent) who

grown wheat and corn, 10.34 percent who grow cotton, and 13.79 percent who grow fruits indicate that these crops account for more than 75 percent of their income. These results are consistent with responses obtained from the focus group discussions.

Livestock is another source of income for respondents, with 31 percent of these households raising livestock. Income from livestock accounts for only small proportion of these rural households as only 3% of respondents indicate that more than 75 percent of their income is from raising livestock.

Table 4.2 Dominant Crops of Each Research Village Site[6]

Village and Prefecture	Most Important Crop		2nd Most Important Crop		3rd Most Important Crop	
	Crop	Percentage (%)	Crop	Percentage (%)	Crop	Percentage (%)
Laozhao Zhuang—(Liaocheng)	Corn and wheat	45	Cotton	45	Vegetable	10
Guanzhuang Cun—(Dezhou)	Cotton	74	Corn and wheat	26	Fruit tree	2
Zhangyi Cun—(BinZhou)	Cotton	59	Corn and wheat	40	Fruit tree	1
Jinzhuang—(Heze)	Corn and wheat	73	Vegetable	16	Cotton	5
Duzhuang Cun—(Heze)	Corn and wheat	85	Cotton	13	Vegetable	4
Yanzi Guan Zhuang—(Linyi)	Garlic and garlic sprouts	99	Corn	89	Peanuts or soybeans	12
Tanglin Cun—(Linyi)	Corn and wheat	51	Peanuts or soybeans	28	Cotton	10
Chengjia Zhuang—(Yantai)	Corn and wheat	52	Peanuts or soybeans	37	Fruit tree	11
Zhaili Cun—(Yantai)	Fruit tree	67	Peanuts or soybeans	28	Corn and wheat	4
Yangti Cun—(Taian)	Fruit tree	74	Corn and wheat	16	Peanuts or soybeans	8

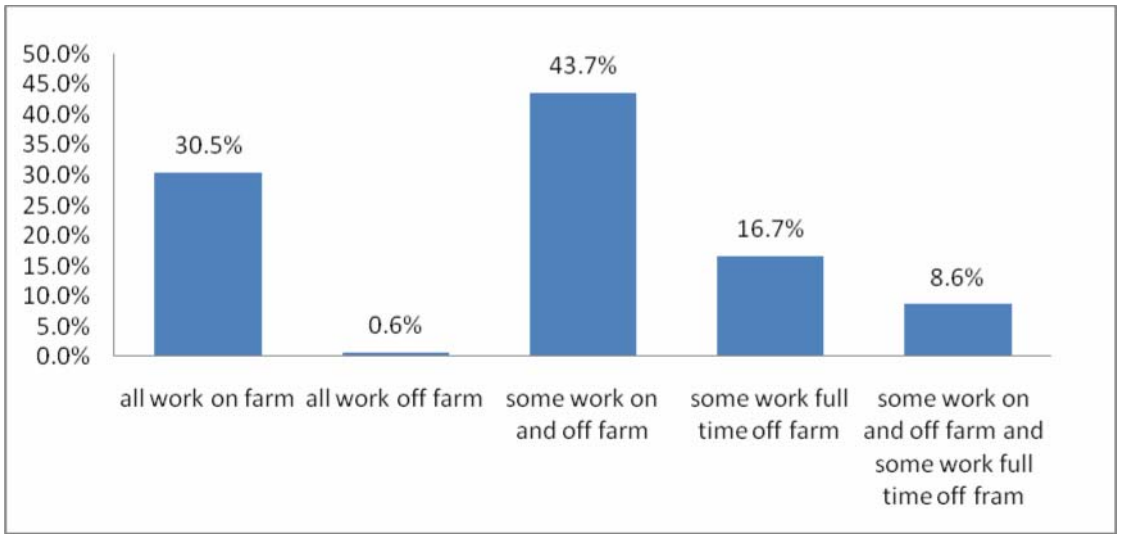
Source: Author

As Figure 4.1 presents, 30 percent of respondents to the questionnaire indicate that all household members work exclusively on-farm, 44 percent indicate that some members of their household work on-farm and also have off-farm employment, 17 percent of

[6] More than one crop may be grown on the same parcel in a year, therefore the sum of the percentages of the 3 crop groups may be greater than 100

respondents indicate that some members of their household have full-time non agricultural jobs, and 9 percent indicate that all members of their household have either full- or part-time off-farm employment.

Figure 4.1 Work Activities of Households Participating in the Research

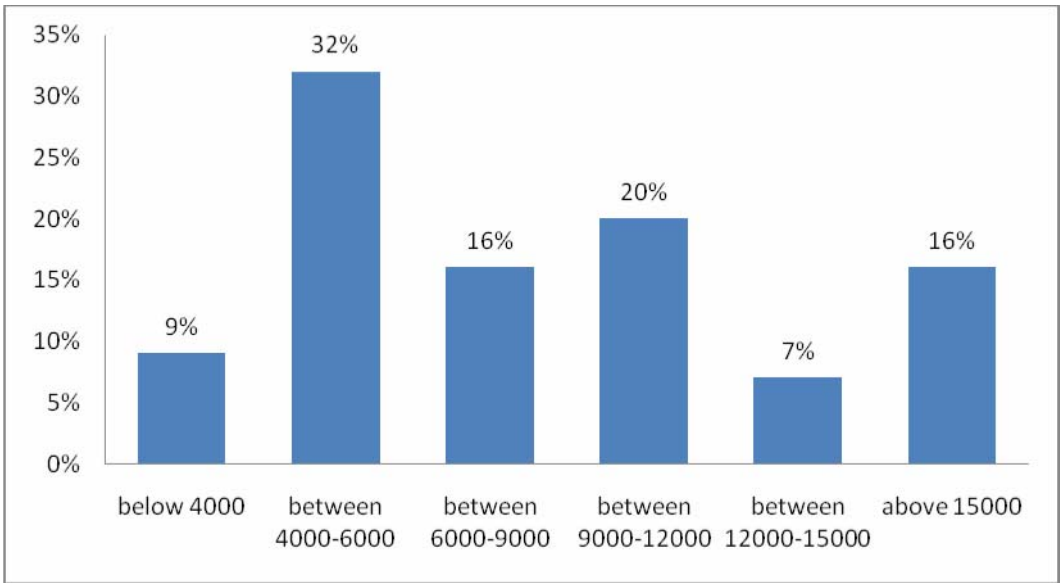


Source: Author

4.3.2 HOUSEHOLD ANNUAL NET INCOME

Household income is an important measure of a rural households' economic status. The information obtained in the questionnaires indicates that in general no income range is predominant across the research sites. Figure 4.2 shows the annual net household income ranges between CNY 4000 and CNY 6000 for 32 percent of respondents, 16 percent of families have more than CNY 15000 of annual net income, and less than 9 percent of households have annual net incomes lower than CNY 4000. This suggests that there are more households who are better-off than households who are not, and that even those households with annual net incomes lower than CNY 4000 do not experience starvation.

Figure 4.2 Annual Net Household Income Range of Research Participants



Source: Author

The income per person is the weighted average of the median in each income range indicated by the participants. In Table 4.3, the differences of income per person among all the research sites are significant. In Yantai, income per person is more than twice as much as Heze, the poorest district in Shandong. It is obvious that the income averages that are the results of the questionnaire are significantly lower than what are given as the official data. On average, the income data obtained from the questionnaires are 38 percent lower than incomes reported in the official data source. However, both data sources result in similar rankings for poor and better-off households. For example, official data indicate that Yantai is the wealthiest location and Heze is poorest one, which, as noted above, is consistent with data obtained by this research.

Table 4.3 Ratio of Difference between Data Obtained from the Questionnaires and Official Data for the Average Income in the Seven Prefectures

Location	Liaocheng	Dezhou	BinZhou	Heze	Linyi	Yantai	Taian
Questionnaire Data (CNY)	2397	1787	2950	1583	1945	3952	2397
Official Data (CNY)	3359	3704	3692	2936	3584	5640	4205
Difference Ratio[7] (%)	29	52	20	46	46	30	43

Source: Author; Source of Official Data: Shandong Statistics Yearbook 2006, publication year: 2007

4.4 Risks Faced by Agricultural Households in the Research Sites

Households participating in this research face a variety of risks stemming from weather, agricultural or animal husbandry activities, and economic stresses from price changes in the market or the poor quality of agricultural inputs, and stresses as a result of life-cycle events such as illness or the death of a family member. The following sections discuss findings with a focus on the risks of rural households in Shandong.

4.4.1 Risks from Weather and Pests

Farmers in the Shandong research sites are subject to many naturally occurring risks due to adverse weather and pests, which can damage or destroy not only their crops, but also their rural economy. In this section we discuss the effects of the seven most severe shocks identified by the farmers in both the focus group discussions and the questionnaires (see Table 4.4). To give more insight to the discussion, we present the months when each of these shocks are likely to occur (see Table 4.5) and the summary findings of the focus group discussions and questionnaires along with the participants' overall ranking of the affects of these shocks.

[7] Difference Ratio = (Official Number – Questionnaire Number) / Official Number

Table 4.4 Risks from Weather and Pests Experienced in the Research Locations Ranked by Severity[8]

Type of Risk	Laozhao Zhuang—Liaocheng	Guanzhuang Cun—Dezhou	Zhangyi Cun—Binzhou	Jinzhuang—Heze	Duzhuang Cun—Heze	Yanzi Guan Zhuang—Linyi	Tanglin Cun—Linyi	Chengjia Zhuang—Yantai	Zhaili Cun—Yantai	Yangti Cun—Taian
Drought	2	1	1	1	3	2	1	1	5	1
Flood	5	6	5	5	6	1	3	6	6	4
Excess Rain	4	4	4	3	2	3	4	5	6	6
Hail	7	3	3	2	4	5	6	2	2	2
Freeze	5	7	7	7	7	7	7	4	1	5
Strong Wind	1	5	6	4	1	4	5	3	3	3
Insect Pests	3	2	2	6	5	6	2	6	4	6

Source: Author

Table 4.5 Ranking of Importance for the of Major Important Months for Weather Shocks

Type of Risk	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Drought	8	7	2	1	3	4	5	6	9	10	10	NA
Flood	NA	NA	NA	NA	NA	3	1	2	NA	NA	NA	NA
Excess Rain	NA	NA	NA	NA	NA	2	1	2	NA	NA	NA	NA
Hail	NA	NA	NA	4	3	1	1	4	NA	NA	NA	NA
Freeze	NA	NA	2	1	3	NA	NA	NA	NA	NA	NA	NA
Strong Wind	NA	NA	6	4	3	5	1	1	6	NA	NA	NA
Insect Pests	NA	NA	NA	NA	NA	2	1	3	3	NA	NA	NA

Source: Author

[8] In Table 4.4, the number (1) is the ranking for the most severe and in Table 4.5, the month most likely to occur.

4.4.1.1 Drought and Its Impact

Perspectives from Focus Group Discussions. Most of the groups ranked drought as either their first or second weather concern. Participants said if a drought strikes, crop yield can be reduced by 50 percent to 70 percent on average. Drought has more impact on wheat and corn than the other cash crops in all interview locations. Wheat is mainly affected by the "spring drought," which usually occurs in the March–May period. The drought that impacts the corn yield is known as "fall drought," and usually takes place in the June–August period.

Although drought is the most frequent weather shock to occur, in some districts, it may not be the weather risk of primary concern because some villages have irrigation systems that can greatly alleviate the impact of drought on their crops. Therefore, although some villages experience drought almost every year, their crop yields may not be reduced by drought. Most participants, however, indicate that the need for a water pump to offset drought increases their production costs.

Drought is of little concern for those households who raise poultry as only a few households are large producers and the households who raise a few chickens are hardly concerned about the impact of weather risks on their poultry. Moreover, the lack of water almost has no impact on rural households' other off-farm income because most of that casual work is not related to agricultural activities. Since rural households in Shandong diversify their livelihood strategies, droughts are only of concern for growing crops and have less impact on their lives than in places where people rely more heavily on farming as the primary source of their income.

Perspectives from Individual Questionnaires. Farm households in six locations ranked drought as their primary weather risk, and in two research locations, drought was ranked as the second weather risk of most concern. The average of the ranking for drought (see Table 4.4) is 1.8, the highest ranking among all the other risks, indicating drought is the primary weather risk in Shandong.

Weather concerns can vary greatly among villages within the same prefecture. For example, drought is ranked as the major weather shock for Chengjia Zhuang, one of two of the villages in Yantai prefecture that participated in the research. However in second

village, drought is only ranked fifth. A similar case occurs in Heze, where one place ranked drought as the first concern while in another place it was ranked third.

The results also suggest that the spring drought (March–May period) that primarily affects their wheat crops is more worrisome to respondents than the fall drought (June–August period), which affects the corn crops, and thus, participants are more concerned with the impacts of drought on wheat than corn.

4.4.1.2 Strong Wind and Its Impact

Perspectives from Focus Group Discussions. Strong wind mainly affects tall plants, such as corn, and fruit trees. Serious strong wind can destroy corn stalks during the harvesting seasons, causing 100 percent loss of corn yields. Therefore strong wind occurring in the corn harvest period is of most concern to farmers growing corn. Fruit growers are concerned with strong wind because it can blow off ripening fruits. Strong wind in May can also have a negative impact on wheat, as this is the time in its growing season when wheat is tallest. In some research sites, losses from strong wind occur almost every year. There is no efficient method for farmers to cope with strong wind after it strikes, as most respondents noted, "Unlike drought, whose impact can be alleviated by the water pump, we can do nothing about strong wind."

Perspectives from Individual Questionnaires. Strong wind ranked as the first weather risk in Liaocheng prefecture and in one village, Duzhuang Cun in Heze prefecture (see Table 4.4). The average of the rankings is 3.5, secondary to drought among all districts, though its standard of deviation of ranking is 1.64, which is higher than most of the other weather risks. The high standard of deviation indicates that in some places, strong wind can either be the primary concern or as important as drought. Important months for strong wind are May, July, August. May and August are harvest seasons for wheat and corn, respectively.

4.4.1.3 Excess Rain and Its Impact

Perspectives from Focus Group Discussions. Excess rain falling from June through August can cause considerable damage to the fall crops. Compared to other locations, Heze and Linyi prefectures, in the southern part of Shandong, are more vulnerable to

excess rain. Duzhuang Cun, in Heze, where participants ranked excess rain second to strong wind as the weather risks of most concern, experienced excess rain in both 2004 and 2005, which resulted in crop loss of, on average, more than 60 percent Participants reported that even the most severe occurrence of excess rain may not be completely responsible for the devastation to their crops, since the lack of drainage systems in these places makes it very difficult to pump the excess water out of the fields, thereby reduce damages and losses.

Perspectives from Individual Questionnaires. Excess rain is not of primary concern in all locations. Its average ranking among the 7 weather risks is 4.1, with the smallest standard of deviation at 1.28. The small deviation number implies that participants in all research locations have assigned a similar ranking status for this weather risk. Summer is the rainy season in southern Shandong, which is corroborated by the questionnaire responses that June, July, and August are the months in which excess rain is most likely to occur.

4.4.1.4 Hail and Its Impact

Perspectives from Focus Group Discussions. Cotton and fruit tree growers express the most concern about hail, as like other weather risks, hail can decrease their crop yields. An important negative impact is that hail blemishes the fruit, which greatly reduces its market value, even if the quality of the taste is not affected. In addition, hail is usually accompanied by heavy rain, worsening the effects of the hail.

Perspectives from Individual Questionnaires. Respondents from four villages (Jinzhuang in Heze; Chengjia Zhuang and Zhaili Cun in Yantai; and Yangti Cun in Taian) report hail as the weather risk of second most concern. The later three villages mainly grow fruit trees, and cotton is the dominant crop in Jinzhuang.

Overall, hail is ranked third of most concern among the 7 weather risks, with an average ranking of 3.6. However, the standard deviation is 1.8, so just as with excess rain, respondents from some locations consider hail an important weather shock, but not one of too much concern. Hail is most likely to occur in June and July, which overlaps the time period that excess rain is likely to occur.

4.4.1.5 Freeze and Its Impact

Perspectives from Focus Group Discussions. Freeze is the major weather risk for fruit growers. One participating village in Yantai had a severe freeze in 2003, with nearly 100 percent crop loss. A majority of the growers in Yantai had no income from fruits in that year. The participants from this village, who experienced the 2003 freeze, believe that freeze is the main weather shock that can negatively affect their income. Except for this village, freeze is the weather risk of the least concern for most participants in the other research sites.

Perspectives from Individual Questionnaires. The ranking standard of deviation for freeze is as high as 2, the highest of all 7 risks, whereas the average of all the ranks is 5.4, the lowest level of importance because freeze is the primary weather shock in only one place, and of least concern in the other six locations. Freeze is most likely to happen from March to May. According to respondents, April is most critical month for freeze as all the freezes of the last 5 years took place at the end of April.

4.4.1.6 Flood and Its Impact

Perspectives from Focus Group Discussions. Except for the one village of Yanzi Guan Zhuang in Linyi prefecture, most of research sites never experience flood. The southern regions of Shandong are more vulnerable to excessive rainfall, which can wipe out low-growing crops such as cotton and peanut. A severe flood can result in a household losing their entire harvest. The outcome of the flood in Linyi was not total devastation, but increased costs due to replanting, refertilizing, and respraying pesticides. Most households in Yanzi Guan Zhuang lost nearly 50 percent of their crops.

Perspectives from Individual Questionnaires. Responses corroborate the information obtained in the group discussions that flood is the risk of most concern in one village location of Linyi and rarely is of concern for participants from the other research locations. Even respondents from the 2 villages in Heze, where annual rainfall is highest in Shandong, ranked flood as the fifth or sixth weather risk of most concern. Like excess rain, flooding usually occurs from June through August.

4.4.1.7 Insect Pests and Their Impact

*Perspectives from Focus Group Discussion*s. Insect infestations are a serious production risk, especially for cotton, in all research sites. The seriousness of this risk for farmers depends on whether cotton is the dominant crop. Some groups report that insect pests are the primary reason for low cotton yield. There has been an obvious trend of increasing pesticide use to alleviate the impact of insect pests. Farmers report that the risk of insects is increasing every year as insects become more resistant to insecticides.

Perspectives from Individual Questionnaires. The importance of this risk to respondents varies from region to region as demonstrated by the fact that farmers ranked it from the second to sixth most significant agricultural risk. Cotton is the dominant crops for all three sites where the risk from insect pests was ranked second as the weather risk of most concern. The average of the 7 ranks of this risk is 4.2 and indicates that insect infestations are not important for crops other than cotton.

4.4.2 Summary Findings of Weather and Pests Risks

In summary, water-related weather risks are the most significant natural disasters in research regions. As shown in Table 4.6, 56 percent of respondents believe that drought is the weather risk of most concern in their locations. Both flood and excess rain account for another 5 percent, but excess rain ranked first in the category of the second weather shock of most concern.

Along with water-related shocks, strong wind is another important risk that 14 percent of participants ranked as their first concern. Roughly 60 percent of respondents list it in their 3 weather risks of most concern, and only second to drought.

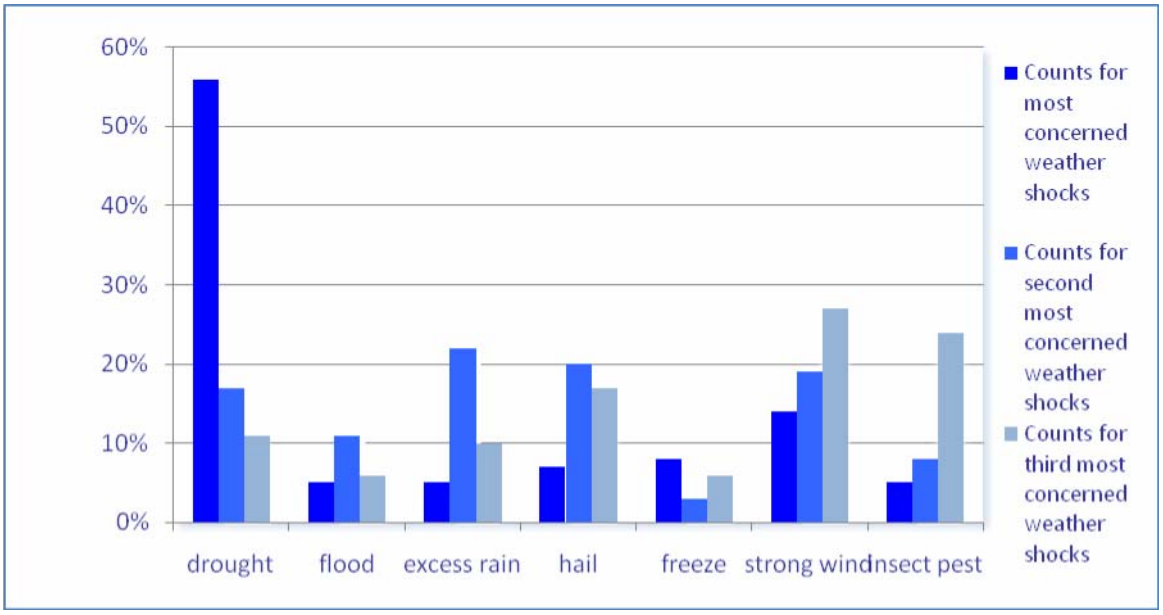
Other risks are important for specific crops. For example, freeze is particularly important for fruit trees, and insect pests have a severe impact on cotton, although these risks may not be the contributory factor in the low yield of other crops.

Table 4.6 Overall Ranking of Weather Shocks of Most Concern to Participants

	Most Concern	2nd Most Concern	3rd Most Concern
Weather shocks		(%)	
Drought	56	17	11
Flood	5	11	6
Excess Rain	5	22	10
Hail	7	20	17
Freeze	8	3	6
Strong Wind	14	19	27
Insect Pests	5	8	24

Source: Author

Figure 4.3 Percentages of Weather Shocks of Most Concern to Participants



Source: Author

4.4.3 Other Risks Related to Agriculture

In the following subsections describes the risks that farmers in Shandong face beside weather risks.

4.4.3.1 Livestock Risks

The most common husbandry activities in the research villages are small-scale pig and poultry breeding. Intensive, large-scale livestock breeding is uncommon. On average, there are 3 or 4 households in each participating village raising more than one thousand

chickens. Disease is the largest risk facing livestock production, especially intensive production. Some participating farm households shared painful experiences of their animals sickening and dying. Intensive chicken breeding is subject to numerous diseases. As soon as they realize the potential of an epidemic, some farmers sell their chickens, which results in a high level of economic stress. In addition, some large livestock, like cows and pigs, are easily stolen in rural places, which is another big risk for breeders.

4.4.3.2 Price Risk

High input prices increase production costs and every research group complained that the increasing price of fertilizer is making farming less profitable, "Sometimes the money spent on fertilizer is higher than the return from crops. The worst thing is that the price of fertilizer can vary greatly during the year. You never know when the best time to buy it is." Another risk is a highly volatile market price. The price for garlic in 2006 was the only a tenth of what it was in 2005. In 2006, farmers whose dominant crop is garlic experienced major losses even though they had a great harvest. If price volatility affects their major crops, it is difficult for farmers in a short period of time to alter their crop planning. As we observed during the time of the research, participating farmers were still growing garlic that year regardless of its potential low market price.

4.4.3.3 Fake Seeds

Farm households in the research sites normally purchase cotton and corn seed and are unlikely to buy wheat seed, therefore the problem of purchasing fake seeds worries cotton and corn farmers more than other farmers. Some participating households report that crop yield loss can be up to 70 percent due to inferior seeds. As a result, farmers usually buy more than one brand of seed. A big farmer said that he once bought 8 different corn seeds to avoid the likelihood of fake seed. "It is always a big decision for our families of which brand of seed will be purchased every year." Their purchase decisions are based on past experience, other people's recommendations, and some advertisements. Most participants said that price was not a consideration when they buy seed and that they would be willing to pay higher prices for guaranteed, high-quality seed.

4.4.3.4 Life-Cycle Risks

Illness of a Family Member. The economic shock to a rural household can be severe if a family member has a serious illness or accident. The most obvious financial impact is the cost of treatment, especially when a surgery or hospitalization is required. Farmers report that common illnesses can be treated at local medical centers for little cost. More serious illness, however, must be treated at hospitals at the provincial level or further distances. Many households cannot afford high treatment costs in addition to other costs such as transportation and living expenses. Moreover, serious illness can result in a loss of labor for farm production activities, reducing a family's income as expenses increase.

Home Building. Unlike unexpected illness, building a new house is a planed event and one of the most important investments in a family's life cycle, which may require many years of saving. In rural places, building a house usually coincides with marriage. Parents in rural places are responsible for offering to pay to build a house for their sons, when they marry. Some families began to save as early as the birth of a son. But even these long-term savings are usually insufficient and farmers must borrow from relatives, friends, and neighbors.

Marriages of Children and Funerals of Parents. Weddings are organized by the parents of the bride and groom. As previously explained, the groom's family is usually responsible for the cost of building the couple's new house and for the betrothal gift to bride's family, which is considerable. Hosting a wedding reception is another big expense. However, the cost of a reception can be compensated for with "red envelopes" from relatives, friends, and neighbors. The amount of some generous red envelopes can actually be higher than the cost of hosting a wedding.

Funerals are stressful emotionally and financially. Children share the obligation to pay for the funeral expenses of their parents. As with weddings, bereaved families can also receive generous financial support from others. Every family keeps a record of the giver and amount of money received during wedding and funeral events and may reciprocate with a red envelope of the same amount of money. So the custom of the red envelope might actually be considered an interest-free loan.

4.5 Existing *Ex post* and *Ex ante* Risk Management Strategies

This section addresses the existing risk coping (*ex post*) and risk management (*ex ante*) strategies employed by farmers in Shandong. Each strategy is introduced in the order of its importance of use as summarized in Table 4.7.

Table 4.7 *Ex post* and *Ex ante* Risk Management Strategies Ranked by Use of Farmers in Shandong Province[9]

Strategies	Very Important Past Strategies	Important Past Strategies	Very Important Future Strategies
Cut Back Consumption	1	4	7
Work Extra Hours	2	9	8
Family Members Find Employment	3	5	3
Saving	4	2	5
Crop Storage	5	7	4
Borrow Money	6	1	2
No Strategy	7	3	5
Sell Livestock	8	6	10
Children Quit School to Work	9	10	11
Receive Government Money	9	8	9
Use Agricultural Insurance	11	10	1

Source: Author

4.5.1 Ex post Risk Management Strategies

According to questionnaire responses, in general, risk coping strategies are used more than risk management strategies by these farmers. Therefore, we begin with an introduction of their existing risk coping strategies.

4.5.1.1 Cut Back Consumption

After a sudden decrease of income due to an unexpected weather shock, the common strategy for households is to cut back family consumption. This strategy was considered the most important strategy in all research locations—68 percent of participants responded that reducing their families' consumption is one of the most used strategies in

[9] The number (1) being the most used strategy

bad years; more specifically households reduce their food expenses. Instead of consuming fresh vegetables, they may eat salted ones, especially those households who do not grow vegetables and must buy them from the local market. The reduction of meat consumption is also reported in all groups. “If we do not have money on hand, we may only eat meat at festival times or important days.”

By contrast, the expenses for clothes are not normally reduced as much as food because, for rural households, the money spent on clothes is already quite limited. Even in good years, clothes are hardly ever purchased, especially for men and old people. Some male participants said that they have not bought any clothes in the last 5–10 years. Females and young people are more likely to buy clothes, but their expenditures on clothes are quite small, “We work on the land all year long. What do we need good clothes for? Instead of spending money on these useless things, it is much better to have a big meal.” So in both good and bad years, the cutbacks on clothing expenses are not either substantial or as obvious as the cutbacks on the consumption of food.

Some consumption is considered to be “must-be-expenses” that cannot be cut back even in bad years, such as investment in farming inputs—land, new machines, better quality seeds, or fertilizers. In addition, medical treatments and children’s schooling are typical “must-be-expenses.” Almost every group unanimously agreed that nothing is more important than their families’ health and children’s education.

4.5.1.2 Work Extra Hours and Get Other Jobs

In group discussions, participants unanimously agreed that there are no set hours in which they work their farms and that they usually work until dark. In the busy farming seasons, they do not even have time to return home for lunch; family members bring lunch to them to save time. On average, their workday is 8 hours or more. In the slack farming periods, farmers may get part time jobs, if possible, to supplement their income. Ironically, they work less hours on these jobs but earn more money than they do via their farming activities.

After a weather shock, farmers tend to extend both their on-farm and off-farm working hours. For example, if a drought strikes, farm households will spend extra time with irrigation activities. Almost half of all participants (48 percent) believe that working extra

hours is an important risking coping strategy. “Some periods in a year are very critical for crops, if a weather shock occurs during these time, we will have to do our best to reduce the losses. Sometime we do not even have time for lunch.”

On the other hand, the respondents noted that if they realize that they cannot avoid crop losses, they will look for off-farm employment to compensate these losses, and 34 percent of participants report that their family members take other jobs to generate cash. There are some job opportunities they do not consider if the income from farming is sufficient such as construction work, which is dangerous. But with a decrease in income due to weather shock, they are more likely to take work like construction. Extended work hours and the decrease in household income increase the stress for these rural households.

4.5.1.3 Borrow Money

Borrowing money is the third most important *ex post* risk strategy, according to 26 percent of respondents. Three obvious factors were found that help in understanding the rural borrowing structure of the research sites across Shandong: 1) rural households normally borrow money without interest from relatives, neighbors, and friends; 2) it is relatively difficult to borrow from local financial institutions; and 3) there are no moneylenders in rural Shandong.

People borrow to invest in agricultural production and to pay for important family events such as marriage and building a house, as well as emergencies such as serious illness and accidents. Most participants indicated that borrowing from their relatives, neighbors, and friends is the easiest option and to their knowledge and experience, these informal lenders have never charged interest. Respondents consider these interest-free loans as mutual help. “Every household can have short-term financial difficulties. Helping others means you may get help when you are in need.” They all agreed that the correlated risk of a severe weather event reduces everyone’s household income, making it difficult to borrow from friends and family. However, there are usually better-off families in a village, with incomes that do not heavily rely on farming, who are less affected by the bad weather event and may offer financial assistance.

The questionnaire responses reveal that like other rural locations in China, Rural Credit Cooperatives (RCCs) are the main financial institutions in rural Shandong. Households

with loan experience from financial institution answered that they all have borrowed from RCCs. The interest rates, however, vary from 0.7 percent to 1 percent among individuals and locations. The loans require some type of collateral from the borrower in the amount of the loan, or from friends or family that promise to repay a certain amount of the loan if the farmer does not. The farmer must obtain this collateral for the full value of the RCC loan. Along with this mortgaging requirement, some loans also require a warrantor, who is financially responsible for the borrower's potential default. The mortgaging and warranty requirements reduce the accessibility to the RCCs of farmers with small parcels and lacking these necessary social connections. Farmers who farm large parcels, on the other hand, are more likely to be able to borrow money from RCCs. Moreover, if they have economic status and the connections, the mortgaging and warranty requirements may even be waived, as for example one respondent, who is farmer with a relatively large farm of more than 200 mu, said that in the past year, he succeeded in borrowing CNY 80,000 in one loan and without those requirements from his RCC. Another finding is that farmers tend to borrow from the RCCs for investment purposes. None of the respondents report that they borrow after a weather shock in order to cope with crises.

Moneylenders are uncommon in the research sites and are considered unethical by all participating groups. The informal lending of money with interest is not acceptable in these rural locations. "If someone lends money to others with an interest rate, he is taking advantage of other people's difficulties. We do not like this kind of person, and rational people should never do this." Not surprisingly, none of the respondents had any experience borrowing from moneylenders.

4.5.1.4 Sell Livestock

Livestock is not counted on as an important income source for rural households in the research locations. Selling livestock after a weather shock is not deemed to be helpful in alleviating their financial stress. Even households whose income is mainly from raising chickens or pigs rarely sell their livestock before the normal time when livestock is ready to cope with weather risks. "We may sell chickens ahead of time if the market price is really good or we observe some potential illness among them, otherwise we do not sell

them at the improper time." Accordingly, only 11 percent of respondents sell livestock after adverse weather events.

4.5.1.5 Children Quit School

Having their children quit school to reduce the household expenses after a weather shock is also an uncommon strategy in the research locations. Only one individual said that he heard of a child quitting school after a drought in their village. Only 3 out of 174 participants ranked this strategy as "Very Important." Because the first nine years of compulsory and universal education is free, rural households in Shandong do not experience the financial stress of educating their children, especially in the first nine years. Some families may have difficulties supporting education for their children after nine years, but it is commonly recognized in all groups that education is the only way that children growing up in a rural household can change their destiny to have better lives in the big cities. Therefore, almost all parents participating in the research gave an identical response: "We can eat less and borrow more. But we cannot turn down the only opportunity to change our kids' future. As long as they would like to study, we will try our best to ensure that they can sit in their classrooms." So it would be very uncommon for children to quit school after a natural disaster.

4.5.1.6 Assistance from Government

Participating households respond that they rarely receive assistance from government in bad years, and only 2 percent of respondents believe that support from government is a very important way to cope with weather risk. Instead of cash, government assistance is usually a commodity item. One group said that they received free fertilizer from the government in 1998 after a severe drought, but as it was one bag of fertilizer to two households, it was not really helpful. Another group recalled that the part of their electric bill that was used for drainage was waived in 1990s. Although there are no specific policies for *ex post* government assistance and participants have received very little government support, they are confident that government would help them in a disaster.

4.5.2 Ex ante Risk Management Strategies

The risk management strategies include saving, crop storage and agricultural insurance. The ranking statuses for saving and crops storage are similar. By contrast, agricultural insurance is the least important for both *ex ante* and *ex post* strategies.

4.5.2.1 Saving

Saving is the most important *ex ante* risk management strategy, used by participants and 27 percent rank it the most important strategy they have used in the past. Although most participants are not considered rich, almost every household has some level of savings. Participants in the focus group discussions indicated they save money for life-cycle events and some save for emergencies such as accidents or illness, but few of them save money for adverse weather. They believe that in these days, they are unlikely to starve even if a natural disaster strikes. As weather shock is unpredictable in terms of frequency and severity, participants tend to not see the need to worry too much about catastrophic natural disasters because they think of these large events as happening at some time in the far future. Although saving is ranked as an important *ex ante* strategy in the questionnaire, few respondents actually plan to use their savings to offset weather risk. In addition, rural residents, aged 40–50 years old, are lowest percentage of all age groups to save because at this age they are financially responsible for two generations: their parents, who usually have health problems at this time, as well as their children, who, by this time, have completed their nine years of free education and tuition for further education is the responsibility of their family.

4.5.2.2 Crop Storage

Compared to past decades, storing crops has become a less important strategy for risk coping. According to the respondents of the questionnaire, 26 percent of them store crops for an unexpected weather event. Respondents said they store a year’s surplus of mainly wheat and corn in case of reduced or no harvests in the coming year. Older participants are more likely to store crops because in their lifetimes they are more likely to have had experienced starvation. The individual household’s decision as to whether or not to store crops also depends on the customs of their village, so usually either most participants in a group would store crops or only a few of them chose to store crops.

4.5.2.3 Agricultural Insurance

Agricultural insurance is the least important strategy used to cope with previous weather risks. In the questionnaire, only 1 respondent out of 174 has voluntarily purchased insurance against freeze for their fruit trees. Of the two participating groups in Liaocheng, 17 participants indicated they were required to purchase subsidized crop insurance. In general, households in the research sites were not familiar with or have never heard of agricultural insurance and those who have purchased crop insurance do not really understand it. Without awareness or an understanding of agricultural insurance, it is not surprising that agricultural insurance has been the least important strategy for farmers in the research sites.

4.6 Future Risk Coping and Management Mechanisms

Participants' perspectives about their future risk coping and management strategies differ from what has been their past experience. They rank some strategies as more important in the future than in the past, while ranking some strategies with less importance (see Table 4.7).

The most dramatic difference is the ranking status for agricultural insurance: from least important to most important strategy. The group discussions (before individual questionnaires were filled out) increased participants' awareness of the effectiveness of agricultural insurance as an important risk management method. As a result of the discussions, 25 percent of respondents of the questionnaire ranked agricultural insurance as the most important future strategy. This implies that the lack of awareness and understanding of agricultural insurance may be an important reason for the least important risk management strategy used in the past.

The ranking status of borrowing money as a future strategy also increased from 6 to 2. According to group discussions, the increasing demand for loans is for two reasons: 1) there is a tendency that more and more rural farmers are becoming increasingly active in small businesses either related or not to farming and as a result, these investments require more loans from various sources; and 2) although borrowing from RCCs is currently difficult for most respondents due to the mortgaging and collateral requirements, they are confident that this problem will be alleviated in the near future, because they believe

central policies aim at improving the well-being of rural people and it only a matter of time before these policies will be fully implemented by the local governments.

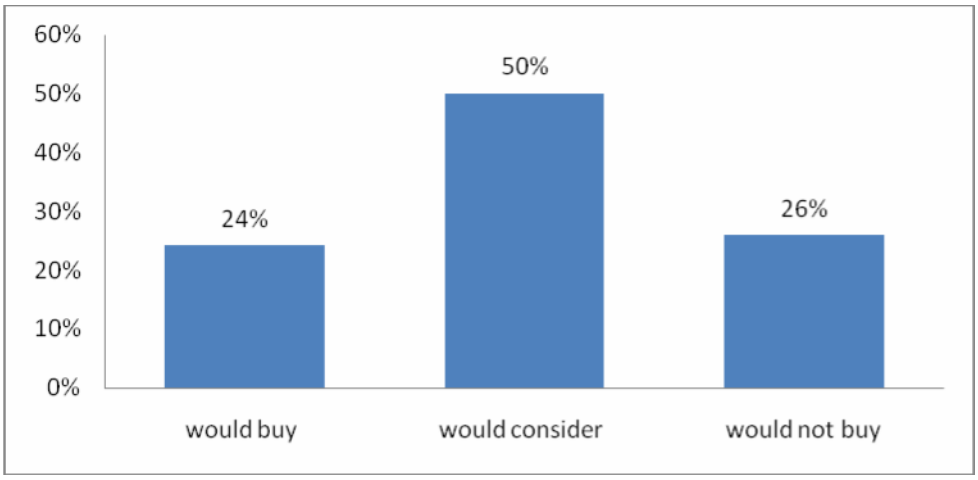
The strategies of cutting consumption and working extra hours, the two most important past strategies, were ranked at 7th and 8th as future strategies. The primary reason for these lower rankings is an increased awareness of the potential effects on their family members' health status. Malnutrition and extreme workloads can result in irreparable health problems. Therefore, as future conditions for rural residents improve due to the availability of other strategies, these strategies will become less and less important.

4.7 Demand for Index-based Weather Insurance

The major part of the focus group discussions centered on introducing and discussing index-based weather insurance. Most participants had no difficulty understanding the basic concepts and some raised insightful questions and were able to express their concerns about the insurance. Because drought is the major weather concern across the research sites in Shandong, our emphasis is on analyzing the demand for drought insurance and summarizing the concerns that participants have for index-based weather insurance products.

Most participants in the focus group discussions seemed positive about index-based insurance and the simplicity of its concept; however, in the questionnaires, a majority of individuals expressed a wait-and-see attitude as a result of doubts about the concept and its implementation. As shown in Figure 4.4, 50 percent of respondents to the questionnaire would consider purchasing index insurance, 24 percent would definitely purchase an index insurance product if they had the access to such insurance, and 26 percent would not choose to purchase the product.

Figure 4.4 Demand for Drought Insurance in the Research Locations



Source: Author

Participants raised astute questions regarding the problems index insurance has with basis risk. Some indicated that payments based only on rainfall are not fair because individual losses may vary greatly in the same village. Many respondents illustrated how geographic features can differ even in adjacent farmlands so that the same rainfall could have different impacts on the crops. They also indicated it would be impossible for one weather station to measure the rainfall level for all households' farmlands. As a result, it was easy to see that using an index, an average level, to assess losses would be unfair to some farmers.

Along with the questions about its concept, most doubts are raised by the implementation of index insurance. Many participants and their families have had bad experiences with insurance companies: they did not receive full payment due them or it took long time to receive payment. In order to get their indemnity, some respondents bribed local insurance agents or representatives. Their common perception of insurance companies are of businesses which are only interested in making money and do not care about their reputation and their clients' interests.

In addition, the implementation by a local government of subsidized crop insurance disappointed those rural residents, making it difficult for them to accept how index-based insurance would be offered. Respondents in Liaocheng said that the subsidized insurance is bundled with the Cooperative Medical Insurance (CMI), which they were not allowed to purchase if they did not purchase the subsidized crop insurance. Because farmers

wanted the benefits of CMI, they were indirectly forced to buy the subsidized insurance products in 2006 and 2007. Besides, people were not clear about the subsided crop insurance they bought. None of these respondents were clear about the conditions of the subsidized product they bought, either with the details of the payments or what exactly they insured against. Finally, there was no standard amount for the premium to be paid. The premiums were supposed to be based per mu. But some households paid CNY 5/mu and some paid CNY 10/mu. All these problems make agricultural related insurance seem unreliable.

Along with the implementation problems that respondents experienced with the insurance companies and local governments, they were also worried that an interested party could tamper with the weather station to distort the weather data for the benefit of the insurance companies and therefore the data might not truly reflect rainfall levels.

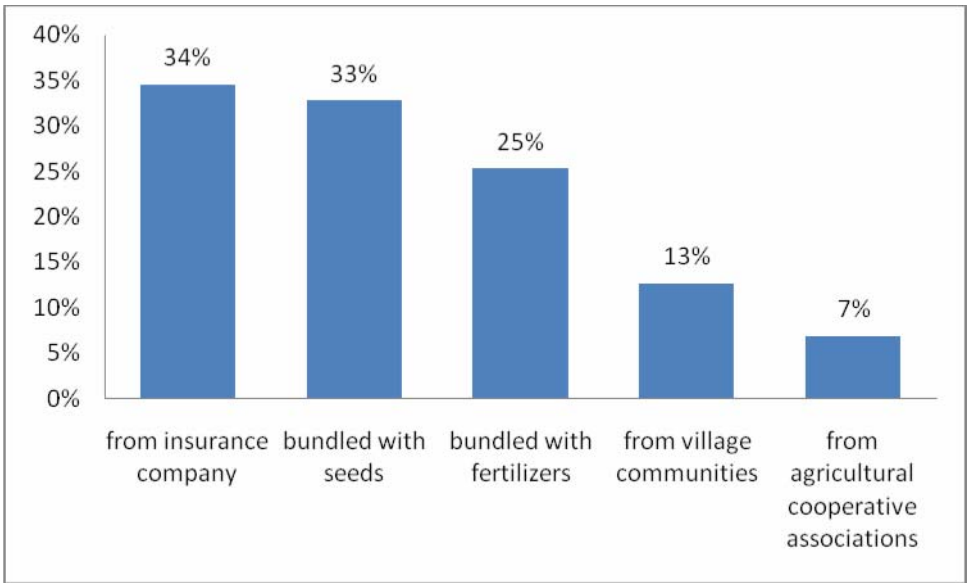
Finally, there were a few misunderstandings about the nature of insurance. Some participants asked whether their premiums could be refunded to them if no weather event occurred. Some participants considered insurance as a luxury item that only the rich would purchase; and some felt because they could not completely understand their insurance policy, they could easily be defrauded by the insurance companies.

The common finding for all groups is that they like the concept of index-based insurance, but majority of participants do not trust it, especially the implementation process. How to gain confidence and trust will be the biggest challenge to promoting index-based insurance in these regions.

4.8 Delivery Methods for Index-based Weather Insurance

Another important part of the design of index insurance product is the bundling with one of agricultural inputs for its delivery. There are five nonexclusive delivery options presented in the questionnaire. Respondents could choose more than one option. There was no predominant delivery method preferred by participants (see Figure 4.5). Roughly one-third of the participants would prefer to buy index-based insurance directly from the insurance company instead of buying the product bundled with an input product as they expressed doubts that an insurance contract on an input bag would be legally recognized when they make a claim.

Figure 4.5 Delivery Methods Preferred by Participants



Source: Author

Another third of the participants prefer the insurance products bundled with seeds and 25 percent of participants prefer the insurance bundled with fertilizers. These two groups preferred bundling over any other delivery method. In the group discussions, however, participants expressed a concern with bundling the insurance product with fake seeds or low quality fertilizers resulting in a market loss for the insurance product. However some participants suggested that index-based weather insurance bundled with seed could be combined with fake seed insurance in order to guarantee the quality of seeds. The major problem with the bundling with seed or fertilizer is there are no commonly recognized brands or factories for either seeds or fertilizer. Farmers said their purchase decisions are randomly made each year but that it is unlikely they would switch their purchase decision for bundled insurance, especially in the promotion stages of index-based weather insurance.

The village is the smallest unit of local government and the level of government closest to rural residents. The small percentage (13 percent) of participants who would prefer to buy insurance from the village government agency implies the lack of confidence in local government to promote index-based insurance products. The agricultural cooperative associations, chosen by 7 percent of participants, are not favored as delivery agent either.

4.9 Demand for Other Insurance Products

Another purpose of this survey is to investigate the demand for other insurance products in Shandong. Table 4.8 summarizes all the demand for "would buy" and "would consider" insurance products, respectively and gives us a quick review about the ranking of demand. This rest part of this section will address the reasons behind the demand for each insurance product.

Table 4.8 Demand for Other Insurance Products

Would Buy Insurance			Would Consider Insurance		
Insurance Type	Percentage	Ranking	Insurance Type	Percentage	Ranking
Old-Age	34	1	Old-Age	41	6
Health	28	2	Health	49	3
No Insurance	27	3	No Insurance	12	14
Education	25	4	Education	25	12
Strong Wind	25	4	Strong Wind	42	4
Drought	24	6	Drought	50	1
Life/Death	19	7	Life/Death	50	1
Excess Rain	16	8	Excess Rain	40	7
Flood	14	9	Flood	30	9
Property	13	10	Property	30	9
Hail	12	11	Hail	42	4
Freeze	11	12	Freeze	39	8
Insect Pest	11	12	Insect Pest	26	11
Livestock	10	14	Livestock	13	13

Source: Author

Old-Age Insurance. Traditionally in rural areas family members have the financial responsibility to support the elderly. But this culture is currently challenged by the fact that the average number of children in rural household is decreasing. The financial burden on next generation is increasingly heavy. Therefore, the old-age support relying on own family members becomes harder to accomplish. The higher demand for old-age insurance reflects participants' increasing awareness of importance of old age security.

The participants currently with old-age insurance products mostly were employee of local government, state farms, or collective enterprises, all of which offer the compulsory

cooperative pension insurance between employee and employers. Many farmers without employment in those organizations were interested in planning savings and investments in the form of insurance for their future lives. But many of them are worried that they may not guarantee a regular payment on monthly or yearly basis in case of a lack of money periodical financial difficulties. . In addition, some participants said that they did not know where to buy the old-age insurance, and some people with the access to insurance companies or agents are also very careful to choose the insurance company because this long term investment requires the trustful commitment made by reliable insurance company.

Health Insurance. In the group discussion many respondents stated that they became to understand the basic concept of insurance from New Rural Cooperative Medical Scheme (NRCMS). In 2003, the Chinese government establishes a new voluntary communal insurance system. Under this system, the government and rural residents both contribute to a collective insurance pool, which is accessible to cover health care services. The plan requires a 10 Yuan annual contribution from rural residents, which is matched by a 40 Yuan contribution from the government (20 Yuan each from the central and local governments), and deposited in a special, county-level account. This program has provided rural people the access to affordable medical services. After realizing the benefit from NRCMS from neighbors, friends or families, almost every household voluntarily purchases this insurance product, which was initially mandatory in the first two years. In all surveyed locations, participants responded that almost every resident, even the young, purchased this insurance product. They said that they would continue to buy this insurance product as long as its policy conditions remain same. The higher ranking of health insurance in Table 4.8 in some degree indicates the high recognition of current NRCMS. Therefore market space for other potential health insurance products in rural areas might be limited.

Education Insurance. As discussed in the section on risk coping strategy, education is very important for rural Shandong. It is quite uncommon to discontinue study due to poverty. But the relatively high tuition especially expenses during the university period burthen normal families. Insurance designed for bearing education costs interests many participants. Some participants said that they kept looking for insurance product as a form

of investment for their children's future education. Like the old-age insurance, such insurance requires long term regular payment. To gain the confidence of insurance company is also the key point.

Life/Death Insurance. A common finding during the survey was that participants were usually confused between financial and emotional stresses due to unexpected risks. They believed that the unexpected illness or even the death is the biggest issues for a family. They wanted to purchase life or death insurance to make them not feel worst when the worst thing happens.

Some households, whose families engage in risky jobs like construction and mining, are particularly interested in life and death insurance. In Taian, the last place to be surveyed, mining and other non-agricultural activities are the sources of most households' incomes. Instead of discussing agricultural related risks, they were more interested in the life and death insurance. Some participants even had the families dead in the mining accidents. Without being insured, these families had experienced extreme emotional and financial stresses.

Property Insurance. The demands for property insurance were from those participants who are interested in protecting their faming machines against stealing. Participants said that the most valuable assets for them were their faming machines. The lack of productive machinery can result in the big losses in the successive years because the purchase requires several years' saving. Compared to the interest in protecting farming tools, only one participant among 174 said he considered to buy insurance for home appliances. Others said that there was no valuable stuff worth to be insured in their houses.

Livestock Insurance. Big livestock farmers are interested in the livestock insurance against common disease affecting farm animals. Those people with purchase interest usually raise livestock in a big scale—thousands of chicken or more than 10 pigs were considered large raising scale. Livestock insurance against stealing was also demanded, especially for those households who raise pigs or cows. By contrast, most small livestock farmers commonly think that it is not necessary to buy an insurance product for their livestock, which contribute small portion of their family income.

Insurance for Other Natural Disasters. The demand for insurance against strong wind is highest among all natural disaster, corn and wheat growers were particularly interested in this product. But the biggest challenge for strong wind is hard to measure in index basis. The crop losses due to strong wind are quite random. In the survey, no participants reported that they have ever heard about the wind insurance. The strong demand and less supply created the potential market opportunities, requiring more sophisticated insurance products designed to against strong wind.

The demands for other different insurance products are usually determined by the crop type. For example, participants whose incomes are from fruit trees were interested in freeze and hail insurance. And cotton growers are more concerned about the insect pest, and therefore have high demand for insect pest insurance. Like drought insurance, the index for excess rain and flood are easily to measure. Instead of relying on crop types, the demands for excess rain and flood were determined by the locations—southern rural residents are more vulnerable to excess rainfall and therefore their demands are higher than the people in the northern parts.

4.10 Conclusion to Chapter 4

This chapter addresses the descriptive results in terms of rural households' livelihood strategies, facing risks, risk coping and management strategies as well as demands for index-based weather insurance and other insurance products. With the well diversified income sources, agricultural income is less and less important for rural households. As a result, weather risks, which mainly affect farming, do not worry some households whose agricultural income accounts for small part of their earnings. Rural households primarily cut consumption to cope with risks. By contrast, agricultural insurance against weather shocks is least important in the past, but ranked first in the future with participants' increasing awareness its advantages over other risk coping strategies, although people also reported that they had some concerns about implementation of index-based insurance.

CHAPTER 5
SUMMARY AND CONCLUSION

5.1 Introduction

While the basic conceptual framework for this thesis was tied to poverty trap dynamics, a key finding for this region of the world is that farmers were much more prone to smooth income rather than smooth assets. This form of risk coping is less likely to result in poverty traps. Well-diversified income sources distinguish rural households in Shandong from farmers in other places where agriculture is the dominant income source. As a result, in Shandong, the impacts of weather risk on rural households and their corresponding risk management strategies do not appear to be consistent with theories that emerge in the poverty trap literature.

5.2 Livelihood Strategies in Shandong

Understanding rural households' livelihood strategies is fundamental for understanding impacts of weather risks on rural households and their behaviors to cope with risks. Casual work is a significant source of income in the rural places of Shandong, although most of the job opportunities are not related to agricultural activities. Many rural laborers, usually males, migrate to towns or cities and work as masons, porters, carpenter, and construction workers. They work full time in cities year around or they return during the busy farming seasons. The households with more family members working in casual or full time non-agricultural jobs are more likely to grow wheat or corn, less time-consuming crops. However, these crops also appear to be grown for household consumption only. Because their jobs are not agriculturally related, adverse weather events only affect their crop yields rather than their income, although their expenditures on food may increase in bad years.

By contrast, households who grow higher-return crops like vegetables, cotton, fruits, and peanuts are more concerned about the weather risks. These crops are more time consuming, so more laborers in a households work on the farming than casual work. Because the farming income is more important for these households, the weather shocks can greatly impact on their lives. However, it is a challenge to offer weather insurance products for specialty crops like these. There are two reasons. First, compared to wheat

and corn that are grown in nearly every village, these crops are not planted in a big scale in Shandong. As a result, the potential policyholders are not in a large group. This would increase the delivery cost of insurance. Second, farmers whose dominant incomes are from higher-return crops are usually worried about specific risks. For example, freeze is particularly important for fruit trees, and insect pests have a severe impact on cotton production. Consequently, a single weather risk like drought does not affect high value crops in the same fashion as wheat and corn. It would require several index insurance products against the risks that affect high value crops

Both government secondary data and questionnaire data indicated that the drought is the most frequent weather shock. It has more impacts on wheat and corn than other crops. Big farmers growing wheat and corn are much more concerned about their losses due to drought than small farmers and other crop growers. These larger scale farmers expressed more interest in the drought index insurance than smaller farmers. Nonetheless, larger scale farmers in Shandong account for small percentages of all farmers.

5.3 Risk Coping and Management Strategies in Shandong

Smoothing consumption is the primary strategy to cope with risks for rural households in Shandong: 68 percent of participants responded that reducing their families' consumption is one of the most important methods in their bad years. Given the already low expenses on clothes, the reduction of families' consumption is mainly from food, especially meat and fresh vegetables.

With the awareness of the importance of education, the rural households in Shandong rarely withdraw their children from school and put them to work full time as a strategy for reducing expenditures or increasing income through the labor of their children. This is the significant difference in terms of smoothing consumption between rural Shandong and other many other rural places described in the development literature.

Smoothing income is the second important strategy to manage risks. Although there are limited accessibilities to formal financial institutions, mutual aids is common—rural people borrow from their families, friends, and neighbors without paying interest. This is a cultural practice that may also distinguish Shandong from many other rural communities that are described in the development literature. Because of various income

sources that are not affected by weather, correlated weather shocks are also less likely to reduce large numbers of household income in the region at the same time. This is especially true for those whose incomes are not dependent on farming, making borrowing possible.

Smoothing assets is quite uncommon in Shandong. Participants believed that selling off assets used for farming is the last choice in the aftermath of weather shocks. One participant summed up the common view well by saying, “We can borrow, eat less, or get the support from government to get though the hard time. If we sell off the farming machines, we cannot do farming for the successive years. It is a not wise choice.”

5.4 Impacts of Weather Risks in Shandong

Well-diversified income sources contribute to the possibility of mutual aid in the form of free or low cost borrowing among rural residents. Smoothing income and consumption reduce the likelihood of selling off assets to generate income after the adverse weather event. In the absence of smoothing assets, poverty traps are not observed in rural Shandong. Even those households with annual net incomes lower than CNY 4000 do not experience starvation. All participants responded that they can eventually recover from a weather shock. As one participant said, “It’s just the time problem, and no weather risk is big enough to result in the permanent poverty.”

Exposed to weather shocks and other agricultural risks, agricultural households often choose low-risk, low-return activities to avoid or minimize exposure. With the worry of a potential change of land use rights, many interviewed farmers hesitate to invest in new farming machines and technologies. In the presence of fake seeds, farmers are more likely to purchase the familiar brands of seeds. This strategy, however, limits their chances to try the new and productive seeds. The common finding is that many participants continued to use the same machines, purchase the same inputs, and grow the same crops in many years regardless of the changes of markets. For example, all the participants responded that they will continue to grow garlic even given the price decline of 10 percent between 2006 and 2007. As a result, risk-averse farm households that are highly vulnerable to shocks often manage risk by engaging in activities characterized by

low risk but also low expected return. These risk-averse choices can significantly slow economic growth in the rural economy.

5.5 Challenges and Recommendations for Index-based Weather Insurance

Most participants understood and liked the idea that indemnity payment is based on the actual rainfall level rather than individual losses. Still, many questions were raised regarding how such insurance would be implemented. The poor image about insurance companies existed in most of the surveyed places. As soon as one of the participants shared his or her bad experience about insurance companies with others, it would became more difficult for the group to believe that index-based insurance can be reliable form of insurance. Farmers expected that they can get the payment as soon as they claim the losses. The prospect of delays in payments also damaged the perceptions among farmers about the trustworthiness of insurance products. Therefore, the groups seemed to appreciate the transparency and timely payments that might be associated with index insurance.

Currently, Cooperative Health Insurance under the New Rural Cooperative Medical Scheme (NRCMS) is one of the most successful insurance products in rural Shandong—more than 90 percent of households purchased this insurance. It was mandatory when it was initially promoted in Shandong in the first two years. After realizing the benefit from NRCMS from neighbors, friends or families, almost all rural households now voluntarily purchase this insurance product. Without the mandatory requirement, it will be hard to promote a new insurance product—farmers are less likely to buy something they are not familiar with given their limited budgets. Unlike health insurance which can be well understood and trusted based on other people's experience, it may take several years for rural households to realize the benefit of index-based insurance (e.g., after the first weather shock), therefore there are less incentives for them to make the continuous purchase in the successive years. In this sense, the mandatory requirement with the support by the authorities may be important to initiate index-based insurance at the early stage.

There are some challenges and opportunities of cooperation with government and authorities. First, the Shandong government currently is promoting subsided agricultural

insurance, and it will become harder to have a market share for index-based insurance. On the other hand, the concept of index-based insurance is different from the subsided insurance, and it can be tailored to complement the current agricultural insurance, creating new opportunities for different products. Second, many participants have some doubts about private firms. The surveys suggest that farmer will trust insurance more if there is a government guarantee. However, the participants' attitudes towards the local government were not consistent. Some places trust more private insurance companies than the local government while the case is just the opposite in other places.

The insurance literature, however, discourages government involvement as in the long term it increases transaction costs and distorts the insurance market. Substantial market development is prevented as some private insurance firms might be crowded out by improper government intervention. But in the case of Shandong, where the agricultural insurance market is thin, the government support is helpful to initiate the index-based insurance product. Therefore, the key is to determine the most appropriate form of cooperation with government so that the drawbacks of government intervention can be limited while the index-based insurance is being widely promoted with the support from the government.

The surveys also clearly demonstrated that education is also necessary to initiate a new index-based insurance product in Shandong. If the insurance is misunderstood, farmers will quickly lose interest in this new approach. Many farmers learned the basic principles of insurance from the Cooperative Health Insurance, but the index-based insurance is different from traditional insurance product. So appropriate education is necessary for policy holders to understand the conditions and gain their confidence.

In addition, the design of a simple contract with fewer clauses is important to the acceptance of index-based insurance in the rural Shandong. Some participants believed that too many clauses act as a restriction to receiving their payments. Participants said they like the Cooperative Health Insurance because they can receive a payment as long as their names are written correctly in the receipts.

Along with the challenges during the implementation process, the idea of index-based insurance bundled with the agricultural inputs may be further tailored to meet the local

conditions. First, there are only 144 weather observation stations in Shandong—almost every county has only one station. A county may include hundreds of villages. Even the two close villages may have different weather conditions creating a basis risk for the insured. This constraint challenges the fairness of the rainfall data which may be obtained from weather station far away to estimate the individual losses. Second, choosing the products bundled with index-based insurance would also face some challenges. There is no commonly recognized brand or factory for either seeds or fertilizers in Shandong. Farmers are less likely to switch their purchase decisions from the familiar to unfamiliar brand to get the index-based insurance.

5.6 Limitations of the Study

Caution is needed when making conclusions about this project and the understanding that future research is necessary to identify the challenges that arise in response to the methods used here.

First, the responses concerning irrigations methods, especially the use of pumps, were all obtained from the FGD, as there were no related questions in the questionnaires. The lack of questions regarding irrigation methods in the questionnaires may create potential problems for the future study on an individual basis. For example, if wanting to estimate the factors determining the individual demand for drought insurance, a variable created for the irrigation method has to be on the group than rather than on an individual basis, because only group responses were recorded. In other words, if the use of pump was reported in the group during the FGD, then all individuals' questions were recorded to use the pump. Although in a village, whether to use pump is fairly similar for most of residents, some special cases might be ignored in the parts of individual questionnaires.

Secondly, even though the questionnaires were given to participants as soon as the focus group discussions were finished (helping participants better understand the questions posed in the questionnaire), the participants who had less time between these two events to fully think about index-based insurance may have given more positive answers, confirming their interest in index insurance without a full consideration. Therefore, participants who indicated their demand for index-based insurance in the questionnaire may later have felt that this decision was too quickly made.

Third, the all the official data for the background information was from 2006, a time period of two years from the time when the research was conducted (May, 2008). This time gap created some challenges when comparing the data obtained from this research to the official data, especially for comparisons between household incomes. In addition, the data on agricultural insurance was limited to only 2006. Since the Shandong government initiated the subsided insurance from 2006, the current agricultural insurance market in Shandong may have experienced great change in those two years. As a result, one should be cautious when using the previous data to estimate the current market for agricultural insurance in Shandong.

Finally, understanding the performance of the current subsided insurance is important to adjust design for index-based insurance. However, at the present moment, official data indicating its performance is not available, and detailed information on the implementation process is limited through official sources. Given that the interviewed participants had limited knowledge of the subsidized insurance, their answers may be incorrect. This may distort the conclusions of this study. Therefore, to further understand the agricultural insurance market in Shandong, it will be necessary to learn more about the subsided insurance.

APPENDIX A
THE QUESTIONNAIRE USED IN THE RESEARCH PROJECT[10]

ID _____ Location _____ Age _____ Sex _____ Years of Education _____

(1) How many mu does your family's farm in total? _____

How many mu does your family's farm for wheat and corn? _____

How many mu does your family's farm for vegetable? _____

How many mu does your family's plant for fruit tree? _____

How many mu does your family's farm for cotton? _____

Does your family farm for other crops? If yes, specify _____, how many mu? _____

Does your family raise livestock? If yes, specify _____, how many livestock? _____

(2) How many years have you been farming? _____

(3) Including your self, how many people live in your house? _____

Among your family members, how many people work? _____

Among your family members, how many only work on farm? _____

Among your family members, how many only work off farm? (more than 9 months a year) ___

Among your family members, how many work both on and off farm? _____

(4) Among your children in your household,

How many are either too young for school or in elementary school? _____

How many are in high school? _____

How many are in a college or university? _____

(5) Is at least one member of your family suffering a serious illness? ____ Yes ____No

(6) Of the total wheat and corn that your family consumes, roughly what proportion of them comes from what you produce on the farm (check or circle only one of these answers)

a) Less than 25 percent ___

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[10] Appreciation is due to Calum Turvey for sharing the ongoing Cornell University project survey, "Survey of Farmers to Assess Specific Weather Risks and Interest in Weather Insurance."

b) Between 25 and 75 percent ___

c) More than 75 percent ___

(7) Of the total vegetables that your family consumes, roughly what proportion of them comes from what you produce on the farm (check or circle only one of these answers)

a) Less than 25 percent ___

b) Between 25 and 75 percent ___

c) More than 75 percent ___

(8) Of all sources of income, roughly what proportion comes from wheat and corn that you grow and sell into the market (check or circle only one of these answers)

a) Less than 25 percent ___

b) Between 25 and 75 percent ___

c) More than 75 percent ___

(9) Of all sources of income, roughly what proportion comes from vegetables that you grow and sell into the market (check or circle only one of these answers)

a) Less than 25 percent ___

b) Between 25 and 75 percent ___

c) More than 75 percent ___

(10) Of all sources of income, roughly what proportion comes from livestock that you raise and sell into the market (check or circle only one of these answers)

a) Less than 25 percent ___

b) Between 25 and 75 percent ___

c) More than 75 percent ___

(11) Of all sources of income, roughly what proportion comes from fruits that you grow and sell into the market (check or circle only one of these answers)

a) Less than 25 percent ___

b) Between 25 and 75 percent ___

c) More than 75 percent ___

(12) Of all sources of income, roughly what proportion comes from cotton that you grow and sell into the market (check or circle only one of these answers)

a) Less than 25 percent ___

b) Between 25 and 75 percent ___

c) More than 75 percent ___

(13) Please check or circle only one of these answers. Roughly what was your household total income from all sources last year

a) Less than 4000 yuan

b) Between 4000 and 6000 yuan

c) Between 6000 and 9000 yuan

d) Between 9000 and 12000 yuan

e) Between 12000 and 15000 yuan

f) More than 15000 yuan

(14) Please list top three crops by the area of mu in spring by the standard of ***Gregorian Calendar***

Name of Crop	Area in Mu	How many Jin in each mu	How many yuan each Jin			How many Jin family consumed
			2005	2006	2007	

(15) Please list top three crops by the area of mu in autumn by the standard of ***Gregorian Calendar***

Name of Crop	Area in Mu	How many Jin in each mu	How many yuan each Jin			How many Jin family consumed
			2005	2006	2007	

(16) We begin by asking you to indicate which of the major weather events are of the most concern to you and for what time period. Please use the Gregorian calendar when you respond to these questions. In this first table, please put in the months

Natural Disaster	Most Important Month	Second Most Important Month
Drought		
Flood		
Excess Rain		
Hail		
Freeze		
Strong Wind		
Insect Pests		
Others		

(17) Please indicate top three natural disasters you are concerned most

a)

b)

c)

(18) When this weather event occurs, please give us some information about how frequently the following coping strategies are for you in the past (for each strategy circle one answer)

1) Borrow money Frequently used ; Once used ; Not used ;

2) Sell livestock Frequently used ; Once used ; Not used ;

3) Family member gets new job Frequently used ; Once used ; Not used ;

4) Work extra hours Frequently used ; Once used ; Not used ;

5) Children quit school to work Frequently used ; Once used ; Not used ;

6) Cut back on consumption Frequently used ; Once used ; Not used ;

7) Get money from government Frequently used ; Once used ; Not used ;

8) Use savings Frequently used ; Once used ; Not used ;

9) Agricultural insurance Frequently used ; Once used ; Not used ;

10) Store crops Frequently used ; Once used ; Not used ;

(19) Please write any other strategy that you use that is not included above _____

(20) Please indicate top 3 coping strategies you consider to use in the future

1_____

2_____

3_____

(21) Have you ever purchased agricultural related insurance? Yes____ No_____

If you have, what was the agricultural insurance product your purchased?_____

And how much was the premium?_____

(22) If a reliable insurance company developed new insurance products for you, please circle your answer for each of the insurance products listed below

1) Insurance for health Would Buy ; Would Consider ; Not interested ;

2) Insurance for life/death Would Buy ; Would Consider ; Not interested ;

3) Insurance for livestock Would Buy ; Would Consider ; Not interested ;

4) Insurance for retirement Would Buy ; Would Consider ; Not interested ;

5) Insurance for education Would Buy ; Would Consider ; Not interested ;

6) Insurance for property Would Buy ; Would Consider ; Not interested ;

7) Insurance for drought Would Buy ; Would Consider ; Not interested ;

8) Insurance for excess rain Would Buy ; Would Consider ; Not interested ;

9) Insurance for flood Would Buy ; Would Consider ; Not interested ;

10) Insurance for hail Would Buy ; Would Consider ; Not interested ;

11) Insurance for freeze Would Buy ; Would Consider ; Not interested ;

12) Insurance for strong wind Would Buy ; Would Consider ; Not interested ;

13) Insurance for insect pests Would Buy ; Would Consider ; Not interested ;

(23) Please indicate top three insurance products that you are interested most

1 _____

2_____

3_____

(24) Please write any other insurance products that you are interested but not included above_____

(25) What is the best approach to purchase agricultural insurance products? (You can choose more than one choice)

a) From insurance company

b) Bundled with seeds of crops

c) Bundled with fertilizer

d) From village committee

e) From agricultural cooperative

REFERENCES AND BIBLIOGRAPHY

Alderman, H. “Managing Risk to Increase Efficiency and Reduce Poverty.” Background Paper 41352 for the World Development Report 2008, The World Bank, Washington, DC, December 1, 2006.

Anderson, J. R. “Risk Management in Rural Development: A Review.” Agriculture and Rural Development (ARD) Strategy Background Paper 7, The World Bank, Washington, DC, February, 2002.

Arrow, K. J. “The Theory of Risk-Bearing: Small and Great Risks.” *Journal of Risk and Uncertainty* 12(1996): 103–11.

Barnett, B. J. “The Federal Crop Insurance Program: Past, Present, and Future.” *Journal of Insurance Issues* 18(1995): 75–100.

Barnett, B. J., C. B. Barrett, and J. R. Skees. “Poverty Traps and Index-Based Risk Transfer Products.” *World Development, doi:10.1016/j.worlddev.2007.10.016* (2008): 1766–1785.

Barrett, C. B., and M. R. Carter. “Can't Get Ahead for Falling Behind: Development Policy, Poverty, and Relief Traps.” *Choices* (Winter, 2001): 35–38.

Barrett, C. B., B. J. Barnett, M. R. Carter, S. Chantarat†, J. W. Hansen, A. G. Mude, D. E. Osgood, J. R. Skees, C. G. Turvey, and M. N. Ward. “Poverty Traps and Climate Risk: Limitations and Opportunities of Index-Based Risk Financing.” IRI Technical Report 07-03, International Research Institute for Climate and Society, Columbia University, New York: Columbia University, October 19, 2007.

Carter, M. R., P. D. Little, T. Mogues, and W. Negatu. “The Long-Term Impacts of Short-Term Shocks: Poverty Traps and Environmental Disasters in Ethiopia and Honduras.” BASIS Collaborative Research Support Program (CRSP) Brief Number 28, Department of Agricultural and Applied Economics, University of Wisconsin, Madison, WI, May, 2005.

Churchill, C., Ed. *Protecting the Poor: A Microinsurance Compendium.* Geneva, Switzerland: International Labor Organization and Munich Re Foundation, 2006.

Dercon, S., Ed. *Insurance against Poverty*. Oxford: Oxford University Press, 2005.

Hazell, P. B. R. "The Appropriate Role of Agricultural Insurance in Developing Countries." *Journal of International Development* 4(1992): 567–581.

IFRCRCS (International Federation of Red Cross and Red Crescent Societies). *World Disaster Report 2004.* Bloomfield, CT: Kumarian Press, Inc., 2004.

Matul, M., J. Pytkowka, and M. Rataj. “Market for Microinsurance in Azerbaijan.” Comprehensive Demand Study funded by KfW and the Microinsurance Centre, Warsaw, Poland, November, 2006.

Padilla, A. “Agency Theory, Evolution, and Austrian Economics.” Working paper, Department of Economics, Metropolitan State College of Denver, Denver, CO, April 21, 2003.

Priest, G. L. “The Government, the Market, and the Problem of Catastrophic Loss.” *Journal of Risk and Uncertainty* 12(1996): 219–237.

Ray, D. *Development Economics.* Princeton, NJ: Princeton University Press, 1998.

Rejda, G. E. *Principles of Risk Management and Insurance*. 7th ed. Boston: Addison Wesley Longman, 2001.

Rosenzweig, M., and H. P. Binswanger. “Wealth, Weather Risk, and the Composition and Profitability of Agricultural Investments.” *Economic Journal* 103(1993): 56–78.

Schuh, G. E. Agriculture as an Engine of Economic Growth. *The Globalization of Science: The Place of Agricultural Research.* Bonte-Friedheim, C., and K. Sheridan, Eds. The Hague: International Service for National Agricultural Research, 1997.

Sebstad, J., M. Cohen, and E. McGuinness. “Guidelines for Market Research on the Demand for Microinsurance.” USAID Accelerated Microenterprise Advancement Project (AMAP) Report, Microfinance Opportunities and Abt Associates Inc., Washington, DC, June, 2006.

Shandong Insurance Website (in Chinese). http://www.sdbx.org/bestnewsdata.jsp

Shandong Statistic Year Book 2006. People’s Republic of China: China Statistics Press, 2007.

Skees, J. R. “Challenges for Use of Index-based Weather Insurance in Lower Income Countries.” *Agricultural Finance Review* 68(2008): 197–217.

Skees, J. R., and B. J. Barnett. “Enhancing Microfinance Using Index-based Risk-Transfer Products.” *Agricultural Finance Review* 66(2006): 235–250.

Skees, J. R., and B. J. Barnett. “Conceptual and Practical Considerations for Sharing Catastrophic/Systemic Risks.” *Review of Agricultural Economics* 21(1999): 424–441.

Skees, J. R., A. Goes, C. Sullivan, R. Carpenter, M. J. Miranda, and B. J. Barnett. “Index Insurance for Weather Risk in Low Income Countries.” USAID Microenterprise Development (MD) Office, USAID/DAI Prime Contract LAG-I-00-98-0026-00 BASIS Task Order 8, Rural Finance Market Development, 2006.

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