Efficiency of Weather Index Insurance in Hedging Rice Yield Risk

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Crop insurance, as a risk management tool has been widely adopted across the world. However, traditional crop insurance schemes have suffered severe moral hazard (Just and Calvin, 1993b; Coble, etc., 1997) and heavy loss investigation expenses. Efficiency of traditional crop insurance has been questioned and it is seemed to be necessary to reconsider the scope and use of such schemes (Makki, 2002). On the other hand, Miranda and Coble (1997) argued that systemic risk, not asymmetric problems might pose more serious obstacle to private crop insurance market. Alternative agriculture insurance schemes are suggested. Among which, weather index insurance has received a great deal of attention. Since index contracts are designed to provide efficient means of risk transfer rather than risk pooling, systemic risk is no longer a problem. In fact, index contracts work even better when the risk being transferred is somewhat systemic (Vedenov and Barnett, 2004). Besides, as index insurance claim payments are determined by certain index other than individual loss, the problems of moral hazard and adverse selection are minimized (Turvey, 2001). Weather index insurance is regarded as a cost-saving and market-transparent program.

Weather index instruments have been piloted in some developed countries, such as Canada, and in several developing countries, such as India, Malawi, and Morocco etc with the technical support of WFP and IFAD (Skees, et al., 2001; Patt, 2009). However, the application of index instruments in worldwide agricultural area has been very limited though weather index insurance was suggested to be an effective tool of agricultural risk transfer in developing countries (World Bank, 2007). So, Index insurance is still underdeveloped and worth further study.

The advantage of weather index insurance to minimize moral hazard makes it attractive to Chinese agricultural insurance market. Chinese agriculture insurance, as the second largest market in the world is suffering from ineffectiveness in reducing farmers' production risk (Shi, 2012). One main reason is that the insurance amount is too low to cover farmers' losses. Intuitively, raising insured amount is a means to improve the efficiency of agricultural insurance plan. Practically, Chinese agriculture insurance firms hesitate to raise the insured amount for they have little advanced as well as economic techniques to mitigate moral hazard even although farmers are eager to be insured against with higher coverage.

Weather index insurance is expected to help Chinese crop insurance get rid of the dilemma. Some crop index insurances have been piloted or developed in China. However, all of these index insurance pilots are based on single risk, which could not satisfy the needs of farmers whose agricultural production activities are involved in a variety of weather risks.

This article aims to design a composite index insurance and examine its risk-reducing effect by case study of Chinese rice production. It extends and improves in two aspects. First, we construct complex index insurance by considering the entire possible weather factors that significantly affect rice yield in our model. Compared to the studies that focus on one or two weather factors, complex index insurance has more practical value. Second, in order to better capture the subtle relationship between weather factor and yield, we use sub-period weather data by dividing the entire rice growth cycle into several phases. Subdivision reflects that the distribution other than the aggregation of weather factors, such as precipitation, sunshine hours are more important for rice growth.

Meteorological data is from China Meteorological Data Sharing Service System and rice yield data is from Statistical Yearbooks. Sample period is from 1990 to 2010. In order to mitigate basis risk, we get weather data by choosing weather stations that are nearest to the centers of rice production counties. The average distance between the center of each county and the weather station is about 35 kilometers. We use semi-log

regression model to capture the statistically significant weather factors to yield. Then, we adopt kernel smoothing to determine the distribution of loss caused by weather factor. We use VaR and mean-semivariance to assess the risk reduction effect of index insurance. Empirical results show that farmers yield risks are considerably reduced by composite index insurance.

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