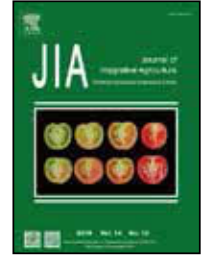




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RESEARCH ARTICLE

## Is the crop insurance program effective in China? Evidence from farmers analysis in five provinces



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### Abstract

This paper aims to evaluate the effectiveness of the Chinese crop insurance program in terms of farmers' utility and welfare. A simulation model based on the power utility function was first developed to evaluate the effectiveness of crop insurance. Then, the Monte Carlo approach was used to generate the datasets of area, price, yield, cost, and income based on the characteristics of representative farmers, which were clustered and calibrated using the farm-level data of 574 individual farmers from five Chinese provinces. Finally, the effectiveness of Chinese crop insurance was evaluated by comparing the certainty equivalence (CE) of farmers' utility/welfare under alternative crop insurance scenarios. Government subsidy is a necessary premise for implementing the crop insurance program. The government should subsidize more than 50% of the crop insurance premium to motivate more farmers to participate in the program. The findings also show that the current crop insurance program in China has increased the farmers' welfare but still need to be improved to achieve the Pareto improvement and to make full use of the financial fund of the government. This paper is believed to not only extend academic research but also has significant implications for policymakers, especially in the context of rapid development of Chinese crop insurance with much issues such as rate, subsidy and coverage level needed to be improved.

**Keywords:** crop insurance, effectiveness evaluation, expected utility model, China

## 1. Introduction

Agriculture is an important industry for almost all countries, especially for developing countries with high population

density such as China. However, agriculture is also considered a high-risk sector because it continually faces risks in production due to adverse weather conditions that farmers cannot control. Droughts, floods, and other natural disasters may result in serious consequences, such as crop failure, poverty, and food insecurity. To minimize the effect of adverse weather on the income of farmers, more than 100 countries have conducted crop insurance program (Mahul and Stutley 2010). The Chinese government has also paid more attention to developing a crop insurance program. The Chinese agricultural insurance program has been very successful since its establishment in 2007, when the central government began to provide a premium subsidy. The premium of Chinese agricultural insurance rose to 30.6 billion

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CNY (appropriately 5 billion USD) in 2013 from 5.2 billion CNY in 2007 and 24.06 billion CNY in 2012. Until now, China is the first and the second agricultural insurance market in terms of premiums in Asia and in the world, respectively (<http://www.circ.gov.cn/web/site0/tab5212/info140976.htm>).

Along with rapid development, the Chinese government had allotted an increasing fund to subsidize crop insurance program. Now, the Chinese government subsidizes more than 70% of crop insurance premiums. In 2012, the central government of China, who can afford to pay 40–50% of the premium subsidy, paid 10 billion CNY to the agricultural insurance program. At the same time, the low insured value of the Chinese crop insurance program was criticized in China. Current Chinese crop insurance only covered some of the physical costs during crop planting, which account for 25 to 40% of crop returns. Thus, government officers, agricultural economists, and farmers argue that the insured value of crop insurance is excessively low and may be of no use for farmers. Therefore, the serious question of valuing Chinese crop insurance has been proposed, and the effective evaluation of the Chinese crop insurance program was highlighted.

In the literature from the end of the 1990s, agricultural economists began to study the effect of crop insurance, revenue insurance, hedging, loans, and other risk management tools. Certain scholars investigated the effect of crop insurance on agricultural production (Hennessy 1998; Coffey *et al.* 2001; O'Donoghue *et al.* 2005), and some explored the effect of crop insurance on farmers' welfare (Wang *et al.* 1998; Chen *et al.* 2007). Other scholars studied the interaction of alternative risk management tools (Coble and Heifner 1998; Coble *et al.* 2004; Wang *et al.* 2004; Antón and Kimura 2009). Most of them had evaluated the effect of risk management tools under the expected utility framework and conducted empirical studies that adopted a robust stochastic simulation approach. However, in China, the majority of studies focused on the theoretical discussion of the necessary and potential effect of subsidizing crop insurance (Tuo and Wang 2003; Wu 2005; Zhang *et al.* 2005; Shi 2008; Hou *et al.* 2010), with the exceptions of Zhang and Shi (2007) and Sun and Zhong (2008). Zhang and Shi (2007) investigate the crop insurance effect in theory by analyzing the issues of crop insurance subsidy and social welfare, but they fails to conduct an empirical study. Sun and Zhong (2008) estimated the net welfare of subsidized crop insurance by calculating the farmers' willingness to pay (WTP) based on survey data. However, this approach, compared to the stochastic simulation approach, lacks the feasibility to be used for hypothesis research.

Agriculture insurance is initially designed to stabilize

the income of farmers by helping them fight against yield loss due to adverse weather. Thus, evaluating the effect of crop insurance from farmer's perspective is valuable and meaningful. However, no studies evaluate the effectiveness of the Chinese crop insurance program from the perspective of farmers and no studies have adopted the stochastic simulation approach, which has the advantage of analyzing the interactions among different policies, allowing the analysis of the possible consequences of modifying crucial points in each policy (Kimura and Thi 2011). This study conducts a quantitative assessment of Chinese crop insurance effectiveness based on the welfare of individual farmers. In this paper, using farm-level data of 574 individual farmers from the provinces of Shandong, Henan, Jiangsu, Sichuan, and Shaanxi, the effectiveness of Chinese crop insurance is evaluated by comparing the certainty equivalence (CE) of the utility/welfare of representative farmers under alternative crop insurance policy scenarios. This paper is believed to not only extend academic research but will also contribute to the better design of the Chinese crop insurance program.

The rest of this paper is organized as follows: the second section describes the methodology. The sample data and empirical results are shown in the third section. The fourth section presents the discussion based on empirical results, and the conclusion and policy implications are presented in the final section.

## 2. Methods and data

### 2.1. Methods

The basic idea to evaluate the effect of Chinese crop insurance in this paper is to compare farmer welfare in alternative scenarios. Four scenarios, including no crop insurance (NOCI), Chinese current crop insurance (CCI), modified crop insurance (MCI) and directly subsidizing farmers (DSF) are hypothesized in this paper. The process to achieve this goal can be divided into four steps.

**Step 1: Estimating farmer welfare** In economic theory, expected utility model is the most general approach for comparing risky choices and studying risk behaviors under uncertainty. Thus, a simulation model based on expected utility function was developed in this paper to estimate farmer welfare. Similar to previous studies (Turvey 1992; Wang *et al.* 1998; Coble *et al.* 2000; Lin 2001), this paper also adopted the power utility function (eq. (1)) to compute for farmer utility.

$$U(w_0+w) = \frac{1}{1-\theta} (w+w_0)^{(1-\theta)} \quad (1)$$

Where,  $\theta$  depicts the constant relative risk aversion

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