Is Insurance effective on relieving Credit Rationing towards Farmers?

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Abstract: Under the theoretical framework of information asymmetry, this paper discovers that the existence of insurance can mitigate impact of asymmetric information and helps to improve the expected return and willingness to supply. Further through case study of an insurance-credit cooperation program in Shaanxi Province of China, this research suggest the inadequacy of insurance item and coverage level should be particularly addressed, as well as supportive measures from the public sector should be implemented before insurance can essentially be an alternative mean to support credit supply to rural household.

1. Introduction

In an average credit market, collaterals and mortgages, through signaling and monitoring, are generally regarded as effective means to deal with information asymmetry that normally results in credit constraints. In Chinese rural environment, the average production units are mostly small-scaled, together with the spatial dispersion, information collection and risk evaluation of the credit institutions inevitably subject to great cost, resulting in even severe asymmetry. While the mortgage financing of farmland has long been restricted institutionally, and average farmers' asset, wealth and ability to earn is generally below the credit grating conditions of formal credit. The insufficiency of qualified collateral resulted in significant difficulties for average rural household in China to get formal credit support, which has not been improved essentially even the financial support from the public sector has been intensified and credit institution branches in rural areas has been increased dramatically since the 16th National Congress of CPC in 2002.

Credit and (agricultural) insurance are both frequently utilized means of financial support in developing countries. In China, in 2009 the No. 1 Central Document stated that "interactive system of rural credit and agricultural insurance" was to be implemented, and after then there have been many innovative approaches utilizing insurance, often requiring a crop insurance, property insurance for production asset, accident insurance for the main bread earner, or a credit insurance as the condition for credit support. Such kind of measures, in some areas of China, were considered effectively improving access to credit and enhanced average amount financed (Niu Hao et al,2014[1]), but in other areas far less behind expectation or subject to sustainability problems(Yue Yi-Ding & Li Jun,2011[2]). Before system and policy design, the relationship between the two supplies should be theoretically analyzed. This is what this paper meant to do.

Up to now, research on the impact of insurance on credit supply has mostly focused on the summary of practice in various region, and also empirical analysis investigating on the interrelationship between insurance premium and credit volume(Olubiyo and Hill, 2005[3]; Ifft et al, 2015[4]), resulting in contrasting conclusions on the function of insurance on credit supply.

Compare to empirical research, theoretical work on this subject has not received much attention. Binswanger (1986) stated that insurance can substitute collateral by increasing the lender's expected return, but also argued that impact of insurance on credit supply can be very different in subject and risk insured, as well as coverage level. Liu Zuo Xiang et al. (2012)[5] discovered a positive relationship between insurance and volume of credit granted. By highlighting the environmental characteristics of asymmetric information, this paper intends to construct a theoretical model and investigate on impact of insurance on credit supply through the profit-maximizing choices of rural household and credit institution.

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2. Theoretical Analysis

Assume there are more than one farmer household in need of credit support to invest in its chosen one project, and there is a bank providing loans with interest rate r, ^{i}、^{B_j}和^{W_j}are risk-free rate, loan amount that the farmer household j receives and its initial wealth, respectively. Other assumptions includes: (1)The households and bank are all rusk-neutral;(2) No collateral or mortgage; (3) probability of success for the jth project is^{p_j}, with return^{R_j}when it is success,and 0 otherwise. All the project have the same expected return R; (4) the bank has no idea of the riskiness of every project (^{p_j}), but it does know the density function of the probability distribution in all household projects$^{f(p)}$.

Without considering insurance, the expected return$^{\pi_{fj}}$for the jth project would be:

$$\pi_{fj} = R - p_j(1+r)B_j - (1+i)W_j \tag{1}$$

The farmer household will only apply for credit if the expected return from investing is greater than 0, so the critical probability $^{\dot{p}_j}$ for the jth household is$\dot{p}_j = R-(1+i)W_j/(1+r)B_j$, and the probability interval for the credit application would be$^{[0,\dot{p}_j]}$. Now denote $^{\dot{p}}$、W 和 B as the general symbol of critical success probability, initial wealth and loan amount. Then we have: $\dot{p} = R-(1+i)W/(1+r)B$, and the average success probability after the granting of credit would be:

$$\bar{p} = \int_0^{\dot{p}} pf(p)dp \Big/ \int_0^{\dot{p}} f(p)dp \tag{2}$$

The derivative of $^{\bar{p}}$ to r is:

$$\frac{\partial \bar{p}}{\partial r} = \frac{\partial \dot{p}}{\partial r}\dot{p}f(\dot{p})\int_0^{\dot{p}} f(p)dp - \frac{\partial \dot{p}}{\partial r}\int_0^{\dot{p}} pf(p)dp \Big/ \left(\int_0^{\dot{p}} f(p)dp\right)^2 = \frac{\partial \dot{p}}{\partial r}f(\dot{p})\left[\dot{p}\int_0^{\dot{p}} f(p)dp - \int_0^{\dot{p}} pf(p)dp\right] \Big/ \left(\int_0^{\dot{p}} f(p)dp\right)^2 \tag{3}$$

Since $\dot{p}\int_0^{\dot{p}} f(p)dp - \int_0^{\dot{p}} pf(p)dp > 0$,so the symbol of $^{\frac{\partial \bar{p}}{\partial r}}$is the same with $^{\frac{\partial \dot{p}}{\partial r}}$, meanwhile we have $\frac{\partial \dot{p}}{\partial r} = \frac{(1+i)W-R}{(1+r)^2B}$, then it can be seen that if $^{R>(1+i)W}$, $^{\frac{\partial \bar{p}}{\partial r}<0}$, this implies that if the expected return is greater than the initial wealth, that is if the farmer households choses to apply, the average success probability will display a negative relationship with the interest rate, this is essential what is illustrate in Stiglitz and Weiss(1981)that adverse selection makes the expected return of bank begin to decline after its initial increase when interest rare reach a certain level.

When insurance and credit are contractually connected, insurance is purchased as a condition for credit, and insurance indemnity will be paid to the bank predominantly to the bank if the project fails. Assume that the premium of insurance is Y, indemnity X, then the expected return for individual household after the purchasing of insurance would be:

$$\pi_f = R - p[(1+r)B+Y] - (1-p)Y - (1+i)W \tag{4}$$

In this case the critical success probability for the farm household to apply for credit would be $\dot{p}' = R-Y-(1+i)W/(1+r)B$. The average success probability for all the project after the purchase of insurance is denoted as$^{\bar{p}'}$,derivative of $^{\bar{p}'}$ to r is then:

$$\frac{\partial \bar{p}'}{\partial r} = \frac{\partial \dot{p}'}{\partial r}f(\dot{p}')\left[\dot{p}'\int_0^{\dot{p}'} f(p)dp - \int_0^{\dot{p}'} pf(p)dp\right] \Big/ \left(\int_0^{\dot{p}'} f(p)dp\right)^2 \tag{5}$$

And the expected rate of return per unit is:

$$\pi_b/B = \bar{p}'(1+r) + \left(1-\bar{p}'\right)\frac{X}{B} - (1+i) \tag{6}$$

$$\frac{\partial \pi_b/B}{\partial r} = \bar{p}' + \frac{\partial \bar{p}'}{\partial r}\left(1+r-\frac{X}{B}\right) \tag{7}$$

This time, we have $\frac{\partial \dot{p}'}{\partial r} = \frac{(1+i)W+Y-R}{(1+r)^2 B}$, it can be seen that when $Y > R-(1+i)W$, $\partial \dot{p}'/\partial r > 0$, $\partial \overline{p}'/\partial r > 0$, then when $R-(1+i)W < Y$ and $X < (1+r)B$, we have: $\partial \pi_b'/\partial r > 0$

The bank's expected rate of return increases with the rate of interest, rather different from that without insurance. This result tells us that when insurance coverage is enough, meaning the actuarial fair premium is greater than the difference of project return and accumulated value of initial wealth, meanwhile insurance indemnity is no greater than the loan principal and interest, that is insurance does not result in moral hazard behavior, the expected return of insurance and interest rate would be monotonously positive related.

The theory underlying this mechanism, is in risk sharing and better information structure that insurance functions. A well designed insurance program is to improve risk bearing capacity of the insured. If insurance loss compensation can be used to repay loans, it can also reduce the risk of applicant becoming defaulter of credit, the compensation of indemnities in the case of crop failure enables the farmer to repay his debts and maintain his credit line with financial institutions, then insurance also makes itself an substitute for collateral, enhancing the credit worthiness of applicant.

Secondly, insurance itself is essentially a risk pooling mechanism based on law of large numbers, which requires the independence and same distribution between individual pooling units. The latter condition suggests that individual units should not vary very much in their riskiness. Therefore the insurance companies tend to acquire knowledge of the riskiness of individual applicant. In the cooperation between credit and insurance sector, this information are probably shared with credit institutions, whose information–obtaining can be very costly. Thus insurance can in effect function as a mechanism that improve the information structure between the credit supply and demand.

3. Practice Analysis: Case Study of Shaanxi Province of China

From 2010, PICC and the provincial government of Shaanxi Province began to implement "Yin Bao Fu" program, requiring a crop insurance, property insurance for greenhouse facility, accident insurance for the main bread earner as the condition for credit support, and subsidize insurance premium and loan interest. Open data showed that till the end of 2012, there were in all 1,800 farmer household participated in this program, accumulated premium amounted to 20,120 million RMB, and over 60,000 million RMB loan was grated to farmer household in this area.

In December, 2014, the research group of this paper conducted a field investigation in YangLing of Shaanxi Province which was among the first ones to implement "Yin Bao Fu". The investigation found that between 2013 and 2014, government promotion for this program had been relatively reduced, resulting in substantial decrease of employing insurance as a financial support to the situation of newly built facilities and the refinancing of existing projects. This implies that without of the government organization and support, rural credit institutions and insurance companies have little incentive to cooperate. The reasons underlying this phenomenon, besides the low expectation of return concerning rural credit, lies more in the significant inadequacy of insured item and insurance coverage in the current agricultural insurance context.

According to the statistics of CIRC, in 2015, crops underwritten in China amounted to a total of 14.5 million mu, accounting for 59% of the national acreage. Yet over 80% of the acreage insured are currently for food crops, cash crops that rely more on credit support has not been insured to an extent that meet the production sector's demand. Taking Shaanxi province as an example, cash crop insurance by now only cover cotton, rape, apple, walnut, jujube and pepper, no specialized insurance for the target crop vegetable and fruit in the "Yin Bao Fu" Program. Another problem is the inadequacy of insurance coverage in the current agricultural insurance program. The vast majority of agricultural insurance in China are cost insurance. Taking Shaanxi Province as an example, the coverage for rape, cotton, walnut, jujube are only 300, 400, 1000, and 700 RMB per mu, only accounting for a very small portion in expected revenue and the amount of general loans. The low level of crop insurance coverage, on one hand cannot attract the effective demand of farmer household, on the other hand, not qualified as support for credit application.

4. Policy Application

The policy application for this study lies in that: insurance can be an alternative and effective mean to mitigate the credit constraints toward the farm sector. The bank and insurance sectors in rural credit should be treated with the view of "interconnection", and the role of insurance sharing credit risk and improving information structure should be further exerted. Therefore, it is necessary to create a favorable legal and policy environment.

Firstly, the public sector should gradually give confirmation to credit and insurance collaboration mechanism through the special legislation or the amendment to the existing laws and regulations, especially the current restrictions on insurance indemnity used for debt repayment. Also, the public sector should improve the awareness and recognition of the banks, insurance institutions and the farmers on the role of insurance.

Secondly, fiscal and taxation measures should be harnessed to give incentive for the insurance companies to further improve their insured item and coverage, design insurance products that are better targeted to local credit crops, including credit guarantee insurance, and price and revenue insurance that have higher protection.

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