THE SUSTAINABILITY OF MICRO-CREDIT SYSTEM IN RURAL CHINA: CONSIDERING FARMERS' LONG-RUN UTILITY

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1. Introduction

Micro-credit is becoming more and more popular and helpful in the world because of its innovative design and poor-focusing purpose. Many people and institutions (the World Bank, the Grameen Bank, ProFI, BKDs, BANCOSOL and so on) are applying themselves to applying, generalizing and improving micro-credit programs, although they have different ideas about what is micro-credit. According to OECD, micro-credit programs offer loans and/or technical assistance in business development to poor people[1]. And in general, micro-credit has one or more of the following three goals[1].

(a) Improvement of self-sufficiency and welfare of poor entrepreneurs.
(b) Development of stable sources of income and full-time employment.
(c) Expansion of micro-enterprises to larger firms.

Because of its born characteristics, micro-credit does make much meaningful improvement in the outreach and relevance of credit for the poor. Jonathan Morduch[2] shows that micro-credit has the following advantages at least.

(a) Contract innovations like "Group Lending" mitigate the problems created by informational asymmetries.
(b) High repayment rate.
(c) Make credit really reach poor individuals, particularly women.
(d) Reduce government involvement.
(e) Pay close attention to the incentives that drive efficient performance.

The quick economic development and more governmental attention on the development of rural China cause more and more available loan (especially micro-credit loan) resources for farmers in rural China[3].

Under the monitoring of the People's Bank of China (PBC), Rural Credit Cooperatives (RCCs) are the main institutions that supply farmers with loans in the forms of individual micro-credit and group lending micro-credit. The latter form comes from Grameen Bank mode. During 1950s, Chinese Rural Credit Cooperatives (RCCs) were found as the rural primary organizations of the bank. Their main function is to supply farmers with necessary loan for agricultural production. In 1996, rural financial system reformation happened. The Agricultural Bank of China has no longer supervising right on Rural Credit Cooperatives (RCCs). The latter are becoming the cooperatives that make their own management decisions[4]. Individual and group-lending micro-credit loans from RCCs were put into practice in 1996 and popularized in 2000. The loan interest rate should be decided by RCCs with considering about the basic interest rate set by People's Bank of China. Loan term is always 1 year. In the end of 2002, 93% of RCCs are

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operating micro-credit loans. And more than 20% farmers got micro-credit loans. When the loan size is relatively bigger, the group-lending is proposed. The loan group consists of 3-5 farmers. They have mutual monitoring among themselves[4].

According to current study on RCCs, they have some intractable insufficiencies[5)-6)]. One of them is that the sustainability of Rural Credit Cooperatives is being challenged. Because of relatively high credit risk, RCCs' income can not cover relatively high operation cost. The root of credit risk is farmers' unsuccessful repayment induced by their ignoring about RCCs' sustainability. As we know, the unsuccessful repayment will damage the sustainability of RCCs because the cost of capital and even the capital itself will not be gotten back. That is not good for RCCs to supply farmers with long-term micro-credit. And without long-run loan support, farmers can not make crop or animal production continue. As one certain but bad result, farmers' long-run benefit will also be damaged. Equally important, we cannot stop the micro-credit supplying from RCCs, because that will affect farmers' current welfare and even their future benefit. So what can we do? For solving above embarrassment, this paper introduced one model in which farmers know that the long-run benefit will come in the future if they put adequate attention and effort on their repayment to RCCs and make RCCs can supply durative loan service. In the following, we will show farmers and RCCs how to reach the maximizations of expected utility and sustainability.

2. Model and Results

(1) Basic idea

It is seen from Fig. 1 that in our model there is some kind of future benefit that connects RCCs' sustainability with farmers' expected utility. For simplifying the analysis, we supposed a two-period model in which we have two parties: RCCs and farmers. At first, RCCs decide the size of loan and the loan interest rate. Then in the first period, farmers get loans from RCCs and decide their effort invested in cultivating. Farmers' effort will decide the probability of successful crop and RCCs' surviving from period 1. Here we use RCCs' surviving to stand for their sustainability. Farmers' expected utility in period 1 equals to the income from successful crop minus the cultivating effort. And if RCCs still exists in period 2, farmers will get the long-run benefit in the future. Under the contract supplied by RCCs, farmers' effort in period 1 decides his two-period expected utility. So farmers will choose adequate cultivating effort to maximize their two-period expected utility. Including farmers' welfare, we suppose, RCCs also care about their own sustainability. So with considering farmers' optimal cultivating effort, RCCs would like to maximize their sustainability by offering appropriate loan contract.

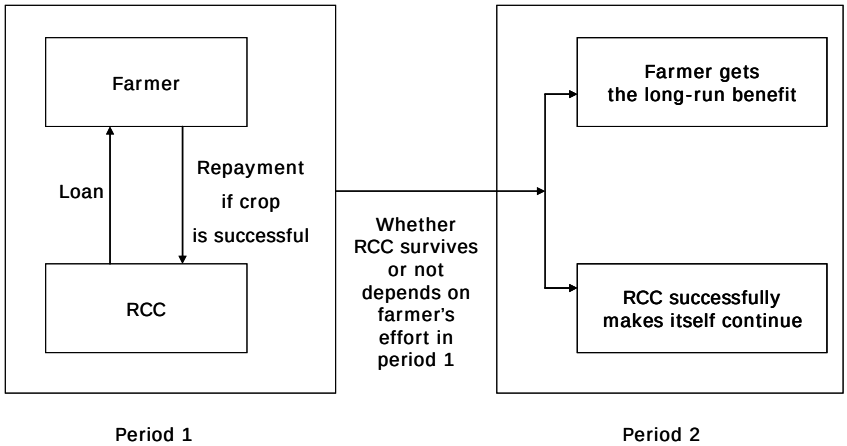

Fig. 1 Basic idea of the mechanism for prompting farmers to care about RCCs' sustainability

(2) Variables

We suppose the successful crop needs two factors: monetary input and labor. These two factors are not substitutive. Farmers get loan from RCCs and use it as monetary input to cultivate with the labor of their own. And farmers can not work outside their farm. For the coming calculation and analysis, we define the variables of our model as follows.

(a) We suppose the farmers are homogeneous and the number of them is standardized to 1.

(b) m : We let m be the loan that farmers get from RCCs. Here m is decided by RCCs.

(c) $f(m)$: We let $f(m)$ be farmers' production function in which $f^{'}>0, f^{''}<0$.

(d) r : We let r be the loan interest rate asked by RCCs.

(e) E^f : We let E^f be the effort that farmers invest in cultivating.

(f) $\gamma(E^f)$: We let $\gamma(E^f)$ be the probability of successful crop in which $\gamma(0)=0, \gamma^{'}>0, \gamma^{''}<0$.

(g) R : We let R be the operation cost for the loan from RCCs to farmers.

(h) We suppose the repayment rate equals to $\gamma(E^f)$. Then we let the probability of RCCs' surviving be

$$\Phi=\gamma(E^f)\cdot\frac{r}{R}.$$

(i) ρ : We let ρ be the market interest rate that is identical to the discount rate. We suppose $\rho>r$.

(3) Results

Obviously, we have farmers' expected utility at period 1 as (A) shows.

$$u=\gamma(E^f)\cdot[f(m)-m\cdot(1+r)]-E^f \tag{A}$$

According to above assumptions, the total expected utility of farmers in the future is as (B) shows.

$$U=u+\frac{\gamma(E^f)\cdot r}{(1+\rho)R}\times u+[\frac{\gamma(E^f)\cdot r}{(1+\rho)R}]^2\times u+\cdots+[\frac{\gamma(E^f)\cdot r}{(1+\rho)R}]^n\times u+\cdots$$

$$=u+\frac{\gamma(E^f)\cdot r}{(1+\rho)R}\times\{u+\frac{\gamma(E^f)\cdot r}{(1+\rho)R}\times u+[\frac{\gamma(E^f)\cdot r}{(1+\rho)R}]^2\times u+\cdots+[\frac{\gamma(E^f)\cdot r}{(1+\rho)R}]^n\times u+\cdots\}$$

$$=u+\frac{\gamma(E^f)\cdot r}{(1+\rho)R}\times U \tag{B}$$

Where $\frac{\gamma(E^f)\cdot r}{(1+\rho)R}\times U$ is the long-run benefit.

According to (B), we have the expression of U as (C) shows.

$$U=R(1+\rho)\times\frac{\gamma(E^f)\cdot[f(m)-m\cdot(1+r)]-E^f}{R(1+\rho)-r\cdot\gamma(E^f)} \tag{C}$$

It is easy to know that U only depends on farmers' cultivating effort if the loan size m and loan interest rate r are fixed. So we have farmers' optimal problem as (D) shows.

$$\underset{E^f}{Max}U=R(1+\rho)\times\frac{\gamma(E^f)\cdot[f(m)-m\cdot(1+r)]-E^f}{R(1+\rho)-r\cdot\gamma(E^f)} \tag{D}$$

In order to maximize U , we need the first order condition about E^f as (E) shows.

$$G=\{\gamma^{'}(E^f)\cdot[f(m)-m\cdot(1+r)]-1\}\cdot R(1+\rho)+r\cdot\gamma(E^f)-E^f\cdot r\cdot\gamma^{'}(E^f)=0 \tag{E}$$

Where we let G be the implicit function implied by (E).

According to the theorem of implicit function, we get the following results.

$$\frac{dE^f}{dm} = -\frac{\partial G/\partial m}{\partial G/\partial E^f} = \frac{-R(1+\rho)\cdot\gamma'(E^f)}{\gamma''(E^f)\cdot\{R(1+\rho)[f(m)-m\cdot(1+r)]-r\cdot E^f\}}\cdot[f'(m)-(1+r)] \quad \text{(F)}$$

$$\frac{dE^f}{dr} = -\frac{\partial G/\partial r}{\partial G/\partial E^f} = \frac{\gamma(E^f)-\gamma'(E^f)\cdot[R(1+\rho)+E^f]}{-\gamma''(E^f)\cdot\{R(1+\rho)[f(m)-m\cdot(1+r)]-r\cdot E^f\}} \quad \text{(G)}$$

According to above assumptions, with considering farmers' welfare, RCCs would like to maximize Φ by choose appropriate loan size m and loan interest rate r. That requires the following partial derivatives to be zero.

$$\frac{d\Phi}{dm} = \frac{r}{R}\times\gamma'(E^f)\times\frac{dE^f}{dm} = 0 \quad \text{(H)}$$

$$\frac{d\Phi}{dr} = \gamma'(E^f)\cdot\frac{dE^f}{dr}\cdot\frac{r}{R}+\gamma(E^f)\cdot\frac{1}{R} = 0 \quad \text{(I)}$$

Because $R(1+\rho)[f(m)-m\cdot(1+r)]-r\cdot E^f > f(m)-m\cdot(1+r)-E^f > 0$, so the sign of (F) depends on $f'(m)-(1+r)$. Then based on (F) and (H), we have the relationship between m and r as (J) shows.

$$f'(m)-(1+r) = 0 \quad \text{(J)}$$

And based on (G) and (I), we can get another implicit function of m and r as (K) shows.

$$\varphi(m, r, E^f) = 0 \quad \text{(K)}$$

At last, based on (E), (J) and (K), we can get farmers' optimal cultivating effort E^{f*} and RCCs' optimal loan interest rate r^* and loan size m^*. In the future presentation, we will show some numerical examples.

3. Conclusions

In this paper, we introduced the long-run benefit to motivate farmers to care about RCCs' sustainability. According to this idea, we figured out the interactive behaviors between RCCs and farmers by one two-period model. Based on the calculation, we found out that RCCs should make a careful balance between loan size m and loan interest r.

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