Collective Credit and Behavior Restriction: the Analysis and Improvement of the Credit Village Assessment for Risk Control in Liuyang, China

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Introduction

Background

Chinese government attaches great importance to rural financial institution reform

According to the No.1 Central Document released by the central government in 2014, it imposes additional stress on the innovation of the rural financial system to serve the agriculture, rural area and farmers.

Introduction

The necessity for rural credit risk control

Higher uncertainty of peasants' household income and agricultural production

Improve interest rate would cause adverse selection and moral hazard (Hoff, Stiglitz, 1990)

Financial institution tends to absorb deposits from rural area and lend to urban area (Turvey, 2013)

Introduction

Chinese manner for risk control

The key way is guarantee, to lower the information asymmetry and to improve the expected profit of the loan (Chan Y, G Kanatas, 1985)

In China, a peasant can ask someone trustworthy or some guaranteed institution according to the standard of the financial institution or join a borrower group or buy a micro-credit insurance

Introduction

Guarantee for credit in China

Guarantor ⟷ Limited by the peasants' circle of friends
Unstable income made others afraid to guarantee for them

Borrower group ⟷ Tend to choose peasants with similar financial position (Zhao, He, 2007)
Financial institution controls poor peasants' line of credit (He, 2002)

Micro-credit insurance ⟷ Limited scope of application
Red tape hard for the peasants to suffer

Introduction

The necessity for our research

The Credit Village Assessment has been conducted in some provinces in China and proved its success for risk control to some extent.

Very few researches involved with such a mechanism, leaving a huge blank to fill.

Based on our fieldwork, we believe that it is also a valuable mechanism to recommend to the whole country, even to other countries.

Introduction

Our contribution

Conduct a comprehensive analysis on the Credit Village Assessment.

Compared with the traditional mechanism, build models and emulate the game between the peasants and the financial institution from an evolutionary perspective to prove the innovative mechanism’s advantage.

Combining the fieldwork and the theoretical analysis, provide the direction for its improvement.

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Fieldwork Experience

The development of the rural financial institution in Liuyang

The profit of banking financial institution rose by 25.39% to 1.12 billion yuan, with a loan balance of 22.86 billion yuan, among of which the agricultural related loan was 13.48 billion yuan. While the balance of nonperforming loans and its proportion in total loans has been continuous decreasing, which were only 0.12 billion yuan and 0.5 percent in 2012.

The per capita disposable income of rural residents has risen much higher than the national average level and even exceeded the average level of some eastern developed cities.

Fieldwork Experience

Some characteristics of the rural society in Liuyang

1) Middle and old aged peasants are willing to return their village, regarding employment in cities just as their means of livelihood.

2) Peasants attach great importance to their reputation in the village which strongly influence not just on themselves but also on their family.

3) If someone harms the interest of the village, other villagers will despise him even his family whenever they gossip about his behavior

Fieldwork Experience

Some characteristics of the rural society in Liuyang

4) Peasants tend to live in concentrated communities, and the villagers intermingle more often with each other rather than with those from outside.

5) Rural credit has high market demand nowadays but the financial institutions' service can't sufficiently satisfy the peasants' requirement.

Fieldwork Experience

Some key measures of the Credit Village Assessment

1) Villages are re-tested every year, and the loan repayment rate in the evaluative year is the key part of the mechanism, which is the reference for financial institution to decide whether to improve or lower the credit line of the whole village.

2) The financial institution cooperates with the government to commend and reward the credit village every year, and those awarded village can receive different preferential policies in services or credit interest rates.

Fieldwork Experience

Some key measures of the Credit Village Assessment

3) The village cadre plays an important role in the credit rating of the villager, which will be awarded if he finishes the performance appraisal indicator. And he will receive subsidies in the form of a percentage of non-performing loans which he helps the financial institution call back.

4) Those who default the loans will be noticed publicly. And when the default rate reaches a certain level, the reputation of the Credit Village already gained would be withdrawn.

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Fundamental Analysis

Information asymmetry still exists in the rural area in China, which hinders the financial institution to control the rural credit risk.

Credit Village Assessment is designed to break the predicament of information asymmetry.

The core of this mechanism is collective credit and behavior restriction. Collective credit means that rural financial institutions assess the credit status of the whole village and grant a blanket credit limit based on this assessment. Behavior restriction is the peer monitoring due to the associated responsibility and the supervision of the village cadre.

Fundamental Analysis

Collective credit and behavior restriction are interrelated

Peasants monitor each other due to the collective penalty and reward on the village, which is indirectly related to their own interests. Exploit informational advantage and grant villagers the incentive to exercise the supervisory power, make those who want to default weigh pros and cons.

Make use of the special status of the village cadre and his relative information advantage, well-informed about more detailed personal information of the peasants, to help modify the peasants' line of credit.

Fundamental Analysis

A principal-agent relation exists between the financial institution and the village cadre. The financial institution gives the village cadre title to the net earnings of the village's nonperforming loans, in practice the commission. And the political achievement bringing by the title of "Credit Village" also inspires the village cadre.

Financial institution only needs to provide a standard line of credit for the village cadre to adjust and conduct annual inspection to redistribute total loan amount of the village according to the total repayment rate. Its information cost and monitoring cost is reduced which makes this system achieve a Pareto Optimality.

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Modelling

Assumption

The financial institution evaluates the line of credit of every peasant based on the information it can acquire about the peasants' wealth.

The line of credit cannot always satisfy every peasant's demand. The total loan amount provided is limited and fixed, and is allocated in proportion according to the line of credit.

At the beginning of each period, the financial institution will upgrade its inference about the peasants' project expected return according to historical information

Personal credit assessment

The repayment probability of peasant *i* in the *t* period, meets the following requirement

$$p(i,t) = 1 - (1+r)b_i + b_i R(i,t)$$

The peasant *i*'s project return rate in the *t* period, which is uniformly distributed on

$U(0, Rm(i))$, where $Rm(i)$ is the maximum value of peasant *i*'s project return rate;

$k(i,t)$:The financial institution's inference about the peasant *i*'s expected repayment in proportion to his total wealth in the *t* period before it lends money to the peasant;

Personal credit assessment

At the beginning of the *t* period, the loan amount for peasant *i* equals to the present value of the financial institution's expected repayment amount, which subjects to the following condition:

$$Mk(i,t)(1+r) = k(i,t)Ew^{*}(i,t) = k(i,t)[w_{*}(i,t-1) + E(inc) + Mk(i,t)\cdot E_{i,t}R]$$

After calculating the expected repayment amount for each peasant, the financial institution identifies the peasants who have already paid their loan in the *t* period, and allocates the total loan amount *TM* among them according to the proportion of each peasant's line of credit, so the loan amount each peasant receives is:

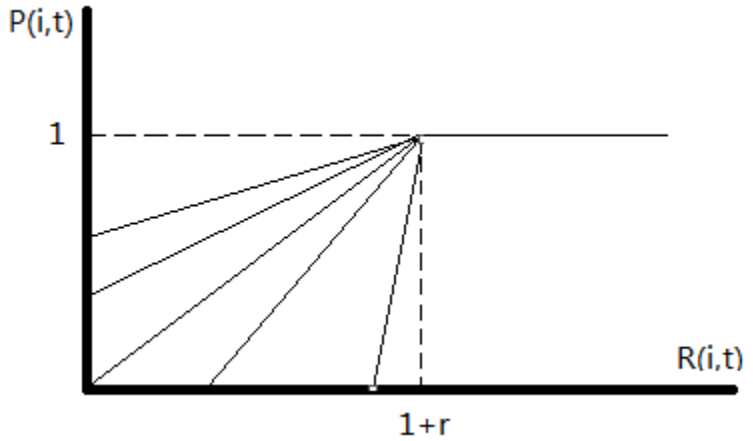
$$M(i,t) = \frac{Mk(i,t)}{\sum_{j\notin D} Mk(j,t)} TM$$

Personal credit assessment

The probability of fully repayment is related to the actual project return rate $R(i,t)$ each peasant's probability of *fully repay* is:

$$p(i,t) = \min\{1,\ \max[1-(1+r)b_i + b_i R(i,t),\ 0]\}$$

where b_i represents the peasants' type. He randomly selects one action according to 0-1 two-point distribution.



If a peasant didn't get the loan in the *t* period because he had not paid off his previous debt, we assume that he does not invest in any project during this period and his $R(i,t) = 0$.

Personal credit assessment

After the peasants take their repayment action, the financial institution can observe their wealth and repayment amount at the end of the *t* period, and upgrade their inference about the proportion $k(i,t)$ as

$$k_{new}(i,t) = \frac{Pay(i,t)}{w^*(i,t)}$$

Then, the financial institution calculates the arithmetic mean of all k_{new} from the first period to the *t* period, and regards the arithmetic mean as the inference about the repayment proportion in the $t+1$ period, that is

$$k(i,t+1) = \frac{tk(i,t) + k_{new}(i,t)}{t+1}$$

Personal credit assessment

In the meantime, the financial institution can estimate the project return rate using the difference between the peasant's wealth of the t period and the $t-1$ period after he repays the loan, and the rule for inference is:

$$R^e(i,t) = \frac{w_*(i,t) + Pay(i,t) - w_*(i,t-1) - E(inc)}{M(i,t)}$$

And upgrade the inference about the project expected return of each peasant:

$$E_{i,t}R = \underset{j=1:t-1}{mean}(R^e(i,j))$$

Then it turns to the next period, and the financial institution uses the upgraded $k(i,t+1)$ and $E_{i,t}R$ to determine each peasant's loan amount.

Credit Village Assessment

We assume that there are only two villages with equal number of peasants. First, the financial institution determines the proportion of the total amount for each village in the *t* period based on its total repayment rate (the ratio of total repayment and total loan amount in the whole village) in the $t-1$ period:

$$TMA(t) = \frac{pA(t-1)}{pA(t-1) + pB(t-1)} TM$$

The financial institution take action in the same way as under the traditional mechanism, but before allocating the total amount *TMA* in village A, the financial institution takes into account the information about each peasant's type from the village cadre, who has a belief that the peasant i's project return rate in the t period subject to the uniform distribution in $(0,\ 2E_{i,t}R)$, making use of the expected project return rate $E_{i,t}R$ from the financial institution.

$$E_{i,t}p = \frac{1}{2E_{i,t}R}\int_0^{2E_{i,t}R} \max\{0, \min[1, 1-(1+r)b_i + b_i R]\}dR = 1 - \frac{(1+r)^2 b_i^2 - I(1-(1+r)b_i)^2}{4b_i E_{i,t}R}$$

Credit Village Assessment

The financial institution adjusts the proportion for each peasant: $$Mk^*(i,t) = Mk(i,t)\left[\frac{E_{i,t}\,p}{Ep}\right]^{\lambda}$$

where λ represents the importance of the village cadre in the assessment of the peasant's line of credit, if λ is below 0, that means the financial institution regards that the village cadre always calls white black.

Then, the financial institution allocates village A's total loan amount *TMA* among the peasants according to the proportion $Mk^*(i,t)$, therefore the loan amount for peasant *i* is:

$$M^*(i,t) = \frac{Mk^*(i,t)}{\sum_{j \notin D} Mk^*(j,t)} TMA$$

And rest of the process is the same with the traditional mechanism.

Emulation analysis

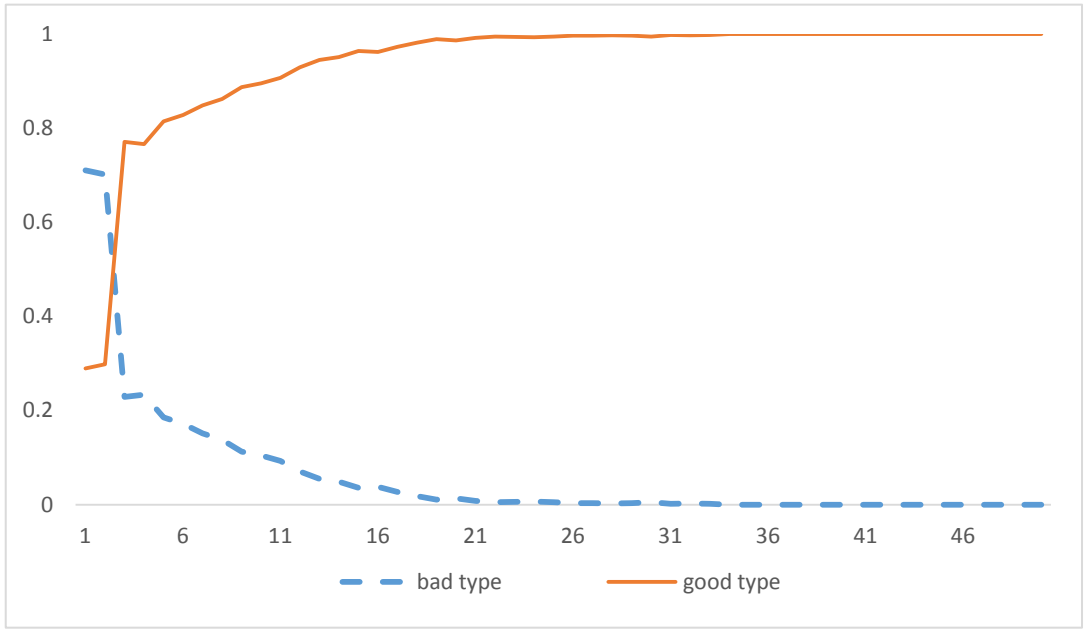
Using the mathematical software (matlab), we simulate both of the mechanisms in 50 periods for 100 times based on our model above, and found that under the innovative mechanism, the average repayment rate of total peasants has significantly been improved ($p < 0.001$).

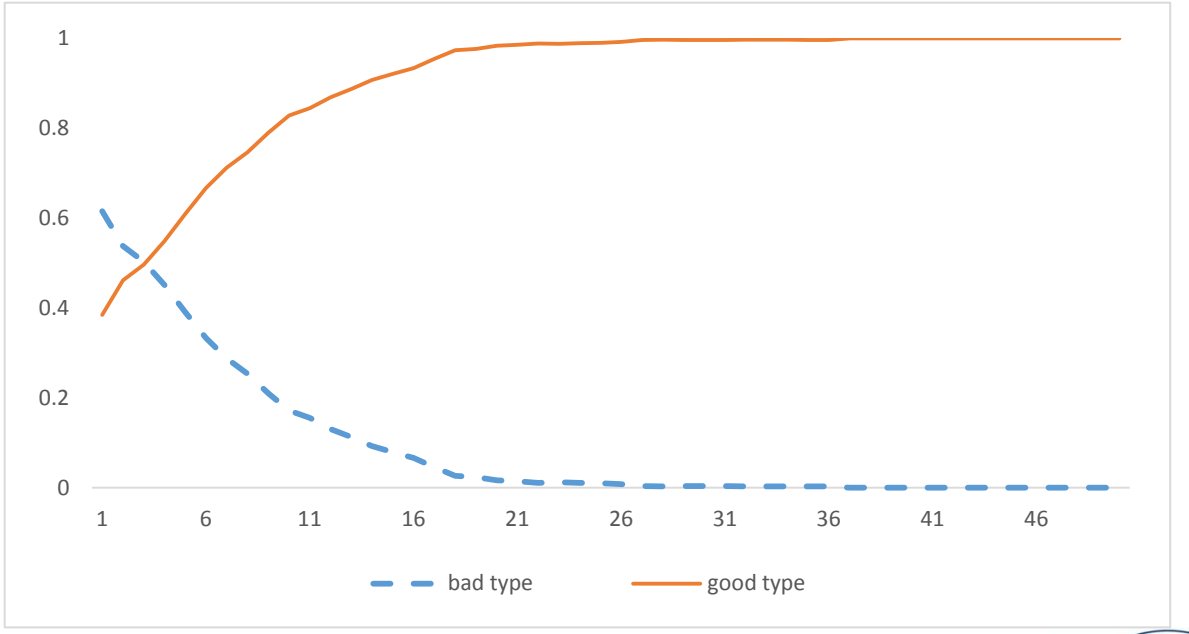
As the time went by, those peasants with a relatively bad character would be distinguished by the financial institution and excluded from the credit market more quickly under the Credit Village Assessment than under the traditional personal credit assessment.

We also changed the importance of the village cadre in the assessment to further probe the village cadre's influence on the financial institution's modification of the line of credit. And divide the peasants according to their types and observe their proportion change in the credit market.

Emulation analysis

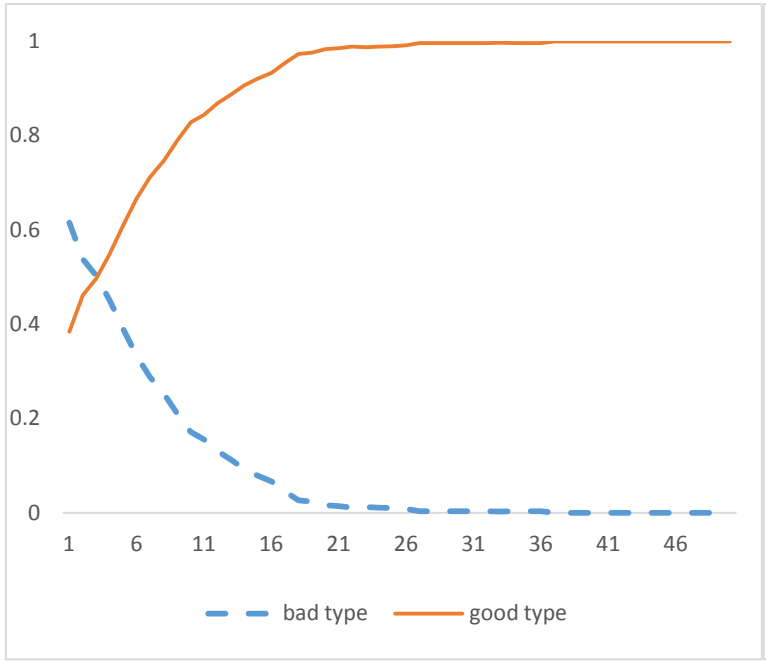
The fluctuation of the proportion of different types of peasants in the credit market (λ = -1, 1)

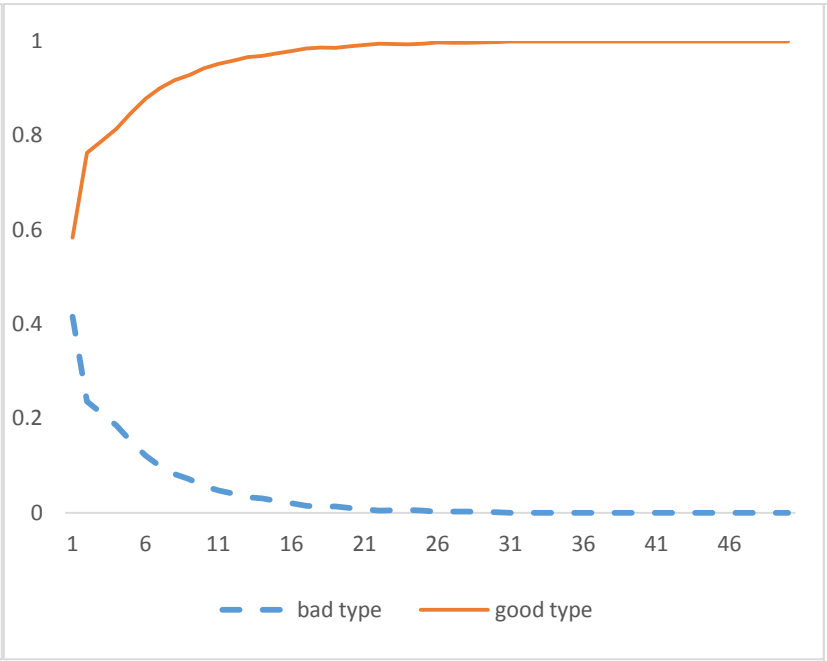


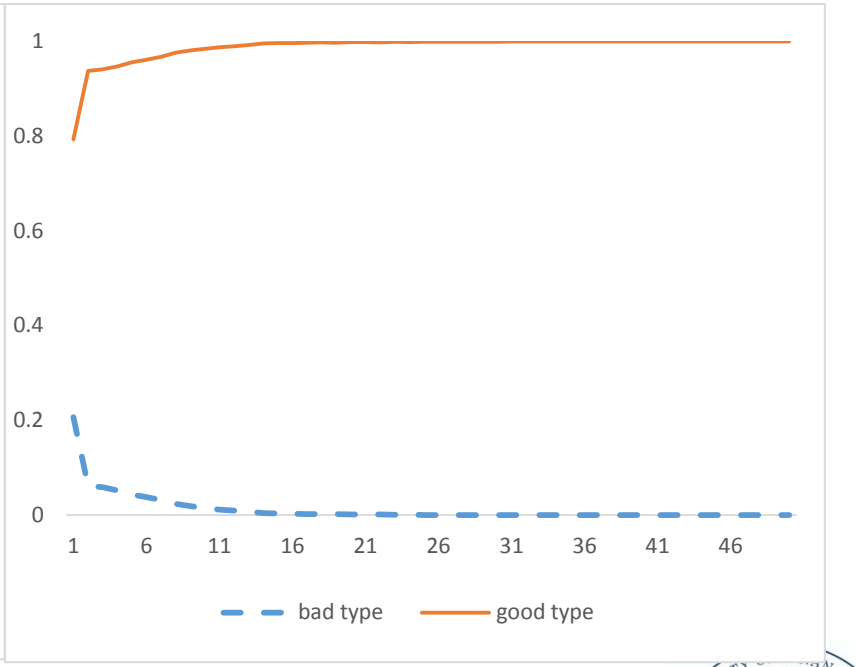


Emulation analysis

The fluctuation of the proportion of different types of peasants in the credit market ($\lambda = 1, 5, 10$)







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Improvement

Control the village cadre’s power and avoid the occurrence of rent seeking by transparent assessment and public review.

Inspire those who perform well with other tempting rewards to encourage their repayment as well as touch those who perform bad, to form an incentive effect.

Establish fund pool to prevent collective default caused by catastrophes, ask peasants to purchase agricultural insurance to cut down the default risk.

Thank you!

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