Research on effectiveness of financial poverty alleviation in Yi region of Sichuan province

Haichun Tang, Kun Song*, Ke Yi

College of Economics, Sichuan Agricultural University, Chengdu, Sichuan, 611130, China

*correspondent author

Abstract: It is particularly important for Liangshan Yi Autonomous Prefecture, Sichuan Province, to fight against poverty since it is a region with grinding poverty, which is rare now in China. Starting from the perspective of the reinvestment of financial poverty alleviation funds, the sustainable conditions for the independent financial poverty alleviation models performed by formal financial institutions and informal financial organizations are obtained using. Research findings suggest that neither of them has long-term sustainability. As a result, the two can establish continuous cooperative poverty alleviation model under the cooperative conditions with synergy effect.

1. Introduction

In China's rural environment, formal finance and informal finance are important components of dual finance. Formal financial institutions and informal financial organizations are also two forms of financial poverty alleviation in the Yi region, and have played an important role in poverty alleviation. Among them, formal financial institutions have sufficient funds but the willingness to help the poor is not strong. Informal financial organizations such as family clan loans have simple procedures and flexible forms, which effectively makes up for the absence of formal financial institutions and is an important source of loans for Yi ethnic group. However, the size of its funds determines its limited poverty alleviation effect. Therefore, what are the sustainable conditions for the independent financial poverty alleviation models performed by formal financial institutions and informal financial organizations in Yi region? Can this be achieved? Can the cooperation between formal financial institutions and informal financial organizations in the region be able to establish a sustainable poverty alleviation model? What are the conditions for establishing this model and what is the effect? In this regard, this paper combining the realistic conditions of Yi region in Sichuan, use the multi-stage dynamic game theory to obtain the conditions and effects of formal financial institutions and informal financial organizations to achieve sustainable poverty alleviation independently under the conditions of satisfying the maximum expected payoff. Then, the Shapley value model of cooperative game is used to distribute the utility of cooperative poverty alleviation and the sustainable cooperative poverty alleviation model in the Yi region is obtained.

2. Analysis of independent poverty alleviation models of formal financial institutions and informal financial organizations

Starting from the perspective of the reinvestment of financial poverty alleviation funds, combining the characteristics of Yi region, the multi-stage dynamic game process of poor households, formal financial institutions and informal financial organizations is constructed. Discuss the conditions and effects of formal financial institutions and informal financial organizations to achieve sustainable poverty alleviation independently in the region.

2.1 Poor household

Considering that this paper studies the sustainability of financial poverty alleviation, poor households are those who have the positive willingness to get rid of poverty and have the ability to

work in Yi region. They are in line with the characteristics of rational people.

2.2 Formal financial institution

Include the China Development Bank Sichuan Branch, Bank of China Sichuan Branch, Agricultural Bank of China, Liangshan Rural Commercial Bank, China Postal Savings Bank Liangshan Branch and so on. Formal financial institutions are inherently profit-seeking and have the characteristics of rational people who maximize their own interests.

2.3 Informal financial organization

Include private lending, microfinance companies, family clan loans and so on, which are in line with the characteristics of rational people. Informal financial organizations in Yi region have special characteristics: Yi ethnic group value their trust, social status and credit enhancement, and family clan's harmony is their more desirable goal. Therefore, the informal financial organizations in the region are pursuing a kind of social capital.

Table 1 Parameter setting and description of multi-stage dynamic game

parameter	description	parameter	description
y_F	The yield of formal financial institutions when they do not provide loans to poor households	$p_1 \& p_2$	The punishment for defaulting poor households from formal financial institutions or informal financial organizations choosing to recover loans $p_1 < p_2$ ①
y_F'	The yield of formal financial institutions when they provide part of the funds provided to enterprises to the poor $y_F' < y_F$ ②	$L_1 \& L_2$	The amount of funds obtained by the poor household for the first time or the second time
$y_{PH} \& y_{PH}'$	The yield of poor households when they obtain funds or don't obtain funds.	μ_A	The probability of poor households applying for loans
y_{PH}''	The yield of poor households whey they obtain the second funds	$\mu_{FT} \& \mu_{IT}$	The probability of poor households choosing repayment to formal financial institutions or informal financial organizations
$c_1 \& c_2$	The audit costs of formal financial institutions or informal financial organizations for poor households	$\mu_{FL} \& \mu_{IL}$	The probability of formal financial institutions or informal financial organizations choosing to lend
$c_3 \& c_4$	The cost of formal financial institutions or informal financial organizations choosing to recover loans from defaulting poor households	$\mu_{FR} \& \mu_{IR}$	The probability of formal financial institutions and informal financial organizations choosing to lend again
$c_5 \& c_6$	The cost of poor households to apply for formal financial institutions and informal financial organizations	$\mu_{FD} \& \mu_{ID}$	The probability of formal financial institutions and informal financial organizations choosing to recover loans from defaulting poor households

①The punishment of defaulters in informal financial organizations in Yi region is more special and stricter.
② The reason is that formal financial institutions providing loans to poor households will redistribute funds and lose high returns from loans to enterprises.

3. Game process

According to the above hypothesis, the game process and results of formal financial institutions, informal financial organizations and poor households are as follows:
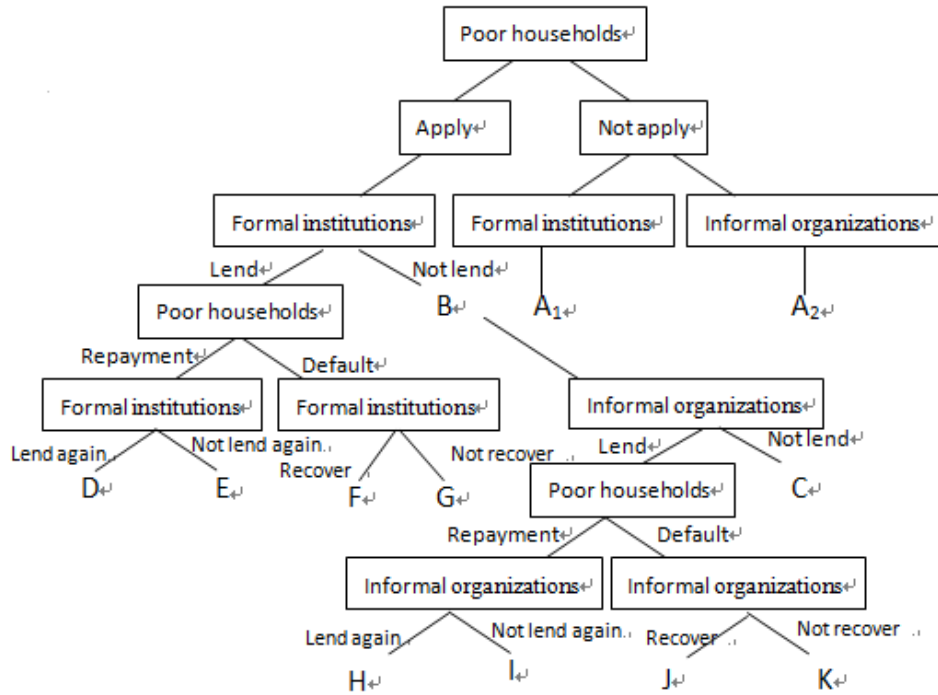

Figure 1 Multi-stage dynamic game process of formal financial institutions, informal financial organizations and poor households

From Figure 1, the payoff results A~K of the three-party game can be obtained. Combined with the correlation probability, based on the expected payoff maximization, the expected payoff function of the formal financial institution is:

$$\max \prod = (1-\mu_A)y_F + \mu_A(1-\mu_{FL})(y_F - c_1) + \mu_A\mu_{FL}\mu_{FT}\mu_{FR}(y_F' - c_1 + L_1r_1 + L_2r_1)$$
$$+ \mu_A\mu_{FL}\mu_{FT}(1-\mu_{FR})(y_F' - c_1 + L_1r_1) + \mu_A\mu_{FL}(1-\mu_{FT})\mu_{FD}(y_F' + L_1r_1 - c_1 - c_3) \qquad (1)$$
$$+ \mu_A\mu_{FL}(1-\mu_{FT})(1-\mu_{FD})(y_F' - L_1(1+r_1) - c_1)$$

Similarly, the expected payoff function of the informal financial organization is:

$$\max \prod = \mu_A\mu_{IL}\mu_{IT}\mu_{IR}(L_1r_2 + L_2r_2 - c_2) + \mu_A\mu_{IL}\mu_{IT}(1-\mu_{IR})(L_1r_2 - c_2)$$
$$+ \mu_A\mu_{IL}(1-\mu_{IT})\mu_{ID}(L_1r_2 - c_2 - c_4) + \mu_A\mu_{IL}(1-\mu_{IT})(1-\mu_{ID})(-L_1(1+r_2) - c_2) \qquad (2)$$

The expected payoff function $\max\prod$ is a function of probability. If the maximum expected payoff is met, the first-order partial derivative to probability of the expected payoff function is equal to zero. Through simplification and calculations, sustainable conditions for the independent financial poverty alleviation performed by formal financial institutions and informal financial institutions can be obtained.

Table 2 The comparison of the sustainable conditions of formal financial institutions and informal financial organizations to alleviate poverty independently

sustainable conditions	Sustainable conditions of formal financial institutions to alleviate poverty independently	Sustainable conditions of informal financial organizations to alleviate poverty independently
Interest rate condition	$r_1 = 0$	$r_2 = 0$
Recovery condition	$c_3 < (1-\dfrac{1}{\mu_{FD}})(y_F' - c_1 - L_1) + (y_F' - L_1)$	$c_4 < (\dfrac{1}{\mu_{ID}} - 1)(L_1 + L_1r_2 + c_2) + L_1r_2 - c_2$

According to Table 2, combined with the characteristics and poverty alleviation status of Yi region, it has the diminishing effect of the marginal utility of poverty alleviation funds and the limitation of poverty alleviation, the interest subsidy can not make up for the cost of formal financial institutions, the willingness to lend is not strong, and the poor households have difficulty in performing their duties. These reasons have led to the inability to achieve sustainable conditions for the independent poverty alleviation model of formal financial institutions in the region, and it is concluded that the model is not sustainable. Informal financial organizations can achieve the desired social capital by alleviate poverty independently, and can realize their interest rate conditions; In addition, the particularity of the recovery makes it possible to fulfill the conditions of recovery. However, due to the limitation of the scale of funds, its poverty alleviation effect is limited. It is concluded that the independent poverty alleviation model of informal financial organizations in the region does not have long-term sustainability.

4. Conclusions

Through using multi-stage dynamic game theory, this paper conducts a continuous analysis of the independent poverty alleviation models of formal financial institutions and informal financial organizations, and concludes that neither has long-term sustainability. So the formal financial institutions and informal financial organizations in Yi region can establish a sustainable cooperation mode in poverty alleviation. The premise is that the two sides of the cooperation need complement each other, so that cooperation and poverty alleviation have synergy effects, thus achieving an overall increase in poverty alleviation effect in Yi region.

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