

Research on the Sustainable Mode of Financial Poverty Alleviation in Yi Region

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Abstract: Historical research puts forward some problems in the current financial poverty alleviation and the sustainable endogenous motivation for financial poverty alleviation in China is insufficient. So the Shapley value model of cooperative game is used to discuss the utility of cooperative poverty alleviation and the conditions of continuous cooperation between formal financial institutions and informal financial organizations in Liangshan Yi Autonomous Prefecture, Sichuan Province. Finally, a sustainable poverty alleviation based on growth symmetry and mutually beneficial cooperation in Yi region is proposed.

1. Introduction

The Yi region in Sichuan province is the most concentrated poverty-stricken area and one of the most difficult task in the entire western region to achieve a comprehensive well-off society. Due to the remoteness of the geographical location and the lack of resources, the poverty level is deep. Besides, the low level of social civilization and the influence of the religious culture of the family clan lead to the complicated causes of poverty. Therefore, it is a huge challenge to win the battle against poverty. By the end of 2017, among the 17 counties and cities in Liangshan Prefecture, 11 minority counties were national poverty counties, accounting for 1/3 of the province. There are still 1618 poor villages, including 1012 villages with the poverty incidence of 20% to 50%, 338 villages with more than 50%, and 183 extremely poor villages with the greatest difficulty in poverty alleviation, with 528,800 poor people, accounting for 19.4% of the province. The poverty incidence was 11.9%, 7.6 percentage points higher than the provincial ^①. The nation and the government are very concerned about the work of poverty alleviation in Yi region of Sichuan province. Due to the heterogeneity of minority areas, especially the Yi region, the research on financial poverty alleviation in the region is very limited, and the study on the sustainable development of financial poverty alleviation in the region is rare. The sustainable development of financial poverty alleviation plays a key role in the stability of poverty alleviation. Therefore, it is urgent to study the sustainable financial poverty alleviation model in Yi region.

2. Analysis of the utility of cooperative poverty alleviation between formal financial institutions and informal financial organizations in Yi region.

2.1 The connotation of the Shapley value model of cooperative game

The analysis unit of the cooperative game is the coalition, which emphasizes collective rationality and focuses on efficiency, fairness and justice. The solution of the cooperative game can adopt a variety of methods, and the Shapley value method proposed by Shapley has the stability of the coalition, and its solution must be unique and feasible. This method uses the utility value to illustrate the marginal contribution of partners in the coalition and considers efficiency and fairness issues.

Shapley value satisfies three basic axioms

The symmetry axiom, that is, the Shapley value of the game has nothing to do with the order of the players.

^①Data from: Sichuan Daily Liangshan Media Center

The validity axiom, that is, the sum of the Shapley values of all the players is equal to the value of the corresponding coalition.

The addition axiom, that is, when two independent games are combined, the Shapley value of the cooperative game is the sum of two independent game Shapley values.

Shapley value method: Suppose there is a collection consisting of n players $N = \{1, 2, 3, \dots, n\}$, $S (S \in N)$, Non-empty subset of N , is a coalition. The characteristic function of coalition S is $V(S)$, which indicates the greatest utility of the coalition through the coordination of the players in the game. The assigned value of the member's utility is V . Use $\phi_i(V)$ to indicate the utility of the player i in the cooperation. The solution formula is:

$$\phi_i(V) = \sum_{\{S|i \in S\}} \frac{(|S|-1)!(n-|S|)!}{n!} [V(S) - V(S/i)] \quad i = 1, 2, 3, \dots, n \quad (1)$$

Thereinto, $|S|$ represents the number of players in the coalition S , $V(S/i)$ represents the utility of removing the player i , $n!$ represents number of rows that can be formed by n players. $V(S) - V(S/i)$ indicates that the i player's marginal contribution to the coalition.

2.2 Constructing a utility distribution model for cooperation between formal financial institutions and informal financial organizations

2.2.1 Defining feature functions.

Set a collection of formal financial institutions and informal financial organizations as $N = \{1, 2, 3, \dots, n\}$, $\phi_i(V)$ represents the utility of each collection member.

A cooperative game of n partners, Assuming each member's contribution is u_i , then there is $S = \sum_{i=1}^n u_i$. And the cooperative contribution of formal financial institutions and informal financial organizations is simply additive or synergistic? So define the feature function as:

$$V(S) = \alpha S + \beta S^2 \quad (2)$$

Equation (2) indicates that the total utility before and after cooperation is unchanged at $\beta = 0$, and $\beta > 0$ indicates a synergy effect.

2.2.2 Utility distribution hypothesis

Combined with the characteristics of Liangshan, the main financial institution for poverty alleviation is Liangshan Rural Commercial Bank, which issues 90% of the loans in the prefecture to poor households.^① Therefore, this article uses Liangshan Rural Commercial Bank as a representative of a formal financial institution participating in the cooperative game, and its contribution is $u_1 = 0.9$; Another poverty alleviation force in Liangshan is other formal financial institutions, and its contribution to poverty alleviation accounts for the remaining 10% of the prefecture. Considering that the remaining formal financial institutions other than Liangshan Rural Commercial Bank have contributed less to poverty alleviation, other formal financial institutions are regarded as a whole, defined as the formal financial institution "2" and the contribution is $u_2 = 0.1$. There are also influential family clans in Yi region to make loans to poor households. Combined with the scale of non-observed loan, the assessment of the scale of loans from family clans is used as the non-observed loan scale of poverty alleviation funds in Yi region, which is used to measure the contribution of informal financial organizations in the region to poverty alleviation. According to a questionnaire survey on the situation of poor financial households and formal financial institutions and family loans, the proportion of poor households in the urban areas is about

^① Data from: Liangshan Daily (2016-11-27)

10%. So suppose its contribution is $u_3 = 0.1$. At this time, the cooperative game is $n = 3$.

2.2.3 Calculate the utility distribution of tripartite cooperation

Calculate the characteristic function value of the tripartite cooperative game according to formula (2):

Table 1 Tripartite characteristic function value

members	characteristic function value $V(S)$
Formal financial institution 1	$0.9\alpha + 0.81\beta$
Formal financial institution 2	$0.1\alpha + 0.01\beta$
Informal financial organization 3	$0.1\alpha + 0.01\beta$
Formal financial institutions 1, 2 cooperation	$\alpha + \beta$
Formal financial institution 1 cooperates with informal financial organization 3	$\alpha + \beta$
Formal financial institutions 2 cooperate with informal financial organizations 3	$0.2\alpha + 0.04\beta$
Tripartite cooperation	$1.1\alpha + 1.21\beta$

The tripartite Shapley values are:

$$\phi_1(V) = 0.9\alpha + 0.99\beta \quad \phi_2(V) = 0.1\alpha + 0.11\beta \quad \phi_3(V) = 0.1\alpha + 0.11\beta \quad (3)$$

2.3 Analysis of the results of cooperation poverty alleviation utility

Table 2 Comparison of utility before and after cooperation

	Cooperation	Non-cooperation
Formal financial institution 1	$0.9\alpha + 0.99\beta$	$0.9\alpha + 0.81\beta$
Formal financial institution 2	$0.1\alpha + 0.11\beta$	$0.1\alpha + 0.01\beta$
Informal financial organization 3	$0.1\alpha + 0.11\beta$	$0.1\alpha + 0.01\beta$
Total utility	$1.1\alpha + 1.21\beta$	$1.1\alpha + 0.83\beta$

It can be seen from the results in Table 2 that the total utility after the tripartite cooperation is $1.1\alpha + 1.21\beta$. Compared with the original utility sum $1.1\alpha + 0.83\beta$ when the members don't cooperate, it can be seen that whether the utility after cooperation is a simple addition depends on the synergy utility coefficient β .

3. Analysis of specific sustainable cooperation modes between formal financial institutions and informal financial organizations

3.1 Proposed cooperation modes

The six cooperation modes between formal financial institutions and informal financial organizations are shown in Table 3.

Table 3 Cooperation modes description

Cooperation modes	Characteristics
Spurious cooperation mode	One party benefits and the other suffers
Partially beneficial mode	One party benefits and the other is unaffected
Partially harmful mode	One party suffers and the other benefits
Symmetric mutual benefit mode	Both sides benefit and are symmetric
Asymmetrical benefit mode	Both sides benefit but are asymmetrical
Competitive cooperation mode	Both sides suffers

3.2 Specific cooperation modes analysis

Through the cooperative game utility distribution results, the premise of long-term sustainable cooperation between formal financial institutions and informal financial organizations is $\beta > 0$, that is, the utility of both parties increases after cooperation. Therefore, the spurious cooperation mode, partially beneficial, partially harmful and competitive cooperation mode in Table 3 is excluded. From the results of the Shapley value of the cooperative game, you can see: In the case where both the formal financial institution 2 and the informal financial organization 3 contribute 0.1, they increase the same 0.1β after the cooperation. Therefore, in Yi region, we should focus on the mode of dependent growth and symmetric mutual benefit.

Referring to the Shapley value of cooperation between formal financial institutions and informal financial organizations, formal financial institutions and informal financial organizations will cooperate only when the utility of cooperation increases. According to the characteristics of the mode of dependent growth and symmetric mutual benefit, it benefits all members and therefore meets the conditions for long-term cooperation; And the Shapley value is based on fair and equitable utility distribution, and the mode of dependent growth and symmetric mutual benefit also benefits the partners symmetrically, so it is in line with the conditions for long-term cooperative poverty alleviation. In summary, the mode of dependent growth and symmetric mutual benefit is in line with the conditions of long-term cooperative poverty alleviation between formal financial institutions and informal financial organizations in Yi region, with long-term sustainability and stable existence in the region. So what kind of cooperation mode is the mode of dependent growth and symmetric mutual benefit? Can this mode be implemented? Therefore, this paper proposes new conceptions of cooperation mode in poverty alleviation between the formal financial institutions and the informal financial organizations.

4. Conclusions

Yi region is suitable for the mode of dependent growth and symmetric mutual benefit. According to the mode and the characteristics of Yi region, the specific way of implementing the mode of dependent growth and symmetric mutual benefit is proposed in an innovative way, in order to solve the problem of sustainability of poverty alleviation in the region.

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