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The Identification of Poverty-returning Risk in Contiguous Poverty-stricken Areas of China

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Abstract

In the connection period between poverty alleviation and rural revitalization, the problem of poverty-returning is still a common and severe problem. Based on this, this paper constructs the risk index system of poverty-returning, identifies the risk factors through model calculation, selects the two dimensions of "individual farmer-village-level environment", comprehensively calculates the weight value of the poverty-returning risk index system of poor households by using the entropy weight method and analytic hierarchy method, uses the obstacle model to diagnose the poverty-returning risk index system, and analyzes the poverty-returning risk index factors. The results show that: first, in the dimension of individual rural households, the magnitude of the impact in the indicators of poverty-returning risk: Economic conditions >Human capital>Viability capability>Social security>Personal condition. Second, in the village-level environmental dimension, the magnitude of the impact degree in the poverty return risk indicator is ranked: Economic> Policy> Natural> Infrastructure> Culture.

Keywords

Identification of risk of poverty-returning; Entropy law; Analytic hierarchy; Barrier model.

1. INTRODUCTION

Since the reform and opening up, China's poverty control has gone through the stages of government all-inclusive, comprehensive development, and targeted poverty alleviation[1], realizing the transformation from large-scale all-encompassing to pluralistic co-governance, and inclusive poverty alleviation to precise poverty alleviation[2]. At the end of 2020, China achieved a comprehensive victory in the battle against poverty, with all 98.99 million rural poor people lifted out of poverty under the current standards, all 832 poverty-stricken counties removed, and all 128,000 poverty-stricken villages lifted out of poverty, regional overall poverty was solved and the arduous task of eliminating absolute poverty was completed[3]. However, China is a vast country, affected by natural, cultural and policy factors, the relative poverty control concentrated in contiguous poverty-stricken areas is still an urgent practical problem. At present, there are 14 contiguous poverty-stricken areas in China, and there are still 16.6 million poor people, of which the incidence of poverty in western provinces such as Yunnan, Guizhou and Sichuan is still high. Most of the concentrated contiguous poverty-stricken areas belong to areas with fragile ecological environment, weak infrastructure construction and lagging industrial development, and are also key areas of knowledge poverty and human poverty, which have become the "fortitude of the strong, the poverty of the poor" during the period of poverty alleviation and rural revitalization strategy.

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Therefore, how to promote the mutual promotion and organic connection between poverty alleviation and rural revitalization in concentrated contiguous poverty-stricken areas during the strategic convergence period is an important indicator system to measure the quality of poverty alleviation.

2. STUDY DESIGN

In order to identify the risk factors of returning to poverty in contiguous poverty-stricken areas, this paper comprehensively uses the entropy weight method, hierarchy method, and obstacle model, among which the entropy weight method and the hierarchical method are used to calculate the weights of each level of the index from the subjective and objective perspectives, so as to lay the foundation for the subsequent analysis. The purpose of using the barrier model is to identify the risk factors of poverty-returning from the dimensions of individual farmers and village-level environment, and to provide a basis for proposing prevention and control countermeasures according to the degree of obstacles.

2.1. The entropy weight method

The entropy weight method is an objective method, and the use of the entropy weight method can remove the influence of human subjectivity, so that the data results obtained are objective, scientific and feasible. The greater the difference in indicators, the smaller the entropy value of the data, and the greater the weight if it shows a negative correlation.

Since the indicators in this paper contain positive indicators and reverse indicators, it is necessary to distinguish the processing of indicators. The method is used to standardize the data to form standardized data, and the calculation formula is as follows:

For positive indicators:

$$X_{ij} = \frac{x_{\lambda ij} - x_{min}}{x_{max} - x_{min}}$$

For negative indicators:

$$X_{ij} = \frac{x_{max} - x_{\lambda ij}}{x_{max} - x_{min}}$$

Calculate the share of the study area under indicator j:

$$p_{ij} = \frac{X_{ij}}{\sum_{i=1}^{n} X_{ij}} \quad ,(i = 1,2...,n,\ j = 1,2...,m)$$

Calculate the entropy value of each index.

$$e_j = -k\sum_{i=1}^{n} p_{ij} \ln(p_{ij}),\ \ k > 0,\ \ k = 1/\ln(n),\ \ e_j \geq 0$$

2.2. The analytic hierarchy method

Establish a hierarchical structure model. The level analysis method divides the indicators into three levels: target layer, guideline layer, and index layer. In the stepped layer model constructed by text, the elements of the same level have a certain meaning on the previous level. The elements, the same level of various elements at the same level are relatively independent and cannot work with each other.

Invite experts to evaluate the indicators. Let the experts compare the indicators of each layer in the criterion layer and the indicator layer, score them according to their importance, and comprehensively consider the impact of poor households on the indicators of the risk of poverty-returning.

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Establish a judgment matrix. Several judgment matrices A=$(a_{ij})_{n\times n}$, where a_{ij} represents the relative importance of the comparison between element A_i and element A_j. If you set the importance of the elements of each factor layer to the target, it is C_1,...C_i...C_j...C_n..., then there is $a_{ij} = \frac{c_i}{c_j}$.

The specific form is as follows:

$$\begin{matrix} a_{11}a_{12} & \ldots & a_{1j} \\ a_{21}a_{22} & \ldots & a_{2j} \\ \ldots \quad \ldots & \ldots & \ldots \\ a_{i1}a_{i2} & \ldots & a_{ij} \end{matrix}$$

Calculate the weight indicator. The arithmetic average method is used to calculate the weight matrix of the criterion layer and the index layer, and the criterion layer matrix is shown in Table 1 and 2, in the same way, the weight of each index of the index layer can be obtained by the same method.

Table 1. The judgment matrix of criterion layer F against target layer A

	F1	F2	F3	F4	F5
F1	1	1/2	4	3	3
F2	2	1	7	5	5
F3	1/4	1/7	1	1/2	1/3
F4	1/3	1/5	2	1	1
F5	1/3	1/5	3	1	1

Table 2. The judgment matrix of criterion layer F against target layer B

	F1	F2	F3	F4	F5
F1	1	1/2	1	2	3
F2	2	1	2	4	3/2
F3	1	1/2	1	2	3
F4	1/2	1/4	1/2	1	3/2
F5	1/3	1/6	1/3	2/3	1

Consistency test. The test coefficient index CR test is introduced to determine whether the matrix meets the consistency, and if the CR< 0.1, pass the consistency test; Otherwise, it fails the consistency test. In this paper, the CR of each criterion layer and index layer are less than 0.1, which passes the consistency test.

Calculate the comprehensive weight. The above entropy method and the weights calculated by the analytic hierarchy method are combined, and the average of the weights obtained by the two is used as the comprehensive weight of each index.

2.3. Obstruction model

Poverty alleviation is the cornerstone of rural revitalization, the existence of poverty return directly affects the promotion of strategy, according to the investigation and research, the risk factors of poverty return in the strategic convergence period of each village and town are also different, so understand the hindrance factors in the exploration area, aim at the "lesion", and make a pathological diagnosis of the risk of returning to poverty in concentrated contiguous poverty-stricken areas, find out the "cause", and achieve "the right medicine". Therefore, this paper introduces the obstacle degree model to identify the risk of poverty-returning, and

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attempts to explore the resistance factors of rural revitalization in poor villages. The specific calculation formula is as follows:

The calculation method is to introduce three variables: factor contribution, index deviation and obstacle.

The factor contribution rate (R_{ij}) is the weight of a single indicator j to the total target in the criterion layer i, that is, it is expressed by the comprehensive weight of indicator j;

The deviation of the index (O_{ij}) is the difference between the single index j in the criterion layer I and the standard value of the index, which is obtained by subtracting the standard value from 1;

$$O_{ij} = 1 - E_{ij}$$

Barrier degree (V_{ij}) is the degree of obstacle to stable poverty alleviation in the strategic convergence period of a single indicator j in the criterion layer, that is, the diagnosis result of the obstacle factor, the larger its value, the higher the degree of hindrance of this indicator to rural revitalization.

$$V_{ij} = \frac{O_{ij} \times R_{ij}}{\sum_{j=1}^{n} O_{ij} \times R_{ij}} \times 100\%$$

According to the formula, the two-dimensional obstacle degree of "individual farmer household - village-level environment" in each village and town can be obtained, and the obstacle degree of each obstacle factor can be arranged in the order of the calculation result, and the primary and secondary relationship of the obstacle factors affecting the degree of poverty return of each index can be obtained, so as to obtain the diagnosis of the obstacle factors of the risk of returning to poverty.

3. METRIC WEIGHT DETERMINATION

Table 3. Individual dimension indicators and weights of farmers

Target layer	Guidelines layer	Metrics layer	Objective weights	Subjective weights	Comprehensive weights
The risk of returning to poverty in the individual dimension of farmers	Personal condition (0.0538)	Age	0.1008	0.1304	0.1156
		Literacy	0.2372	0.2174	0.2273
		Health	0.6520	0.6522	0.6521
	Economic conditions (0.4758)	House	0.0710	0.0968	0.0839
		Annual income per capita	0.7002	0.6774	0.6888
		liability	0.2398	0.2258	0.2328
	Human capital (0.2636)	Total number of households	0.2300	0.2000	0.2150
		Number of workers	0.3600	0.4000	0.3800
		Proportion of labor force	0.4100	0.4000	0.4050
	Capability (0.1087)	Financial support	0.3231	0.5882	0.4557
		Skills training	0.1481	0.2941	0.2211
		Quality of education	0.0830	0.1176	0.1003
	Social security (0.0981)	Health insurance	0.0464	0.6087	0.3276
		Pension insurance	0.0579	0.3043	0.1811
		Post-disaster assistance	0.0344	0.0870	0.0607

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In order to distinguish the importance of different systems and indicators in the dimension of "individual farmer-village-level environment", it is necessary to weight the indicators of the risk of poverty-returning, and scientific and reasonable index, which can make the results more realistic reflection of the situation. There are many ways to calculate weights, in order to reduce the error caused by the single weight method, this paper will use a combination of the common analytic hierarchy method (AHP) and entropy weight method (EVW) to determine the weights of each indicator in the individual dimension of farmers and the village-level environmental dimension, which lays the foundation for the following data analysis.

Finally, the weighting results of the individual dimension of farmers and the specific indicators of the village-level environmental dimension are shown in Table 3 and 4.

From the above results, it can be seen that the economic condition risk (0.4758) with the largest weight in the individual dimension criterion layer of rural households, followed by human capital risk (0.2636), capability risk (0.1087), personal condition risk (0.0981), and finally social security risk (0.0538). The highest weight value in economic condition risk is annual income per capita (0.6888), the highest weight value in human capital risk is the proportion of labor force (0.4050), the highest weight value in capability risk is financial support (0.4557), the highest weight value in personal condition risk is health status (0.6521), and the highest weight value in social security risk is health insurance (0.3276).

Table 4. Village-level environmental dimension indicators and weights

Target layer	Guidelines layer	Metrics layer	Objective weights	Subjective weights	Comprehensive weights
Village-level environmental dimension risk of poverty-returning	Nature (0.2210)	Disaster accidents	0.1104	0.3000	0.2052
		Arable land	0.1157	0.6000	0.3579
		Water	0.0536	0.1000	0.0768
	Economy (0.3737)	Primary	0.1389	0.2105	0.1747
		Secondary industry	0.1871	0.1579	0.1725
		Tertiary industry	0.4168	0.6316	0.5242
	Culture (0.0737)	Neighborhoods	0.0720	0.2454	0.1587
		Township covenant folklore	0.0435	0.6053	0.3244
		Cultural and sports activities	0.0132	0.1493	0.0813
	Policy (0.2212)	Support department	0.0720	0.2233	0.1477
		Ability to help	0.1002	0.4703	0.2853
		Local government	0.1716	0.2678	0.2197
	Infrastructure (0.1105)	Transportation	0.0764	0.3753	0.2259
		Power communication	0.1000	0.2162	0.1581
		Water facilities	0.0150	0.0347	0.0249
		Educational facilities	0.1167	0.1147	0.1157
		Medical facilities	0.1144	0.1181	0.1163
		Cultural and sports facilities	0.1144	0.0322	0.0292

From the above results, it can be seen that the economic risk (0.3737) with the largest weight in the village-level environmental dimension criterion layer, followed by police risk (0.2212), natural risk (0.2210), infrastructure risk (0.1105), and finally cultural risk (0.0737). The highest

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weight value in economic is the tertiary industry (0.5242), the highest weight value in policy is the ability to help (0.2853), the highest weight value in natural risk is arable land (0.3579), the highest weight value in infrastructure is transportation (0.2259), and the highest weight value in cultural environmental risk is township covenant folklore (0.3244).

4. OBSTRUCTION ANALYSIS

This paper divides the degree of factor disorder into three grades according to the equidistance method: mild disorder (0-3%), moderate disorder (3-5%) and severe disorder (>5%). The obstacle degree of each criterion layer is calculated by formulating all sample villages, so as to obtain the proportion of barrier levels.

4.1. Identification of risk factors at the benchmark layer

Table 5. Shizhu County Standard Layer Barrier Level Percentage (%)

Barrier factors	Mild disorder	Moderate disorder	Severe disorder
Personal condition	55.53	34.96	9.51
Economic conditions	0.04	8.09	91.87
Human capital	10.11	20.33	69.56
Capability	9.98	27.44	62.58
social security	21.29	57.47	21.24

As can be seen from Table 5, the five criteria layers are ranked by the proportion of severe barriers, economic conditions> human capital>capability> social security > personal condition.

First of all, because economic factors are one of the core indicators to judge poverty alleviation standards and rural revitalization, economic conditions directly affect the quality of life and poverty alleviation results of poor households, but since the outbreak of the new crown epidemic, the economic condition has been grim, the development of various industries has been hindered, resulting in employment setbacks and income reductions, the economic condition of poor households has been strongly affected, and the economic income of some poor households has shown a downward trend year-on-year, seriously threatening the quality of life. Then, human capital and capability, which are factors for sustainable development of poverty alleviation, are at a high value in the risk of poverty-returning, the quantity and quality of labor are small, and the self-development ability and risk resistance ability of poor households are poor, and the subjective initiative of poor households to sustain and stable poverty alleviation needs to be improved. Thirdly, there are relatively many disabled and seriously ill rural households in the sample villages, and the effect of providing blood transfusion assistance is certainly better, but once the social security is reduced or abolished, combined with personal circumstances, it is difficult for their family to maintain the stability of poverty alleviation for a long time in terms of the economic burden of the target, and the return of poor households to poverty fluctuates greatly.

4.2. Identification of risk factors at the benchmark layer

Table 6. Shizhu County Standard Layer Barrier Level Percentage (%)

Barrier factors	Mild impairment	Moderate impairment	Severe disorder
Nature	17.87	27.64	54.49
Economy	5.3	12.33	82.37
Culture	49.66	28.23	22.11
policy	13.11	21.84	65.05
Infrastructure	7.62	38.51	52.87

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The barrier degree of each criterion layer is calculated for all sample village formulas, so as to obtain the barrier level ratio, as shown in Table 6 above. In the village-level environmental dimension of Shizhu County, the five barrier levels of the criterion layer were sorted by the proportion of severe obstacles, economy> policy >nature> infrastructure > culture. The data show that poor villages mainly rely on planting and animal husbandry, the production structure is relatively single, although the variety of characteristic agricultural products is rich, but limited by the geographical environment of the region, the mountain heights are steep, the degree of land fertility is not high, the cultivated land area is small and the quality is poor, it is difficult for agriculture to achieve scale and intensification, and at the same time, the cultivated land area is vulnerable to natural disasters, such as mud and rock flows. The agricultural production efficiency are difficult to break through the development bottleneck, restricting the rural revitalization and development of poor villages. Rural products are not equivalent to urban area products, too imitating the urban Internet celebrity model, even if it can attract a group of tourists in the short term, but in the long run, the attractiveness of tourism products may gradually decline, which will be a thorny problem for the poverty alleviation industry, and rural revitalization will also suffer from it. The links between various industries are not close, and the links between industries show that they cannot complement each other, and even shell cooperatives appear, and the economic structure needs to be optimized.

5. CONCLUSIONS

Among these endogenous risk factors, economic conditions, human capital, and severe capacity obstacles of more than 50%, and the contribution rate of the risk of poverty-returning was high. Among them, the per capita annual income and liabilities in the risk of economic conditions, the number of workers, the proportion of labor force and the risk of feasible capacity in the risk of human capital, and the financial support and skill training are the main controlling factors affecting the individual dimension of rural households' return to poverty, and the medical insurance and pension insurance in the social security risk are important factors affecting the individual dimension of rural households. Among the exogenous risk factors, the natural environment, economic environment, policy environment and infrastructure have severe obstacles of more than 50%, and the contribution rate of poverty return risk is relatively high. The cultivated land area in the natural risk, the primary, secondary and tertiary industries in the economic risk, the support department and assistance capacity in the policy environmental risk, and the educational facilities and medical facilities in the infrastructure risk are the main controlling factors affecting the village-level environmental dimension of poverty reduction. The local policies in the policy environmental risk are important factors affecting the individual dimension of rural households.

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