



REVIEW ARTICLE

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## ANALYSIS OF MULTIDIMENSIONAL POVERTY IN MINORITY AREAS -- EVIDENCE FROM ETHNIC MINORITY AREAS IN CHINA

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### ABSTRACT

Poverty is not only the low level of income, but also the lack of development ability and opportunities in education, health, working conditions, living standards and other aspects. Therefore, in order to measure the current situation of poverty more comprehensively, based on the "capability" poverty theory of Amartya Sen (1999), combined with the calculation method of multidimensional poverty, we use the CFPS data from 2010 to 2018 to construct a multidimensional poverty indicator, analyzed the current situation of multidimensional poverty in China's ethnic minority areas from five aspects, decomposed the multidimensional poverty index according to the indicators and individual characteristics, and explored the root causes of multidimensional poverty. The research results show that when threshold is 30%, the multidimensional poverty index of ethnic areas is 0.2836, which 63.85% of individuals will be in multidimensional poverty, and their poverty degree index is 0.4442. The multidimensional poverty index of women is higher than that of men, and the elderly are more likely to fall into multidimensional poverty. With the increase of education level, the incidence of poverty is gradually decreasing. The years of education, income level and mental health status are important reasons for multidimensional poverty in 2018.

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## INTRODUCTION

When discussing poverty, we often pay more attention to the economy, per capita GDP, per capita disposable income and other aspects. It is undeniable that income can be used to buy daily necessities to meet People's daily needs, so as to improve living standards and achieve the goal of poverty alleviation. However, income is only a tool or a small part of the material needs, the improvement of people's living standards is the real goal of poverty alleviation. Therefore, excessive attention to income level, on the one hand, tends to ignore the nature of poverty, making poverty alleviation policies deviate from the purpose of improving people's living standards. On the other hand, poverty in other dimensions may affect the instability of poverty alleviation in the income dimension, resulting in the phenomenon of falling into poverty again. After the 1980s, Amartya Sen (1999), influenced by Adam Smith's thoughts, deeply explored the nature of poverty. Based on the viewpoint of "Substantive freedom", he proposed the theory of feasible capacity poverty, providing a new perspective for the study of poverty. According to Sen, the root cause of poverty is not simply low income, but deprivation of viable capacity, which refers to the possible combination of various possible functional activities. Functional activities reflect a variety of things or states that one considers worthwhile to do or achieve, ranging from those that satisfy one's physiological needs, such as adequate nutrition and avoidance of disease, to complex social activities or individual states, such as participation in community life and having self-esteem. Sen poverty as feasible ability be deprived of the reason is that one is by the deprivation of the power to define poverty more can reflect the essence of poverty; Second, poverty is not only the low level of income, but also the deprivation of other abilities, such as education, medical care and so on.

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Third, low income is only the appearance of poverty, between different families and individuals, the correlation between income and feasible ability is variable, for example, one family's income poverty is due to the lack of individual disability and other labor ability, another family's income poverty is due to disease poverty. The theory of capability poverty meets the interpretation of poverty from the perspective of freedom. The definition of poverty is not only limited to the lack of material life, but also includes the lack of individual in political freedom, economic resources, social opportunities, transparency guarantee, protection guarantee, individuals are in a state of social exclusion and relative deprivation.

**The application of multidimensional poverty theory:** Inspired by Sen's poverty theory, United Nations Development Programme (UNDP) (1996,1997) successively released Capacity Poverty Index (CPI) and Human Poverty Index (HPI) in the Human Development Report. The Capacity Poverty Index (CPI) is made up of three indicators: the proportion of underweight children under five years old, the proportion of babies born without professional health care and the proportion of illiterate women over 15 years old. The Human Poverty Index (HPI) measures the degree of capacity deprivation from three aspects: life expectancy, literacy and living standard. The World Bank has also applied Amartya Sen's poverty theory to the study of poverty. In 1990, the World Bank regarded poverty as "under consumption, low level of education and low level of health", and took the promotion of labor-intensive growth model, extensive provision of social services, and promotion of human capital investment in the poor as the main means of poverty reduction. In 2001 the World Bank argued that poverty is not just a lack of goods (measured by appropriate income and consumption concepts), but also a lack of educational resources, the vulnerability of the poor to risk, and the inability to express their needs.

Sabina Alkire (2007) discussed the nature of poverty comprehensively and systematically and he believed that the multidimensional poverty measurement related to the ability method, which could provide more accurate information and facilitate the identification of people's ability deprivation. In 2010 the United Nations development programme (UNDP) and the Oxford poverty and human development center (OPHI) jointly developed an international general multidimensional poverty index, covering more than 100 countries in health, education and living standard of the three dimension 10 indicators, multidimensional poverty index has become an important index measured area and relatively poor family. The Multidimensional Poverty Index (MPI) not only measure the intensity of multidimensional poverty, but also reflect the deprivation of individuals. And the Oxford Centre for Poverty and Human Development (OPHI) points out that Multidimensional Poverty Index provides a method for measuring the extent and intensity of multidimensional poverty among individuals, families and regions, and different regions can change and select the indicators according to their actual situation. Based on the advantages of multidimensional poverty indicators and the flexibility of their measurement, this method has been used in many countries to measure poverty. For example, the European Union believes that poverty is a product of social inequality. Individual strapped in poverty not only have low income, but also may be trapped in multidimensional difficulties, such as unemployment, lack of housing, lack of medical supply, and barriers in culture and education, which limit the opportunities for poor individuals to obtain basic rights. Europe "employment, social policy, public health and consumer affairs" (EPSCO), established multidimensional poverty index system in 2010, including the relative income poverty, material deprivation, extremely low work intensity, satisfy any items are seen as "at risk of poverty or social exclusion". Mexico measures poverty from eight dimensions, including income, education, medical and health services, social security, housing quality and housing space, infrastructure construction, food, and social integration (Coneval,2010), and divides the extreme multidimensional poverty population and the general multidimensional poverty population.

**Research on the multidimensional poverty in China:** Based on the multidimensional poverty theory, the research on poverty in China has also shifted from the single income perspective to the multidimensional poverty research. Wang Xiaolin (2009) calculated China's multidimensional poverty index from housing, drinking water, sanitation facilities, electricity assets, land, education, health and other dimensions by using the data of China's Health and Nutrition Survey in 2006, and discussed index decomposition. Guo Jianyu(2012) measurement method based on multidimensional poverty, poverty-stricken counties in Shanxi Province as an example, from the level of education, children drop out of school, poor nutrition, children's death, and property, housing, electricity consumption, and clean drinking water, sanitation and living fuel such as dimension measurement of the counties in the multidimensional poverty index, analyzes the causes of poverty; Zhang Quanhong (2015) used the data from 1991 to 2011 to measure China's multidimensional poverty index and analyze the dynamic changes of China's multidimensional poverty from a dynamic perspective. Guo Xibao and Zhou Qiang (2016) combined the A-F method with the Duration Approach to extend the study of multidimensional poverty to the intertemporal dynamic analysis, and realized the integration of static or comparative static analysis and dynamic analysis to study the differences between urban families and rural families in multidimensional poverty and the causes. Wu Pinzhou (2019) studied the multidimensional poverty index for children. Taking children in ethnic minority areas as research samples, he measured poverty and analyzed its causes from five dimensions, including living standard, individual health, daily protection, development capital and social participation. Wang Bingbing (2020) took Chinese rural families as the research object and based on the data of Chinese family tracking survey from 2010 to 2018, used AF double threshold method from 4 dimensions and 7 indicators such as income, education, health and life, to investigate the current situation and causes of rural family poverty from different regions, landforms and geographical locations. Although the above studies have analyzed the situation of multidimensional poverty from different perspectives, few studies have analyzed the multidimensional poverty in ethnic areas from the perspective of multidimensional poverty. And ethnic minority areas are the focus of poverty control in China, so in order to comprehensively analyze the poverty situation in the minority areas, this paper analyzes the multidimensional poverty situation from five dimensions.

**Multidimensional poverty indicators selection and calculation:** For calculating individual Poverty minority nationality region, using the MPI method, from the level of income, education, health, living standard, working condition ,5 dimensions 15 indicators to calculate the relative Poverty in the ethnic areas in China.

**The calculation of multidimensional poverty:** Multidimensional poverty measurement is mainly divided into two parts. One is to measure the values of individuals or families in a single dimension by questionnaire to judge whether they are poor in that dimension. The other is to identify whether a family or an individual is poor in that dimension according to the poverty standard according to the aggravation of the situation in each dimension. The specific measurement methods and steps are as follows:

Values of each dimension and indicator: Assuming that the number of samples is  $n$  and the welfare level of each individual is evaluated by  $d$  dimensions, let the observation matrix of the samples be  $M = (\lambda_{ij})^{n \times d}$ , where  $M$  represents the value of  $n$  individuals on  $d$  dimension,  $\lambda_{ij}$  represents the value of  $i$  individuals on index  $j, i=1, 2, \dots, n, j=1, 2, \dots, d$ . Row vector  $\lambda_i = (\lambda_{i1}, \lambda_{i2}, \lambda_{i3}, \dots, \lambda_{id})$ , which reflects the individual value in all dimensions. Column vector  $\lambda_j = (\lambda_{1j}, \lambda_{2j}, \lambda_{3j}, \dots, \lambda_{nj})$ , which represents the value of different individuals on the  $j$  dimension or index. For single income poverty, as long as the individual's income index is below the poverty line, it is defined as poverty. However, the definition of multidimensional poverty usually involves two thresholds.

**Poverty identification:** Firstly, the identification of poverty in each dimension.  $z_j$  represent the threshold or poverty line for the individual. For any matrix  $\lambda_{ij}$ , we can define a critical matrix  $g_0 = [g_{ij}^0]$ . When  $\lambda_{ij} < z_j, g_{ij}^0 = 1; \lambda_{ij} \geq z_j, g_{ij}^0 = 0$ . Which means that for individual  $i$ , if individual  $i$  is poor, then it is assigned to 1; When the individual  $i$  is not poor, the value is assigned to 0. For example, the critical value  $z_j$  that defines the number of years of education ( $j$ ) is 9 years. When the number of years of education of individual  $i$  is 10 years,  $\lambda_{ij} = 10 > z_j = 9$ , then  $g_{ij}^0 = 0$ ; When an individual has 8 years of schooling, then  $g_{ij}^0 = 1$ , indicating that the individual is defined as poor or lack of educational opportunities in terms of schooling. Secondly, multidimensional ( $k$ ) poverty identification. For the critical matrix  $g_0$ , a column vector  $c_i$  can be defined to represent the number of multiple poverty dimensions of individual  $i, c_i = [g_i^0]$ . Considering the influence degree of different dimension  $d$  on multidimensional poverty, the weighting index  $w_j$  is introduced to calculate the total score of the individual in dimension  $d$ :

$$c_i = \sum_{j=1}^d w_j g_{ij}^0$$

the value range of  $c_i$  is  $[0, 1]$ ,  $w_j$  is the weight of dimension  $j$ . An individual  $i$  is defined as multidimensional poverty if the total score on all  $d$  dimensions exceeds a certain threshold value  $k$ , when  $c_i \geq k$ , then the individual is fall into poverty, otherwise it is non-multidimensional poverty, when  $c_i < k, c_i(k) = c_i$ , or  $c_i(k) = 0$ .

**The index of Multidimensional poverty:** The multidimensional poverty index of the sample was calculated by the above two steps:

$$M = \frac{1}{n} \sum_{i=1}^n c_i(k) = \frac{q}{n} \frac{1}{q} \sum_{i=1}^q c_i(k) = H * A$$

$q$  represents the number of multidimensional poor people, the incidence of multidimensional poverty ( $H$ ) is equal to the ratio of the number of poor people to the total number of samples, and the average poverty degree  $A$  is equal to the comparison of the poverty index of all poor individuals to the total number of indicators  $d$ . At the same time,  $M$  can also be expressed as the weighted average sum of the poverty index of each dimension (index), so the poverty incidence rate  $h_j$  is:

$$h_j = \frac{1}{n} \sum_{i=1}^n g_{ij}(k)$$

When  $c_i \geq k, g_{ij}(k) = g_{ij}; c_i < k, g_{ij}(k) = 0$ .

Similarly, the contribution rate of poverty degree of the average poverty degree index  $A$  and indicator  $j$  to overall poverty  $\phi_j$  can be decomposed into the following expression,  $h_j^p$  represents the proportion of the number of people in poverty in the multidimensional poverty population, and  $w_j$  is the weight of each index in the calculation of  $M$ .

$$A = \frac{M}{H} = \sum_{j=1}^d w_j \frac{h_j}{H} = \sum_{j=1}^d w_j h_j^p$$

$$\phi_j = w_j \frac{h_j}{M} = w_j \frac{h_j^p}{A}$$

**Data Resource and indicators Selection**

**Data Resource:** The data used in this paper are mainly from the national sample of the China Family Panel Studies (CFPS) from 2010 to 2018, which is a biennial follow-up survey conducted by the Chinese Center for Social Science Survey at Peking

University. The survey aims to comprehensively reflect the social changes and economic development in China by collecting nationally representative information on villages, families and family members. According to the research of this paper, rural residents in eight ethnic provinces of China are selected as the research object to analyze their multidimensional poverty in the dimensions of economy, education, health, living standard, work.

**Indicators Selection:** In order to comprehensively present the situation of multidimensional poverty in ethnic areas, we analyze the situation of multidimensional poverty in ethnic areas from five dimensions: economy, education, health, work situation and living standard. The economic dimension is replaced by per capita disposable income, while the education dimension is represented by the number of years of education and dropout rate. The health condition is measured from three aspects: self-rated physical health, chronic disease and mental health. Work condition is measured from five aspects: employment, work formality, satisfaction with work environment, satisfaction with job promotion and information resources. Living standard from medical insurance, cooking water, cooking fuel, culture, education and entertainment expenditure ratio of 4 aspects to measure. The choice of index weight has an important influence on the results of multidimensional poverty index, but there is no consistent conclusion or standard for setting index weight. The United Nations Development Programme (UNDP) used the equal-weight method when calculating the multidimensional poverty index of 20 backward countries, and the equal-weight method was also commonly used by most scholars at home and abroad in their studies on multidimensional poverty (Zhang Quanhong, 2015; Guo Xibao, Zhou Qiang, 2016; Shen Yangyang, 2018; Xiao Rongrong, 2018; Wu Pinzhou, 2019; Wang Bingbing, 2020; Zhong Chao, 2020, etc.). Therefore, the study of multidimensional poverty in ethnic areas in this paper also adopts the method of equal weight of dimensions, that is, the weight of each dimension is 1/5.

**Table 1. Multidimensional poverty indicators and weight description**

Dimension	Indicators	Description
Economic level( 1/5)	Disposable income per capita( 1/5)	40% of income per capita, If it is greater than this, it is 0, otherwise it is 1.
Education( 1/5)	Number of average education years( 1/10)	If the average number of years of schooling for a family member over the age of 16 is less than 9 years, it is 1; otherwise, it is 0.
	Dropout rates( 1/10)	If the dropout ratio of children aged 6-16 in a family is greater than 0, it is 1; otherwise, it is 0.
Health Condition (1/5)	Physical health( 1/15)	If you are not in good health, it is 1, otherwise it is 0.
	Chronic diseases (1/15)	If the individual has a chronic disease, it is 1, otherwise it is 0.
	Mental health( 1/15)	If the individual is depressed in life, it is 1, otherwise it is 0.
Work condition( 1/5)	Long-term unemployed( 1/25)	If long-term unemployed, it is 1, otherwise it is 0.
	Work formality( 1/25)	Yes is 1, otherwise it is 0.
	Job environment satisfaction( 1/25)	Job environment satisfaction is rated on a scale of 1-5, with 1 if less than 3 and 0 if not.
	Job promotion satisfaction ( 1/25)	Job promotion satisfaction is rated on a scale of 1-5, with 1 if less than 3 and 0 if not.
	Information resources( 1/25)	Information resources is rated on a scale of 1-5, with 1 if less than 3 and 0 if not.
Living standard( 1/5)	Medical Insurance( 1/20)	If the individual does not have medical insurance, it is 1, otherwise it is 0.
	Cooking water( 1/20)	1 if the cooking water is not clean, 0 otherwise.
	Cooking fuel( 1/20)	1 if the cooking fuel is not clean energy, 0 otherwise.
	Education and entertainment expenditure ratio( 1/20)	The proportion of cultural, educational and entertainment expenditure in total expenditure. If it is less than 40% of the proportion, it is 1, otherwise it is 0.

## Analysis of Multidimensional Poverty in Ethnic Areas

**Poverty incidence rate of each indicator:** We use the CFPS data from 2010 to 2018 to calculate the incidence of poverty in ethnic minority areas in five dimensions and 15 indicators, and the results are shown in Table 2. First of all, in terms of absolute value, the incidence of poverty in ethnic minority areas was prominent in terms of educational opportunities, cooking fuel, work formality, work environment satisfaction and job promotion satisfaction in 2010. 70.27% of workers had no guarantee of employment quality, 70.19% of workers had no promotion channel, 70.07% of workers had poor working environment, 64.39% of the workers had less than nine years of education on average, and 57.28% of the residents could not use clean energy to cook. In 2018, the incidence of poverty in education opportunities, cooking fuel, job formality, job environment satisfaction and job promotion satisfaction decreased, but the incidence of poverty in the dimensions of job formality and job promotion satisfaction is still prominent. At the same time, information sources and mental health have become the main aspects of poverty in ethnic areas. Secondly, in terms of relative value, from 2010 to 2018, income indicators, education years, dropout rate, medical insurance, cooking water, cooking fuel, employment situation, work formality, work environment satisfaction, job promotion satisfaction, and the incidence of poverty have decreased, among which the incidence of poverty in employment, dropout rate, cooking fuel, and work environment satisfaction has decreased by more than 40%, but the incidence of poverty in education, medical insurance and job satisfaction just decreased 15%. On the one hand, the change of the indicator is affected by the national anti-poverty policy. For example, the implementation of the nine-year compulsory education policy has greatly reduced the dropout rate of school-age children. And the popularization and promotion of the new rural cooperative medical insurance has effectively reduced the incidence of poverty. On the other hand, the change of the indicator is also related to the nature of the indicator. For example, the indicator of the number of years of education is a long-term indicator, so the degree of change is slow. However, from 2010 to 2018, the incidence of poverty in terms of individual physical health, chronic diseases, mental health, education and entertainment expenditure ratio and information sources showed an upward trend, especially in the dimension of physical health, which increased year by year from 2010 to 2018. The incidence of poverty in terms of physical health in 2018 was twice that in 2012. Finally, compared with other aspects of poverty, the incidence of income poverty in 2018 is only 18.89%, but the incidence of poverty in education, work formality, job environment satisfaction and promotion satisfaction, information sources and other

aspects is more than 50%, which is almost twice the incidence of income poverty, indicating that in addition to income poverty, the poverty situation in education, health, work condition and living standard is significant in ethnic minority areas in China. Therefore, it is more comprehensive to measure poverty from a multidimensional perspective than from a single income perspective, which is more in line with the current situation of poverty in China.

**Table 2. Poverty incidence of various indicators in ethnic areas from 2010 to 2018**

Dimension	Indicators	2010	2012	2014	2016	2018	Absolute value change rate (%)	Relative value change rate (%)
Economic	Disposable income	19.48	21.53	27.00	18.80	18.89	-0.59	-3.03
Education	education years	64.39	55.75	52.70	54.73	52.65	-11.74	-18.23
	Dropout rates	5.57	8.62	3.74	2.94	2.88	-2.69	-48.29
Health	Physical health	14.10	22.14	33.98	37.99	28.93	14.83	105.18
	Chronic diseases	7.88	6.19	8.65	10.58	9.91	2.03	25.76
	Mental health	42.60	27.26	44.89	37.44	45.05	2.45	5.75
Living standard	Medical Insurance	16.17	14.43	7.81	5.89	13.16	-3.01	-18.61
	Cooking water	7.19	6.03	6.75	9.79	6.89	-0.3	-4.17
	Cooking fuel	57.28	36.16	43.00	35.54	31.28	-26	-45.39
	Education and entertainment expenditure ratio	25.74	20.33	25.61	28.07	27.24	1.5	5.83
Work condition	unemployed	36.84	10.80	5.59	5.89	7.23	-29.61	-80.37
	Work formality	70.27	10.19	65.97	65.52	62.96	-7.31	-10.40
	Job environment satisfaction	70.07	46.31	41.84	41.31	40.06	-30.01	-42.82
	Job promotion satisfaction	70.19	51.63	64.49	51.16	58.34	-11.85	-16.88
	Information resources	34.88	43.21	57.79	53.82	53.19	18.31	52.49

**Multidimensional Poverty:** In order to get the multidimensional poverty status of individuals, according to the above multidimensional poverty algorithm, 15 indicators of five dimensions are integrated into a multidimensional poverty index M. at the same time, the measurement of multidimensional poverty index is related to the setting of the critical value of individual deprivation score, and the multidimensional poverty index values corresponding to different critical values are different. In order to understand the multidimensional situation of poverty in ethnic areas and grasp the poverty characteristics of ethnic areas as a whole, the multidimensional poverty index of the whole sample with K between 10% and 60% is calculated.

The results are shown in Table 3. With the increase of K value, the multidimensional poverty index M gradually decreases, the incidence of poverty gradually decreases, and the poverty degree index A gradually increases. Specifically, when k is 10%, the Multidimensional Poverty Index is 0.3652, and the incidence of Multidimensional Poverty is high. 98.88% of the individuals are in poverty in at least one dimension, and the number of individuals who are not poor in the six dimensions of economy, education, health, work status and living standard is less, and the poverty index is 0.3694. When k is 60%, the multidimensional poverty index decreases to 0.0476, the incidence of Multidimensional Poverty also decreases to 7.17%, but the poverty degree index rises to 0.6641, and the multidimensional poverty degree increases.

At present, there is no unified standard for the value of K value. The United Nations Development Programme (UNDP) usually sets  $k = 30\%$  as the critical value. When the sample's deprivation score is greater than or equal to 30%, it is considered as multidimensional poverty, otherwise it is non multidimensional poverty. According to table 3, when  $k = 30\%$ , the Multidimensional Poverty Index of ethnic minority areas is 0.2836, of which 63.85% are in Multidimensional Poverty, and the poverty degree index is 0.4442. Furthermore, in order to consider the dynamic change of multidimensional poverty index, we observed the change of multidimensional poverty in ethnic minority areas at the same critical value, and calculated the multidimensional poverty index, poverty incidence and poverty degree index from 2010 to 2018. The results are shown in Table 4.

The multidimensional poverty index shows a downward trend from 2010 to 2018, but the change degree of multidimensional poverty index is different according to different K values. Specifically, first of all, with the increase of K value, the decline of Multidimensional Poverty Index shows an upward trend. When k is 60%, the decline of Multidimensional Poverty Index is the largest from 2010 to 2018, which is 36.34%.

On this critical value, the incidence of Multidimensional Poverty decreases by 35.62%, and the poverty degree index decreases by 0.95%. It shows that when k is 60%, the decline of Multidimensional Poverty Index is mainly due to the decline in the incidence of Multidimensional Poverty rather than the decline in poverty index. Secondly, when k is 10%, the decline of Multidimensional Poverty Index is the smallest, which is 7.12%, and the incidence of Multidimensional Poverty decreases by 0.44%, and the poverty degree index decreases by 6.72%.

It shows that when k is 10%, the decline of Multidimensional Poverty Index in 2010-2018 is mainly caused by the decline of poverty degree index, not the decline of poverty incidence. Finally, when k is 30%, the Multidimensional Poverty Index shows a downward trend year by year from 2020 to 2018. The Multidimensional Poverty Index has decreased by 12.72%, the incidence of poverty has decreased by 9.39%, and the poverty degree index has decreased by 3.65%, indicating that the decline of Multidimensional Poverty Index is caused by the incidence of poverty. However, 63.7% of individuals are still in Multidimensional Poverty in 2018, and the poverty degree index is 0.4352.

Table 3. 2010-2018 Multidimensional Poverty index in ethnic areas

K	Multidimensional Poverty index (M)	Multidimensional incidence of poverty (H)	Multidimensional poverty degree index (A)
10%	0.3652	0.9888	0.3694
20%	0.3504	0.8981	0.3902
30%	0.2836	0.6385	0.4442
40%	0.1892	0.3678	0.5144
50%	0.1017	0.1713	0.5939
60%	0.0476	0.0717	0.6641

Table 4. 2010-2018 Multidimensional Poverty index and change rate in ethnic areas

K	2010			2012			2014		
	M	H	A	M	H	A	M	H	A
10%	0.3860	0.9942	0.3883	0.3411	0.9942	0.3431	0.3777	0.9884	0.3821
20%	0.3750	0.9262	0.4049	0.3287	0.9138	0.3597	0.3624	0.8951	0.4049
30%	0.3176	0.7030	0.4517	0.2449	0.5715	0.4285	0.3047	0.6667	0.4570
40%	0.2242	0.4322	0.5188	0.1770	0.3621	0.4889	0.2138	0.4096	0.5221
50%	0.1305	0.2174	0.6000	0.1007	0.1765	0.5706	0.1235	0.2080	0.5938
60%	0.0666	0.0991	0.6720	0.0711	0.1122	0.6339	0.0555	0.0837	0.6634
K	2016			2018			2010-2018 Change rate(%)		
	M	H	A	M	H	A	M	H	A
10%	0.3687	0.9807	0.3760	0.3585	0.9898	0.3622	-7.12	-0.44	-6.72
20%	0.3521	0.8773	0.4013	0.3434	0.8952	0.3836	-8.43	-3.35	-5.26
30%	0.2983	0.6667	0.4475	0.2772	0.6370	0.4352	-12.72	-9.39	-3.65
40%	0.2001	0.3859	0.5186	0.1713	0.3328	0.5149	-23.60	-23.00	-0.75
50%	0.1092	0.1831	0.5961	0.0934	0.1571	0.5950	-28.43	-27.74	-0.83
60%	0.0555	0.0837	0.6628	0.0424	0.0638	0.6656	-36.34	-35.62	-0.95

### Analysis of Multidimensional Poverty Index

**Poverty Index Analysis:** In order to study the contribution of each index to the multidimensional poverty index in ethnic areas, the contribution rate of poverty of each index to the multidimensional index is calculated. Table 5 shows the poverty contribution rate of each index in ethnic areas when the critical value is 30%. Specifically, as shown in Table 5, first of all, among the 15 indicators in 2010, the contribution of education years to poverty was the highest, reaching 20.28%, and the contribution of per capita income to poverty ranked second, 12.27%. The contribution rate of mental health, cooking fuel, job employment, job environment satisfaction and promotion satisfaction is about 8%, and the contribution rate of poverty of other indicators is less than 5%. The contribution rate of poverty of chronic diseases is the lowest, which is 1.65%. It shows that in 2010, poverty mostly occurs in the dimensions of income and education years, and low income level and lack of education years or education opportunities are the main causes of poverty in ethnic areas. Secondly, the poverty causing factors of Multidimensional Poverty changed in 2018. The contribution of years of education was still the first, but its contribution rate decreased from 20.28% in 2011 to 18.99% in 2018; the contribution of income was still the second, but its contribution rate increased from 12.27% in 2011 to 13.63% in 2018. The contribution of mental health ranked third, rising from 8.94% in 2010 to 10.83% in 2018. Finally, from the change of contribution degree of each index, from 2010 to 2018, the contribution degree of per capita income, health status, information source, chronic diseases, mental health status, education and entertainment expenditure ratio and work formality index showed an upward trend, especially the contribution degree of poverty of health status increased from 2.96% in 2010 to 6.96% in 2018, an increase of 135.14%; the contribution degree of information source increased from 4.39% in 2010 to 7.67% in 2018, an increase of 74.72%. The poverty contribution of education years, dropout rate, medical insurance, cooking fuel, employment, working environment satisfaction and promotion satisfaction showed a downward trend, in particular, the contribution rate of employment poverty decreased from 4.64% in 2010 to 1.04%, a decrease of 77.59%; the dropout rate decreased from 1.75% to 1.04%, a decrease of 40.57%. Therefore, it can be seen from Table 5 that from 2010 to 2018, low per capita income, lack of years of education and opportunities are still the important causes of poverty in ethnic minority areas. The contribution of cooking fuel, cooking water, medical insurance, dropout rate and unemployment is on the decline, but the contribution of physical health, mental health, chronic diseases, information sources, education and entertainment expenditure ratio has gradually become an important cause of poverty in ethnic areas.

Table 5. Contribution rate of various indicators in ethnic areas from 2010 to 2018 (K=30%)

Dimension	Indicators	2010	2012	2014	2016	2018
	M	0.3176	0.2449	0.3047	0.2983	0.2772
Economic	Disposable income	12.27	17.58	17.72	12.60	13.63
Education	education years	20.28	22.77	17.30	18.34	18.99
	Dropout rates	1.75	3.52	1.23	7.35	1.04
Health	Physical health	2.96	6.03	7.44	8.49	6.96
	Chronic diseases	1.65	1.68	1.89	2.36	2.38
	Mental health	8.94	7.42	9.82	8.37	10.83
Living standard	Medical Insurance	2.55	2.95	1.28	0.99	2.37
	Cooking water	0.97	0.21	1.11	1.64	0.84
	Cooking fuel	9.02	7.38	7.06	5.96	5.64
	Education and entertainment expenditure ratio	4.05	4.15	4.20	4.71	5.31
Work condition	unemployed	4.64	1.76	0.73	0.79	1.04
	Work formality	8.85	1.66	8.66	8.78	9.08
	Job environment satisfaction	8.83	7.56	5.49	5.54	5.78
	Job promotion satisfaction	8.84	8.43	8.47	6.86	8.42
	Information resources	4.39	6.89	7.59	7.22	7.67

**Individual Characteristics Analysis:** A large number of empirical studies have proved that there is a significant correlation between multidimensional poverty and individual characteristics (Li Siqi, 2019; Peng Jiquan, 2019). In order to further study the relationship between multidimensional poverty and individual characteristics in ethnic minority areas, the samples are classified according to gender, age and years of education. Gender is divided into two categories according to men and women. Age is divided into four categories: 16-28 years old, 29-50 years old, 51-65 years old and over 65 years old. The years of education are divided into four categories: 0-6 years, 7-9 years, 10-12 years and over 12 years. Table 6 shows the multidimensional poverty results ( $k = 30\%$ ) of the sample from 2010 to 2018. From the perspective of gender, on the one hand, in 2010-2018, the Multidimensional Poverty Index of women is higher than that of men. For example, in 2018, the Multidimensional Poverty Index of men is 0.2690, the incidence of Multidimensional Poverty is 0.6171, and the poverty degree index is 0.4358, which indicates that 61.71% of men in ethnic minority areas are in poverty on average in six indicators, and the poverty index is 0.2690. The multidimensional poverty index of women is 0.2858, the incidence of multidimensional poverty is 0.6577, and the poverty degree index is 0.4346, indicating that 65.77% of women in ethnic minority areas are in poverty on average in six indicators, and the poverty index is 0.2858 in 2018.

The results are consistent with the actual situation. Ye puwan, Jia Huiyong (2010) and Wang Chaoxia (2015) showed that women have less employment opportunities except for agricultural work, and women's wage level is low, which makes women only get low experience income. Compared with men, women are more likely to fall into multidimensional poverty because of the following reasons: first, under the influence of traditional feudal ideology, they advocate that "a woman without talent is virtue", thus depriving women of the opportunity to receive education, resulting in a high dropout rate and a short period of education for women. As an important part of human capital, the level of education has a negative impact on employment and income. Second, women generally bear more family responsibilities than men, and they need to undertake the family activities of cleaning, washing, cooking and taking care of family members, which not only deprives them of the opportunity to work, but also creates a greater burden on their physical and mental health. Li Siqi (2019) also pointed out that the reason why women are more likely to fall into poverty is that women's status is low, the phenomenon of son preference in poor areas is serious, and women bear the responsibility of having children in the family, which increases the difficulty of women in job hunting, medical assistance and other aspects. On the other hand, from 2010 to 2018, the multidimensional poverty index of men and women generally showed a downward trend, and the decline rate of women was greater than that of men. The multidimensional poverty index of men decreased by 6.86%, while that of women decreased by 14.58%, which was double that of men. At the same time, the decline of multidimensional poverty index for men and women is due to the decline of poverty incidence, not the decline of poverty degree. From the perspective of age, on the one hand, with the increase of age, the individual Multidimensional Poverty Index is on the rise. In 2018, the Multidimensional Poverty Index of individuals aged 16-28 is 0.2197, the incidence of poverty is 0.5542, and the poverty degree index is 0.3965.

That is to say, in 2018, 55.42% of individuals aged 16-28 in ethnic minority areas are in poverty on two indicators, which is 0.2197; while 75.8% of individuals aged 65 and above are in poverty on seven indicators, which is 0.2745, indicating that the elderly are more likely to fall into multidimensional poverty, and the reason is that the elderly have basically lost the ability to work, have less sources of income, low income level, poor health and education level compared with young people, so they are more likely to fall into multidimensional poverty. Bai zengbo (2020) pointed out that the elderly in rural areas are poor in economic income, health, education, quality of life and spiritual comfort. On the other hand, from the perspective of multidimensional poverty dynamics, the multidimensional poverty index of all age groups in 2018 decreased compared with 2010. The number of individuals aged 51-65 decreased by 33.00%, followed by those over 65, with a decrease of 21.69%.

At the same time, from the perspective of the causes of Multidimensional Poverty Reduction, the decline rate of poverty incidence is greater than that of poverty degree index. From the perspective of education level, on the one hand, with the growth of education years, the Multidimensional Poverty Index shows a downward trend. In 2010, the Multidimensional Poverty Index with education years of 0-6 years, 7-9 years, 10-12 years and more than 12 years are 0.2069, 0.1848, 0.1421 and 0.1387 respectively. With the improvement of education level, the incidence of poverty is gradually decreasing, but the change of poverty degree index is small.

On the other hand, from the perspective of the dynamic change of Multidimensional Poverty, with the growth of time, the Multidimensional Poverty Index of 7-9 years and 10-12 years shows a downward trend, in which the individual Multidimensional Poverty Index of 10-12 years has the largest change, reducing by 30.75%, but the Multidimensional Poverty Index of individuals with 0-6 years and more than 12 years shows an upward trend, especially for individuals with 0-6 years of education, the multidimensional poverty index increased by 66.75%, and for individuals with more than 12 years of education, the multidimensional poverty index increased by 6.49%. The increase of poverty incidence is an important reason for the rise of Multidimensional Poverty Index. With the deepening of China's education reform and the increase of education investment, China's national education level is gradually improving. Therefore, compared with the individuals in 0-6 years of 2010, the job opportunities and income levels of individuals in 0-6 years of 2018 will be reduced. The decline of economic level has a direct impact on the family life level and individual health. Therefore, individuals with 0-6 years of education will have a higher incidence of poverty in 2018.

Table 6. Heterogeneity analysis

	2010			2012			2014			2016			2018		
	H	A	M	H	A	M	H	A	M	H	A	M	H	A	M
Gender															
Male	0.6426	0.4494	0.2888	0.6218	0.4312	0.2681	0.6485	0.4566	0.2961	0.6650	0.4442	0.2953	0.6171	0.4358	0.2690
Female	0.7388	0.4529	0.3346	0.6322	0.4324	0.2733	0.6843	0.4573	0.3130	0.6684	0.4514	0.3017	0.6577	0.4346	0.2858
Age															
18-28	0.6714	0.3999	0.2685	0.6356	0.4188	0.2662	0.6382	0.4385	0.2799	0.6016	0.4286	0.2579	0.5542	0.3965	0.2197
29-50	0.6179	0.4451	0.2750	0.6057	0.4316	0.2614	0.6373	0.4559	0.2906	0.6790	0.4454	0.3024	0.5907	0.4316	0.2550
51-65	0.8642	0.4740	0.4097	0.6658	0.4367	0.2907	0.7134	0.4651	0.3318	0.7094	0.4512	0.3201	0.6253	0.4390	0.2745
Over 65	0.9129	0.4959	0.4527	0.6740	0.4485	0.3023	0.7521	0.4741	0.3566	0.6587	0.4742	0.3123	0.7580	0.4677	0.3545
Educated															
0-6	0.4594	0.4504	0.2069	0.6382	0.4364	0.2785	0.7535	0.4577	0.3449	0.7056	0.4561	0.3218	0.7838	0.4401	0.3450
7-9	0.4421	0.4181	0.1848	0.5458	0.4203	0.2294	0.5455	0.4162	0.2270	0.5837	0.4238	0.2474	0.3652	0.4146	0.1514
10-12	0.3235	0.4391	0.1421	0.4369	0.3915	0.1711	0.6061	0.4327	0.2622	0.4889	0.4264	0.2085	0.2555	0.3849	0.0984
More than 12	0.2778	0.4993	0.1387	0.5556	0.4215	0.2342	0.4286	0.3433	0.1471	0.3516	0.3978	0.1399	0.3333	0.4431	0.1477

## Conclusion

For a more comprehensive analysis of poverty in China's ethnic areas, this paper uses the 2010-2018 CFPS data and Multidimensional Poverty Analysis Method to calculate the ethnic Multidimensional Poverty Index from the Multidimensional Poverty of 15 indicators in five dimensions of economy, health, education, living standards and working conditions, and analyzes the causes and characteristics of Multidimensional Poverty. The results show that the multi-dimensional poverty index of ethnic areas is 0.2836, 63.85% of them are in multidimensional poverty, and the poverty degree index is 0.4442. The Multidimensional Poverty Index of women is higher than that of men, and the elderly are more likely to fall into multidimensional poverty. With the improvement of education level, the incidence of poverty is gradually decreasing. In 2018, the number of years of education, income level and mental health status are the important reasons for multidimensional poverty. Therefore, in order to solve the poverty problem in ethnic minority areas, we should not only improve the income level of residents, but also improve their education years, pay more attention to their mental health, and solve the Multidimensional Poverty Problem by improving their development ability and development opportunities.

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