



# Research on Multidimensional Relative Poverty Measurement of Rural Left Behind Children and Its Influencing Factors Based on Big Data Samples

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**Abstract.** This paper measures the multidimensional relative poverty of rural left behind children based on the big data samples of the 2018 China family tracking survey (CFPS), and empirically studies the influencing factors of multidimensional relative poverty of rural left behind children by using logistic model. The results show that: (1) the incidence of relative poverty of left behind children in rural areas in four indicators of physical development, parental companionship, clean water and household energy is prominent, all of which are above 40%. (2) With the increase of the critical value  $k$  of multidimensional relative poverty, the incidence of multidimensional relative poverty and multidimensional relative poverty index ( $H$  and  $m$ ) of rural left behind children show a downward trend. (3) Individual characteristics, family population endowment, family resource endowment and social capital have different effects on the multidimensional relative poverty of rural left behind children.

**Keywords:** AF method · multidimensional relative poverty · influencing factors

## 1 Introduction

With the gradual development of China's per capita income level and the comprehensive elimination of absolute poverty under the current standard, China's poverty alleviation work has changed from the goal of "two worries and Three Guarantees" to the goal of coping with and alleviating unbalanced and inadequate development and multidimensional relative poverty [1, 2]. Left behind children in rural areas are social vulnerable groups that appear in the process of urbanization in China and will exist for a long time. They are one of the special groups that need attention most in the process of relative poverty governance in China. As of the end of August 2018, there were 6.97 million rural left behind children in China. This is only the current data of left behind children in rural areas. Over the years, a large number of left behind children have gradually grown up, and a new batch of left behind children continue to emerge. Finally, hundreds of millions of people have left behind experience. Due to the lack of parental care, care and education, rural left behind children are extremely vulnerable to multiple dimensions of

relative poverty deprivation, such as unclean living environment, insufficient cognitive development [3], impaired health and backward education [4, 5]. The growth of children is closely related to China's future economic and social development. A large number of left behind children in rural areas need attention and attention. In the phase of relative poverty governance towards common prosperity, it is necessary to take the rural left behind children as an independent group to investigate their multidimensional relative poverty.

This paper uses the big data samples of the 2018 China family tracking survey (CFPS) to measure the multidimensional relative poverty of rural left behind children and analyze its influencing factors, in order to comprehensively understand the growth plight of rural left behind children in China.

## 2 Data Source and Research Method

### 2.1 Data Source

CFPS is a national big data social survey project. It has strong representativeness. After screening, 1052 effective samples were finally obtained.

### 2.2 Research Methods

#### 2.2.1 A-F Multidimensional Poverty Measurement Method

Let  $X = [x_{ij}]$  be an  $n * m$ -dimensional matrix, which represents the state of  $n$  individuals in  $m$  dimensions,  $x_{ij}$  represents the state of individual  $i$  under dimension  $j$ ;  $z_j$  ( $z_j > 0$ ) represents the deprivation critical value of dimension  $j$ , and row vector  $Z$  represents the deprivation critical value of a specific dimension. The specific steps of multidimensional relative poverty measurement are as follows [6]:

First, one-dimensional poverty. Define deprivation matrix  $g^0 = [g_{ij}^0]$ , if  $x_{ij} < z_j$ ,  $g_{ij}^0 = 1$ , indicating that individual  $j$  is below the deprivation threshold in dimension  $j$  and is in poverty, and the value is 1; If  $x_{ij} \geq z_j$ ,  $g_{ij}^0 = 0$ , indicating that there is no deprivation of individual  $j$  in dimension  $j$ .

Second, determine the deprivation count function. Let  $c_i$  is the deprivation count function of individual  $I$ ,  $w_j$  is the weight of dimension  $J$ , then  $c_i = \sum_{j=1}^m w_j g_{ij}^0$ .

Third, judge whether an individual is in a multidimensional state of relative poverty. Let  $k$  be the critical value of poverty dimension,  $p_k(X_i, Z)$  is a multidimensional relative poverty identification function, then if  $c_i \geq k$ , individual  $i$  is judged as a multidimensional relative poor individual; If  $c_i \leq k$ , individual  $i$  is judged as a non multidimensional relatively poor individual.

Fourth, poverty aggregation. It mainly includes the incidence of poverty (H) and the average deprivation share (A). The specific formula is as follows:

$$H(y, z) = q/n \quad (1)$$

$$A = \sum_{i=1}^n c_i(k)/dq \quad (2)$$

$$MPI(M_0) = \mu(g^0(k)) = H \times A = \sum_{i=1}^n c_i(k) / nd \quad (3)$$

Fifth, the breakdown of poverty. The multidimensional relative poverty index can be decomposed according to different standards such as dimension and region. Taking decomposition by dimension as an example,  $d_1, d_2, \dots, d_n$  represents each dimension, then:

$$\begin{aligned} M_0 = M(d_1, d_2, \dots, d_n; z) &= \frac{n(d_1)}{n(d_1, d_2, \dots, d_n)} M(d_1; z) + \frac{n(d_2)}{n(d_1, d_2, \dots, d_n)} M(d_2; z) \\ &+ \dots + \frac{n(d_n)}{n(d_1, d_2, \dots, d_n)} M(d_n; z) \end{aligned} \quad (4)$$

### 2.2.2 Dimension and Indicator Selection

The relative poverty measurement index system of rural left behind children in this study is shown in Table 1.

### 2.2.3 Logistic Mode

Since the explained variable is the multidimensional relative poverty of rural left behind children, this paper uses Logistic regression model to analyze the influencing factors of multidimensional relative poverty of rural left behind children. Establish function  $\text{Logit}(Y) = \beta_0 + \sum_{i=1}^k \beta_i x_i + \varepsilon$ . The analysis model of multidimensional relative poverty influencing factors of rural left behind children is shown as follows:

$$P(Y_j = 1) = \frac{\exp(\hat{\beta}_0 + \sum_{i=1}^k \hat{\beta}_i x_i)}{1 + \exp(\hat{\beta}_0 + \sum_{i=1}^k \hat{\beta}_i x_i)} \quad (5)$$

Where  $P(Y_j = 1)$  denotes the probability of rural left behind children falling into relative poverty,  $\hat{\beta}_i$  represents the regression coefficient of each variable,  $x_i$  is an independent variable,  $\hat{\beta}_0$  is the regression intercept.

To better fit the research in this paper, we constructed the following regression model to observe the influencing factors of rural left behind children:

$$Pov_i = \eta V_i + \psi Z_i + \Phi F_i + \Pi S_i + \varepsilon \quad (6)$$

Where,  $Pov_i$  is the multidimensional relative poverty situation of rural left behind children,  $\eta V_i$  is an individual characteristic variable matrix,  $\eta$  Is its regression coefficient;  $\psi Z_i$  is the family population endowment variable matrix,  $\psi$  Is its regression coefficient;  $\Phi F_i$  is the family resource endowment variable matrix,  $\Phi$  Is its regression coefficient;  $\Pi S_i$  is the social capital variable matrix,  $\Pi$  For its regression coefficient,  $\varepsilon$  Is a random disturbance term.

### 2.2.4 Variable Selection

Refer to the research of existing scholars [7–9], the descriptive statistical results of the variables selected in this paper are shown in Table 2.

**Table 1.** Setting of relative poverty dimensions, indicators, thresholds and weights of rural left behind children

Dimension	Indicator	Threshold	Weight
Living	Clean water	Domestic water mainly comes from rivers and lakes, rainwater, etc., value 1; otherwise, value 0.	1/15
	Living environment	The per capita living area of the family is less than 15 square meters, value 1; otherwise, value 0.	1/15
	The household energy	Cooking fuel is firewood and coal, value 1; cooking fuel is natural gas, solar energy, electricity, value 0	1/15
Health	Physical development	The BMI index of healthy body development is lower than 18 or higher than 24, value 1; otherwise, value 0.	1/15
	Medical treatment due to illness	The number of medical treatment in the past year is more than 5, value 1; otherwise, value 0.	1/15
	Hospitalization due to illness	Been hospitalized due to illness in the past year, value 1; otherwise, value 0.	1/15
Education	Education dropout or not	Drop out of school, value 1; otherwise, value 0.	1/5
Protection	Medical insurance	No medical insurance, value 1; otherwise, value 0.	1/10
	Parents company	The time of living with the father or mother is less than 3 months in one year, value 1; otherwise, value 0.	1/10
Culture	Parent-child communication	Parents are completely or relatively inactive in communicating with their children, value 1; otherwise, value 0.	1/15
	Learning care	Parents do not care about their children's learning at all or do not care about their children's learning, value 1; otherwise, value 0.	1/15
	Education mode	Scolding and corporal punishment of children, value 1; otherwise, value 0.	1/15

**Table 2.** Descriptive statistical results of variables

variable		Definition and assignment
Multidimensional relative poverty		When the left behind children in rural areas have multidimensional relative poverty, the value is 1; Otherwise, the value is 0
Child characteristics	Child age	Actual age at the time of interview, unit: years
	Child gender	1 = male; 0 = female
Family population endowment	Gender of head of household	1 = male; 0 = female
	age of head of household	Actual age at the time of interview, unit: years
	Education years of the head of household	Years of formal education received by the head of household, unit: years
	Head of household marriage	1 = married; 0 = other
	Family size	Family Population
Family resource endowment	Per capita household net income	Per capita household net income in the past year, unit: Yuan
social capital	Human relationship expense	Family gift expenditure in the past year, in kind expenditure converted into cash, unit: Yuan

### 3 Results and Analysis

#### 3.1 Analysis of Multidimensional Relative Poverty Measurement Results of Rural Left Behind Children

##### 3.1.1 Relative Poverty Incidence of Each Indicator

Table 3 lists the incidence of relative poverty of rural left behind children in 2018. It can be seen that, first of all, the four most prominent indicators in the single dimension of relative poverty of rural left behind children are physical development, parental companionship, clean water and household energy, and the incidence of relative poverty is over 40%. Specifically, 68.97% of the left behind children in rural areas lack parental companionship, 64.77% of the left behind children in rural areas have poor physical development, 43.64% of the left behind children in rural areas use non clean energy, and 33.27% of the left behind children in rural areas use non clean water. Secondly, the incidence of relative poverty of rural left behind children in terms of living environment and education mode is also prominent, and the incidence of relative poverty is more

**Table 3.** Incidence of relative poverty of rural left behind children

Dimension	Indicator	Incidence of relative poverty (%)
Living	Clean water	33.27
	Living environment	17.38
	The household energy	43.64
Health	Physical development	64.77
	Medical treatment due to illness	8.13
	Hospitalization due to illness	7.01
Education	Education dropout or not	8.50
Protection	Medical insurance	8.88
	Parents company	68.97
Culture	Parent-child communication	8.69
	Learning care	9.81
	Education mode	14.30

than 10%. Finally, the incidence of relative poverty in indicators such as medical treatment, hospitalization, school dropout, medical insurance, parent-child communication and attention to education is less than 10%, indicating that the relative poverty situation of rural left behind children in these aspects is better.

**3.1.2 Multidimensional Relative Poverty Measurement Results**

Table 4 shows the multidimensional relative poverty index of rural left behind children in China calculated based on CFPS data. It can be seen from the Table 4 that, first, with the increase of the critical value K, the multidimensional relative poverty incidence and multidimensional relative poverty index (H and m) of rural left behind children show a downward trend. When the critical value k of relative poverty increases from 0.1 to 0.6, the incidence of multidimensional relative poverty of rural left behind children decreases from 90.09% to 0.84%, and the multidimensional relative poverty index decreases from 4.56% to 0.11%. This is because the increase of K means that the threshold of relative poverty identification rises, so the incidence of relative poverty and the relative poverty index decrease. In addition, when  $k = 0.7$ , the incidence of multidimensional relative poverty of rural left behind children is 0, which indicates that the phenomenon of deprivation in a very high dimension does not exist. Second, as the critical value k of multidimensional relative poverty increases, the average deprivation share a of multidimensional relative poverty of rural left behind children increases. When the critical value k of relative poverty increases from 0.1 to 0.6, the average deprivation share a of multidimensional relative poverty of rural left behind children rises from 5.06 to 12.67.

**Table 4.** Multidimensional relative poverty measurement results of rural left behind children

critical value	Incidence of poverty H (%)	Average deprived share A (%)	Multidimensional Poverty Index M (%)
k = 0.1	90.09	5.06	4.56
k = 0.2	60.47	6.08	3.68
k = 0.3	31.40	7.44	2.34
k = 0.4	10.00	9.31	0.93
k = 0.5	3.18	10.94	0.35
k = 0.6	0.84	12.67	0.11
k = 0.7	0	-	-

### 3.2 Analysis on the Influencing Factors of Multidimensional Relative Poverty of Rural Left Behind Children

The regression results are shown in Table 5. From the perspective of individual characteristics, the age of left behind children in rural areas has a significantly negative relationship with the incidence of relative poverty. The reason may be that, with the growth of age, the rural left behind children enter the compulsory education stage in education, and the drop out rate is significantly reduced, making the incidence of relative poverty lower.

From the perspective of family population endowment, firstly, the gender coefficient of the head of household is significantly positive. The possible reason is that female guardians often assume more responsibilities than male guardians in the daily life care of children. Therefore, female heads of household are more important to rural left behind children who lack care, which helps to alleviate the relative poverty of rural left behind children. Secondly, the coefficient of education years of the head of household is significantly negative, that is, the higher the education level of the head of household, the less likely the rural left behind children are to fall into relative poverty. From the perspective of family resource endowment, the per capita family net income coefficient is significantly negative, indicating that family wealth is an important factor to alleviate the relative poverty of rural left behind children. Specifically, every unit increase in per capita household net income will reduce the probability of rural left behind children falling into relative poverty by 0.73 percentage points.

From the perspective of social capital, the coefficient of human favor expenditure is significantly negative, indicating that the higher the family human favor expenditure, the less likely the rural left behind children are to fall into relative poverty. This result confirms the importance of social capital to the relative poverty management of rural left behind children. It can be seen that in the vast rural areas, the construction of neighborhood mutual assistance mechanism with the growth of left behind children as the core should be the reasonable policy orientation for the relative poverty management of rural left behind children.

**Table 5.** Logistic model regression analysis results of multidimensional relative poverty of rural left behind children

variable		Model 1	Model 2	Model 3	Model 4
Child characteristics	Child age	0.94***	0.94***	0.93***	0.93***
	Child gender	1.19	1.19	1.21	1.25
Family population endowment	Gender of head of household		1.01**	1.01**	1.01**
	age of head of household		1.40**	1.38**	1.32**
	Education years of the head of household		0.72***	0.74***	0.76***
	Head of household marriage		0.95	0.96	0.93
Family resource endowment	Per capita household net income			0.99*	0.73***
social capital	Human relationship expense				0.96*
constant		0.78	0.73	0.83	17.52
LR		13.40	50.06	55.14	60.51
P		0.001	0.000	0.000	0.000
R2		0.010	0.038	0.041	0.046
N		1052	1052	1052	1052

## 4 Conclusions and Suggestions

The multidimensional relative poverty of rural left behind children is measured and decomposed by using A-F method, and the influencing factors are empirically analyzed by using binary logit model. The following conclusions are obtained:

- (1) The incidence of relative poverty of left behind children in rural areas is the most prominent in the four indicators of physical development, parental companionship, clean water and household energy, all of which are over 40%.
- (2) With the increase of the critical value  $k$  of multidimensional relative poverty, the incidence of multidimensional relative poverty and multidimensional relative poverty index ( $H$  and  $m$ ) of rural left behind children show a downward trend.
- (3) Individual characteristics, family population endowment, family resource endowment and social capital have different effects on the multidimensional relative poverty of rural left behind children.

Based on the above conclusions, the paper puts forward the following suggestions: first, We will improve the phenomenon that guardians of left behind children in rural



areas place more emphasis on upbringing than education. We can strengthen the training and guidance of the guardians of rural left behind children by holding training courses, holding seminars, and establishing a home visit system, so as to improve their guardianship ability. Second, the problem of long-term separation between children left behind in rural areas and their parents should be alleviated in many ways. For example, the local government should strive to lower the entrance threshold of public schools, further promote the implementation of the education policy for the children of migrant workers in cities, represented by the “two priorities and two inclusion”, reduce the fee items, lower the fee standards, and reduce the cost of education for the children of migrant workers in the inflow areas. Third, it is necessary to build a neighborhood mutual assistance mechanism to provide help for rural left behind families. We should make full use of and give full play to the role of the social network in rural society to promote the governance of the relative poverty of rural left behind children.

**Acknowledgement.** Work partially supported by “Rural Anti-poverty and rural regional development (20AZD079)”.

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