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## On the Relationship between Income Poverty and Multidimensional Poverty in China

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### Abstract

This paper attempts to examine the theoretical relationship between income poverty and multidimensional poverty, and to explore the empirical linkages and discrepancies between these two types of poverty using the Alkire-Foster (AF) multidimensional poverty measurement method with 2011 China Health and Nutrition Survey (CHNS) data. Regarding the relationship between income poverty and multidimensional poverty, poverty can be summarized as not the mere lack of income but the deprivation of human basic capability, covering both monetary and non-monetary poverty. The statistical analysis on income poverty and multidimensional poverty measurement shows that the coincidence of income poverty and multidimensional poverty is 31%. In other words, 69% of multidimensionally poor households are not considered poor in terms of income poverty. The econometric results indicate that an increase in income can significantly reduce the incidence of multidimensional poverty in each dimension, but the impact is limited.

**Keywords:** Multidimensional poverty; Income poverty; Poverty measurement; Comparative analysis, China, Capability Approach

**JEL classification:** D63, I32

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## 1. Introduction

Poverty is usually defined as deprivations in well-being resulting in an inability to meet the basic needs of the individual or family (World Bank 2000). The measurement of poverty is, therefore, a kind of measurement of the income or consumption necessary to meet certain basic needs (poverty line), including food and nonfood needs (Haughton and Khandker 2009). The food poverty line is usually based on the market price of 2100 calories per person per day. Nonfood needs include the basic needs for clothing, housing, etc. The Engel coefficient of the poor is usually above 60%. Based on the food poverty line and an Engel coefficient of 60%, one can estimate the nonfood poverty line and then obtain the income poverty line (Ravallion 2012).

Poverty or lack of well-being covers both monetary and non-monetary aspects. Nobel Laureate Amartya Sen believes that poverty is not the mere lack of income to meet basic needs, but deprivations in basic human capabilities (Sen 1992). An income poverty line well captures the monetary aspect of poverty but cannot accurately reflect the non-monetary aspects. There is no doubt that under normal circumstances, with an increase in people's income, well-being in both monetary and non-monetary domains will be improved to some extent. It is undeniable, however, that non-monetary well-being problems are usually related to market failure or incomplete markets. For a poor illiterate person, for example, even if s/he lives above the income poverty line, her/his educational status will remain unchanged; a person with physical disabilities needs more income to maintain life and mobility than other people. Not only can health and basic education make it easier for people to shake off poverty, but it also makes their lives more meaningful and helps them participate in social activities (Sen 1999). Improvements in non-monetary well-being (such as education and health care) mainly involves the improvement of public goods and services (Bourguignon and Chakravarty 2003).

Correspondingly, two major international standards have been developed for poverty measurement. The first is the World Bank's poverty line based on income level, i.e. \$1.25 or \$2 a day (PPP), and the other is the Multidimensional Poverty Index (MPI) put forward by the United Nations Development Programme (UNDP, see also Alkire and Santos 2014).

Then, what on earth is the relationship between income poverty and multidimensional poverty? When a country develops its MPI, should it take income as a dimension and include it in the MPI system? What is the cause of multidimensional poverty? This is what this paper attempts to study.

In order to answer the above questions, this paper attempts to explore the linkages and discrepancies between the income poverty and multidimensional poverty in China using Alkire-Foster (AF) multidimensional poverty measurement and logit models with 2011 China Health and Nutrition Survey

(CHNS) data. It aims to provide a reference for the measurement of multidimensional poverty in China and a basis for the improvement of the national poverty reduction strategies and policies as well. Part two of this paper is the study of relevant literature and presents the conceptual framework of this paper; the third part describes the models, data, and relevant variables; the fourth part analyzes the empirical results; and the fifth part is the summary and policy implications based on the empirical results.

## 2. Conceptual Framework

What on earth is the relationship between income poverty and multidimensional poverty? From the perspective of basic needs, the World Bank defines poverty as deprivations in well-being and defines the poverty line as the income needed to meet the basic needs of the “shopping basket” (World Bank 2000). According to Amartya Sen, however, poverty refers to deprivations in basic capabilities of the individual or family; the deprivation of basic capabilities is multidimensional and includes premature death, obvious malnutrition, persistent disease and widespread illiteracy, etc. One should understand deprivations in basic capabilities with reference to people’s actual living and empowerment. Such capabilities are intrinsically and also instrumentally valuable: enhancing poor people’s basic capabilities through education and health care will increase their productivity and income (Sen 1999). Therefore, multidimensional poverty measurement based on basic capability can more accurately reflect the real circumstances of poverty, and the measurement of poverty should be multidimensional (Alkire 2002, Alkire and Foster 2007 and 2011, Wang and Alkire 2009).

Income poverty is based on the basic needs approach while multidimensional poverty is based on the basic capabilities approach. The former well reflects monetary poverty while the latter more accurately reflects the non-monetary aspects of poverty. However, there are certain different opinions in the academic world on the measurement of poverty by income or a multidimensional standard. Those who insist on income poverty measurement believe that income poverty is not the single standard since the regression model covers both food and non-food aspects, and it is just putting all dimensions of well-being together as a single monetary dimension (World Bank 2009). Those who persist in using the MPI to measure poverty fall into two categories. The first group believes that income is a dimension of multidimensional poverty and it constitutes multidimensional poverty together with education, health, and living standards (Whelan et al. 2012, Santos 2013, Dhongde and Haveman 2014). The other group believes that multidimensional poverty is a complement to income poverty, focusing on the non-tradable aspects of individual or family poverty, i.e. the non-monetary aspects (Haughton and Khandker 2009).

Many countries now have official national MPIs. Mexico is the only country to include income inside its MPI. The MPI in Mexico, which was the pioneering measure launched in 2009, includes income,

weighted at 50%, and six social rights.<sup>1</sup> The rest of the countries report MPI alongside traditional monetary poverty statistics.<sup>2</sup> For example, the MPI in Columbia covers five dimensions, namely family education condition, children and youth condition, employment, health, access to public facilities and housing condition, using 15 indicators (Salazar et al. 2013). Colombia's MPI is reported alongside a separate income poverty measure, and both guide policy. Bhutan's MPI has the same three dimensions as the global MPI, uses 12 indicators, and informs allocation and targeting. Chile's MPI has four dimensions – education, health, labour and social security, and housing – and 12 indicators. Costa Rica's has five dimensions: education, health, housing, work, and social protection, and 20 indicators; El Salvador has a different five dimensions: Childhood and adolescence, housing, access to work, health and food security, and surroundings and 20 indicators. Ecuador's MPI has four dimensions: education, work and social security, health water and nutrition, and housing and lived environment, and 12 indicators.

The Chinese definition of poverty may help us understand the relationship between income poverty and multidimensional poverty. The *Analytical Dictionary of Characters* defines poverty (贫困, pin kun) as “little wealth”.<sup>3</sup> The *Xinhua Dictionary* defines ‘poor (贫, pin)’ as “little income and difficulties in life” and defines ‘predicament (困, kun)’ as “falling into a harsh environment or any environment that one cannot shake off”.<sup>4</sup> Thus, the “poor” aspect of poverty mainly refers to the lack of income and the “predicament” aspect of poverty emphasizes the social environment. According to the Chinese definition, ‘poverty’ can be defined as “falling into a harsh environment or any environment that one cannot shake off due to little income or wealth” (Wang 2012). Similarly, this paper believes that poverty includes not only the lack of income but also social predicaments (Figure 1).

Poverty is multidimensional and includes not only a shortage of income to maintain basic living, but also social exclusion, expressed as a lack of access to education, health, and housing due to a social predicament. It is obvious that income poverty measures cannot well capture the “predicament” aspect of poverty. If the MPI does not cover the dimension of income, it can hardly capture the “poor” aspect of poverty. But if we include income in the MPI, it will be affected by market prices, exchange rate, and PPP, so the comparison of poverty between regions and countries is not so accurate.

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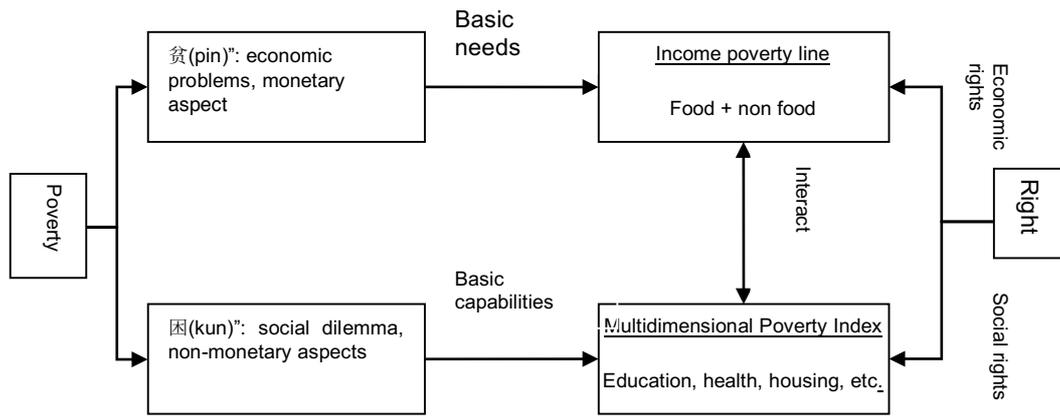
<sup>1</sup> See [http://www.coneval.gob.mx/rw/resource/coneval/med\\_pobreza/MPMMPshortversion100903.pdf](http://www.coneval.gob.mx/rw/resource/coneval/med_pobreza/MPMMPshortversion100903.pdf).

<sup>2</sup> Links to all relevant national documents are found at [www.mppn.org](http://www.mppn.org).

<sup>3</sup> *Analytical Dictionary of Characters* (《说文解字》) is an ancient Chinese dictionary written by Shen Xu (许慎) in the year 121 when China is in the East Han dynasty, in which ‘poor (贫)’ is defined as “财分少也”.

<sup>4</sup> The *Xinhua Dictionary* (《新华字典》) is the modern Chinese dictionary, in which ‘poor (贫)’ is defined as “收入少, 生活困难” and ‘predicament (困, kun)’ is defined as “陷在艰难痛苦或无法摆脱的环境中”.

**Figure 1: The conceptual Framework for Poverty Analysis**



This paper argues, therefore, that setting up the income poverty and MPI measures separately in order to measure the economic and social aspects of poverty will help in the development of a more comprehensive pro-poor strategy and policy system.

Economists are accustomed to using currency (income or consumption) to measure poverty. They divide the income (consumption) poverty line into the basic food needs and non-food needs and convert the basic non-food needs into income according to the Engel coefficient (Ravallion 2012). In such a way, only one income poverty line needs to be set for a country to identify the poor (Sen 1976) and work out the incidence of poverty so as to provide simple policy instruments for anti-poverty policies. However, many aspects of “predicament” involve the supply of basic public goods and services by a government and society, and the private sector seldom provides such goods and services, leading to the phenomenon of market failure; thus, the “predicament” in this aspect cannot be accurately captured by currency. “Predicament” is a kind of social exclusion to a large extent, so it is necessary to analyze the problem from the perspective of sociology and social policy. According to Saunders (2003), social exclusion is what happens to some people or regions when they are facing a series of complex problems such as unemployment, lack of skills, low income, housing difficulties, high incidence of crime, loss of health, and family breakdown.

Being ‘poor’ and facing a social ‘predicament’ often influence each other. Many people cannot afford to attend school, see a doctor, or improve their living conditions due to being poor and then falling into a predicament. On the contrary, in a “predicament” situation, without access to good education or health care, it is difficult to accumulate effective human or material capital, thereby aggravating the “poor” situation and causing people to fall into the “poverty trap”. With the improvement of overall income level and of ensuing social policies, education, health and other social welfare will improve accordingly.

Public policy that is based on the concept of income poverty puts more emphasis on using income support policy to achieve poverty reduction. However, using data across developing countries and across time, Bourguignon et al. (2010) did not find empirical evidence that a reduction of monetary poverty was associated with a reduction of non-monetary deprivations. Social policy based on deprivations in capabilities, stresses poverty reduction through active social policy and social intervention. From the perspective of policy implementation, if no social policy for building basic human capabilities is implemented while eliminating income poverty, it will be very easy for those out of poverty to fall into poverty again. On the contrary, if we implement social policies that stress building basic human capabilities while eliminating income poverty, the population or families who have risen out of poverty, obtaining education and some other basic capabilities, will rarely fall into poverty again (Drèze and Sen 2013). As long as they receive a good education, the originally poor will have the chance to become the elites and hence improve social mobility and inclusiveness.

According to Amartya Sen (1981), the root cause of poverty is an inequality of rights. When some people have too much to eat while some others are starving in a country, a famine takes place. It is a result of the inequality in rights and distribution. To eliminate famine, therefore, we should first eliminate the inequality of rights. Amartya Sen believes that for a poor person to live a decent life, the government needs to empower him/her in many aspects such as production, exchange, and transfer. According to Wang (2012), the fundamental experience of China's success in poverty reduction is empowering the poor, including through the property rights brought by land reform and the social rights brought by population flow. Thus, according to the conceptual framework of this paper, the key to eliminating poverty lies in giving economic and social rights to the poor. The core of "teaching a man to fish" is empowering people and developing their capabilities.

Let's take the world's two most populous developing countries China and India as examples. The land system launched since the founding of New China, especially the land contract system launched since the economic reform, avoided the phenomenon of women's and children's malnutrition in poverty-stricken families due to lack of food. Also, universal nine-year compulsory education has greatly raised the literacy rate and education level of children from poor families in less-developed areas. Since the resumption of college entrance examinations in 1977, tens of millions of young people (including many children from rural poor families) have received higher education.

Amartya Sen (1999) believes that New China's popularization of nine-year compulsory education and countrywide basic medical services before economic reform laid a human capital foundation for the rapid economic growth after the reform. In India, private land ownership, on the one hand, led to the accumulation of a large quantity of grain, and, on the other hand, the high food prices won by large

farmer groups lobbying the government led to the malnutrition of a large number of women and children (Gragnolati et al. 2005, IFPRI 2011). In the field of basic education, India lags far behind China (Drèze and Sen 2013). To a large extent, the difference in economic and social development between India and China lies in the difference in the policies for building basic human capabilities.

As for poverty reduction in China, since the economic reform, China has not only achieved sustained and rapid economic growth, but also disproven the prejudice that economic growth in developing countries does not necessarily lead to poverty reduction (Kuznet 1955). China achieved a sustained significant decline in urban and rural poverty rates (Ravallion 2007), thereby achieving the Millennium Development Goal of halving poverty by 2015 ahead of schedule (Wu 2012). Due to differences in economic development between regions, and between urban and rural areas, a small number of Chinese people still live below the poverty line (the rural poor accounted for 2.8% of the total rural residents in 2010) (NBS 2011), but the “survival, food and clothing problems of the rural residents in China have been basically solved”. Thus the Chinese anti-poverty goal has changed from simple income growth to a systematic anti-poverty strategy to eradicate poverty (CPAD 2011). Specifically, while increasing the income of low-income groups, China now aims to promote the implementation of anti-poverty measures under an inclusive growth strategy covering development, education, health, pension insurance, human survival, the environment, and financial services (CPAD 2011).

In addition, poverty measurement simply from the perspective of income or consumption has limitations, and the definition of a poverty line also has a certain degree of arbitrariness. Moreover, beyond food and shelter, human survival and development also require certain conditions for education, medical treatment, and living environment (Sen 1999). Thus, research based on a multidimensional perspective on poverty helps make clear the complex root causes of poverty.

Multidimensional poverty measurement methods include fuzzy set (FS), totally fuzzy and relative (TFR), Alkire Foster (AF), etc. (see Alkire et al 2015, Chs 3 and 4, for a survey). The FS method, put forward by Cerioli and Zani (1990), is a way to study the problem of poverty with fuzzy sets. To be specific, set a poverty line (such as 60% of the median of family income per capita) higher than the national one and take into account the poverty of low-income groups living above the low poverty line but below the higher one while calculating the poverty rate (determining the weight of poverty based on its distance to the low poverty line). On this basis, Cheli and Lemmi (1995) put forward the TFR method for the study of poverty problem; Betti and Verma (1998) applied the TFR method to the study of dynamic multidimensional poverty by using the multidimensional poverty and panel data. In recent years, an increasing number of studies have used the TFR method to analyze the problem of poverty and even the European Union has used the TFR method to report its poverty index (Giorgi and Verma 2003).

Based on the theory of basic capabilities, Alkire and Foster (2007, 2011) put forward the AF method to establish the MPI and the global MPI. The AF method first sets the “dimensional cutoff” for each dimension and then judges whether a person is poor through a calculation using a “poverty cutoff” similar to that used for the calculation of “incidence of poverty”. Deprivations may be weighted using a vector of relative weights. When a person is poor in at least some proportion the dimensions (as specified by the poverty cutoff), s/he has fallen into multidimensional poverty.

The global MPI includes three dimensions, namely education, health, and living standards, and ten weighted indicators, with a poverty cutoff of one-third (Wang 2012, Alkire and Santos 2010, 2014). The UNDP adopted the global MPI and began to publish the global multidimensional poverty status in their 20<sup>th</sup> *Anniversary Human Development Report* in 2010. Compared to the FS and TFR method, the AF method is adopted more often in studies of China’s multidimensional poverty because it is simple and easy to operate and the conclusion is persuasive (Yu 2008, Wang and Alkire 2009, Zou and Fang 2011, Guo and Wu 2012, and Wang and Wang 2013, among others).

Most scholars have used the AF method in building the MPI system, but there is a big difference in the poverty dimensions they use, especially with respect to whether the poverty dimensions of MPI should include an income dimension or not. However, the income dimension and other non-monetary dimensions are closely related. In the process of building the MPI system, the linkages and discrepancies between income poverty and multidimensional poverty measurement cannot be ignored. In China, in the context of advocating for exact poverty targeting and building a well-off society, the implementation of multidimensional poverty reduction is of great practical significance. However, should China implement the multidimensional poverty reduction strategies with two poverty measures (income and multidimensional) complementing each other, or give income a certain weight and implement a unified multidimensional poverty line including the dimension of income? It is not only a basic issue for the study of multidimensional poverty, but a premise and the key for developing a unified, standardized MPI. On this basis, this paper attempts to study this issue from an empirical perspective through statistical analysis using the rural sample data of CHNS in 2011, aiming to provide a basis for the establishment of a national multidimensional poverty reduction strategy and policy.

### 3. Model, Methods and Data

#### 3.1 Model and Methods

**Multidimensional poverty identification and aggregation method.** The AF method, used by the UNDP's *Human Development Reports* to measure MPI, is the most mature and most widely used method for multidimensional poverty measurement. The multidimensional poverty measurement in this paper is mainly based on the AF identification, aggregation, and decomposition methods. First, we set the deprivation line for each indicator and identify the deprivations of each unit (usually person or household); second, we work out the MPI based on the dimensions of poverty, weights, and a poverty cutoff; and third, we break the MPI down by indicators and partial indices, and disaggregate by groups. The study is carried out to explore the linkages and discrepancies between multidimensional poverty and income poverty measures. Here, we do not discuss the AF identification, aggregation, and decomposition methods. Details of the AF method are described in Alkire and Foster (2007, 2011).

**The method to analyze the relationship between income poverty and multidimensional poverty.**

For further quantitative analysis of the relationship between income poverty and multidimensional poverty, the measurement models below are defined in the spirit of Alkire and Foster (2007, 2011):

$$y_i^j = \beta_0^j + \beta_1^j \ln(x_i) + \beta_2^j Z + \mu_i^j \quad (1)$$

$$y_i^m = \beta_0^m + \beta_1^m \ln(x_i) + \beta_2^m Z + \mu_i^m \quad (2)$$

where,  $y_i^j$  in formula (1) represents rural household  $i$ 's deprivation in the dimension  $j$ ,  $i = 1, 2, \dots, n$ ;  $j=1,2,\dots,d$ . When rural household  $i$  is deprived in the dimension  $j$ ,  $y_i^j = 1$ , otherwise, it is zero.  $y_i^m$  in formula (2) refers to multidimensional poverty. If  $C$ ,  $C=1,2,\dots, d$  refers to the total (weighted) dimensions of deprivation of rural household  $i$ ,  $c_i=C/d$ , is the percentage of dimensions. If the poverty threshold  $k$  is  $k=1/3$ , then when  $c_i \geq 1/3$ ,  $y_i^m = 1$ , otherwise, it is zero.  $x_i$  represents the per capita annual disposable income of households.  $Z$  is a vector of the family's characteristic variables, including the number of family members of rural households and the provinces to which they belong.

It should be noted that the purpose of this paper is to investigate the linkages and discrepancy between income poverty and multidimensional poverty; therefore, we are not reporting and analysing the MPI separately or in detail. Rather, we focus on the identification of who is poor and its analysis. As the explained variables in formulae (1) and (2) are both binary variables, a logit model is used for regression.

**Poverty classification.** We regard the rural households who are deprived in one third of the dimensions

as multidimensionally poor (Alkire and Foster 2007 & 2011, Wang and Alkire 2009). We further divide the multidimensionally poor into the ordinary and extreme multidimensionally poor using a second cutoff of 2/3, and define those with deprivations of more than 0 and less than 1/3 as the vulnerable poor – who are not multidimensionally poor at the moment but will easily fall into multidimensional poverty if there is a slight decline in their circumstances. These four types can be defined by the following formula:<sup>5</sup>

$$y_i^k = \sum_{j=1}^d y_i^j = y_i^1 + y_i^2 + \dots + y_i^d \quad (3)$$

where  $y_i^k$  represents the sum of total deprivations of rural household  $i$ . When  $i$  is deprived in the dimension  $j$ ,  $y_i^j = 1$ , otherwise, it is zero. Thus,  $0 \leq y_i^k \leq d$ . The specific definitions of the four types of poverty are as follows: When  $y_i^k = 0$ ,  $i$  is not multidimensionally poor; when  $0 < y_i^k < 1/3$ ,  $i$  is a vulnerable poor household; when  $1/3 \leq y_i^k < 2/3$ ,  $i$  is multidimensionally poor, but its poverty dimension does not exceed 2/3, we define such groups as ordinary multidimensionally poor households; when  $y_i^k \geq 2/3$ ,  $i$  is in extreme multidimensional poverty.

In addition, according to the official national poverty line (2300 yuan of per capita net income of rural households based on 2010 constant price), we divide the rural poor into two groups: rural households in income poverty and those in non-income poverty.

### 3.2 Dimensions, Indicators, and Poverty Descriptions

The dimensions and indicators of a country's MPI are usually set according to the country's economic and social development stage and the level of economic and social welfare protected by its relevant laws and development strategies. In this paper, six equally weighted dimensions have been set for China's MPI, namely education, health, housing, water and sanitation, energy, and consumer durable goods. The selection of indicators under each dimension is limited by the CHNS data, and a total of nine indicators have been selected (Alkire and Foster 2007 and 2011, Wang and Alkire 2009).

“China's Rural Poverty Alleviation and Development Program (2011–2020)” clearly stipulates that the overall objective of China's poverty alleviation and development in the next decade is to address the

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<sup>5</sup> The indicators in Table 1 are given equal weights when calculating  $y_i^k$  in formula (3).

food and clothing problem of the poor and guarantee their access to compulsory education, basic medical care, and housing by 2020 (CPAD 2011). We assume that income poverty determines whether the food and clothing problem is addressed and the MPI indicates the education, health, and housing situation. According to the definition of energy poverty given by the United Nations Department of Energy, this paper adds the dimension of energy poverty and uses electricity and cooking fuel as indicators. In rural China, “three major items” are usually used to measure the living standard of a family, although the definition of these items has evolved over time.<sup>6</sup> Therefore, this paper increases the dimension of durable consumer goods to further reflect the quality of life.

In this paper, we use the rural sample data of 2011 CHNS and take the household as the unit of analysis, covering a total of 3784 sample households in 12 provinces (or municipalities at provincial level), namely Beijing, Liaoning, Heilongjiang, Shanghai, Jiangsu, Shandong, Henan, Hubei, Hunan, Guangxi, Guizhou, and Chongqing. According to the relevant technical provisions of the UN Millennium Development Goals on specific indicators and the data availability, we set the dimensions and indicators as shown in Table 1.

**Table 1: Multidimensional Poverty Index Dimension and Indicator Setting and their Descriptive Statistics**

Dimension	Indicators	Mean	Std.Dev	Definition of indicator (dimensions are equally weighted)
Education	Years of schooling	0.258	0.437	When the best-educated member of a household has received less than five years of school education, the deprivation index is 1; otherwise, the index is 0.
	Children's enrollment	0.043	0.202	Families with children aged 6–16 out of school are regarded as deprived, the deprivation index is 1; otherwise, the index is 0.
Health	Health insurance	0.061	0.238	When at least one household member has no health insurance, the household is regarded as poor with a deprivation index of 1; otherwise, the index is 0.
Housing	Housing conditions	0.103	0.303	When a household does not have its own housing or has a housing area per capita of less than 9 sq.m., the deprivation index is 1; otherwise, the index is 0.
Water and sanitation facility	Drinking water	0.070	0.256	Households without access to tap water or water plant water, or without underground water within less than 5 meters, the deprivation index is 1; otherwise, the index is 0.
	Sanitation facility	0.357	0.479	Households without indoor or outdoor flush toilet are regarded as deprived and the deprivation index is 1; otherwise, the index is 0.
Energy	Electricity	0.008	0.091	Households with no access to electricity are regarded as deprived and the deprivation index is 1; otherwise, the index is 0.
	Cooking fuel	0.245	0.430	Households with no access to electricity, liquefied gas, or natural gas for cooking are regarded as deprived and the deprivation index is 1; otherwise, the index is 0.
Consumer durables	Consumer goods	0.003	0.058	Households without transportation means, household appliances, or any information communication tool are regarded as deprived and the deprivation index is 1; otherwise, the index is 0; transportation means include tricycles, motorcycles, and vehicles; household appliances include color TV set, washing machine, refrigerator, air conditioner; information communication tools include computer, telephone, and mobile phone.

Figure 2 describes the deprivation incidence of rural households' nine indicators. Figure 2 shows that the coverage rate of electricity and durable consumer goods and children's school enrollment rate are

<sup>6</sup> In the 1970s, “three major items” referred to the sewing machine, wristwatch, and bicycles. In the 1980s, “three major items” indicated the refrigerator, color TV, and washing machine. In the 1990s, “three major items” were a computer, air-conditioner, and motor bike. Since the new century, the “three major items” further changed to house, car, and a large bank deposit sum.

generally high among rural households. The electricity poverty rate is 0.8%, the durable consumer goods poverty rate is 1.72%, and the incidence of poverty of children's enrollment rate is 3.81%. But rural households' problem of deprivation in sanitation, cooking fuel, and adult education level is relatively prominent. Fully 50.03% of the surveyed rural households have no outdoor or indoor flush toilets; 20.56% have no access to electricity, liquefied gas, or natural gas; and 19.65% have no family members who have completed five years of education.

**Figure 2: Poverty Incidental Rates of Rural Households by Each Dimension**

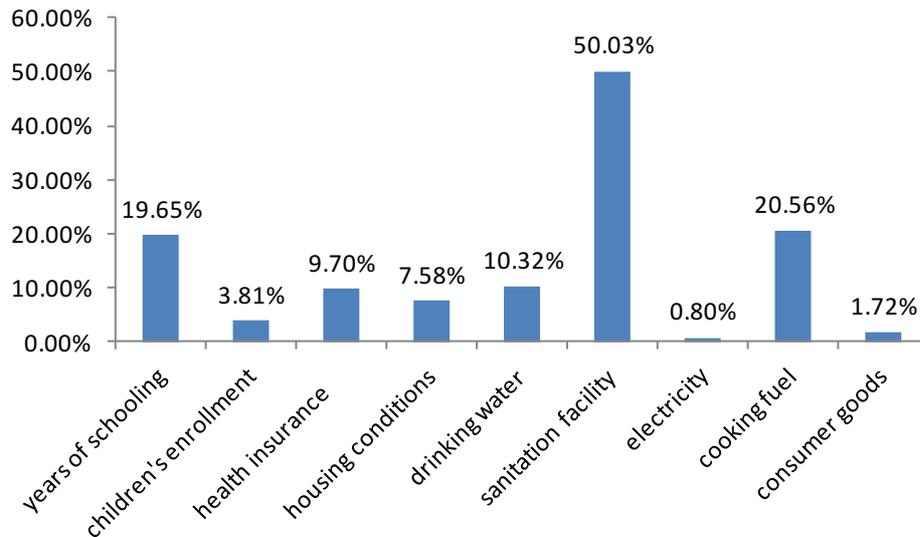


Table 2 and Table 3 respectively describe the distribution of rural households' income poverty and multidimensional poverty. We can see from Table 2 that, according to the national poverty line (2300 yuan of per capita net income of rural households based on 2010 constant price), the poverty incidence in rural China was 13.08% in 2011, slightly higher than the national rural low-income poverty rate of 12.7% and far below the low-income poverty rate of 29.2% in key counties for poverty reduction (NBS 2011). In accordance with this poverty line, the poverty rate in rural China was 35% in 2002, indicating that China's large-scale poverty alleviation and development achieved good results in reducing poverty.<sup>7</sup>

In rural China, however, the multidimensional poverty rate is far higher than the incidence of income poverty. Table 3 shows that when taking 1/3 of dimensions ( $K=2$ ) as the threshold, the incidence of multidimensional poverty among rural households is 33.21%, and this rate reaches 66.96% when the vulnerable poor are included (poor in at least one dimension), which is roughly the same as the estimated result of Wang and Alkire (2009) and Zou and Fang (2011).

<sup>7</sup> With the inflation factors deducted, the poverty line of 2300 yuan in 2010 equals 1796 yuan in 2002. According to this poverty line and Figure 2 in Xia et al. (2010), the rural poverty rate in 2002 was estimated to be about 35%.

**Table 2: Distribution of rural households' income poverty (N=3784)**

Income poverty (X)	Number of samples	Proportion (%)	Cumulative total (%)
Under poverty line $X < 2536$	495	13.08	13.08
At and above poverty line $X \geq 2536$	3289	86.92	100

Note: After CPI adjustment, the national poverty line of 2300 yuan in 2010 equals 2536 yuan in 2011.

In addition, the multidimensionally poor are mainly those vulnerable to multidimensional poverty and the ordinary multidimensionally poor, involving few in extreme multidimensional poverty. Among them, 1390 belong to the vulnerable groups, accounting for 36.75% of the total population; 1197 or 31.65% were ordinary multidimensionally poor households; and only 59 or 1.56% were extremely poor in at least four dimensions. However, only 1136 or 30.04% households were not poor measured by these multidimensional poverty standards, far below the 86.92% of rural households living above the income poverty line (Table 2). Thus, there is a big difference in the identification of income poverty and multidimensional poverty. It also shows that the elimination of income poverty is not necessarily equal to the end of poverty although income growth helps reduce multidimensional poverty. Multidimensional poverty as well as deprivations in education, health insurance, electricity, water, and energy are, however, a result of the undersupply of public goods by the government and society. Simple income growth will not necessarily improve the situation of deprivation in these aspects. Thus, while eliminating income poverty, we should also eliminate multidimensional poverty and deprivation by providing more public products.

**Table 3: Distribution of Rural Households' Multidimensional Poverty (N=3782)**

Dimensions of poverty (k)	Number in sample	Proportion (%)	Cumulative total (%)
Non-multidimensional poverty ( $k=0$ ) $K=0$	1136	30.04	30.04
Vulnerable poverty ( $0 < k < 1/3$ ) $K=1$	1390	36.75	66.79
Ordinary multidimensional poverty ( $1/3 \leq k < 2/3$ ) $K=2$	918	24.27	91.06
$K=3$	279	7.38	98.44
Extreme multidimensional poverty ( $k \geq 2/3$ ) $K=4$	57	1.51	99.95
$K=5$	2	0.05	100

## 4. Comparative Analysis of Income Poverty and Multidimensional Poverty

### 4.1 Statistical Analysis

#### 4.1.1 Linkages and Discrepancies between Income Poverty and Multidimensional Poverty

Table 4 compares the linkages and discrepancies between income poverty and multidimensional poverty in the form of a matrix. According to the national poverty line, 39.77% of households have shaken off income poverty and are not the targets of poverty reduction, but they are multidimensionally poor in at least at one third of the dimensions. In other words, 46% (39.77%/86.92%) of non-income-poor rural families are actually in multidimensional poverty. In terms of the multidimensional poverty measurement standard, only 5.39% of households have shaken off multidimensional poverty but are still in income poverty (41% of the income poverty-stricken rural households have shaken off multidimensional poverty). Therefore, there is a big discrepancy in the measurement of income poverty and multidimensional poverty – up to 45.16% (39.77%+5.39%); and the discrepancy (39.77%) when using income poverty measurement alone is far higher than the discrepancy (5.39%) caused by multidimensional poverty measurement. In other words, if the poverty-reduction policies target only at those in income poverty, then about 40% of rural households will still live in multidimensional poverty to various degrees. Therefore, the poverty-reduction policies should cover not only income poverty but also multidimensional poverty and deprivation.

In addition, the measurement results of income poverty and multidimensional poverty are consistent to a large extent. Fifty-nine percent (7.67%/13.08%) of rural households in income poverty are also multidimensionally poor; 54% (47.17%/86.92%) of non-income-poor households are not in multidimensional poverty. In other words, the measurement results of income poverty and multidimensional poverty are consistent up to 54.84% (7.67%+47.17%), and the rural households not in either income poverty or multidimensional poverty account for 47.17% of the total, far higher than the 7.67% of rural households in both income poverty and multidimensional poverty. Thus, income still plays a basic and critical role in poverty measurement.

**Table 4: Comparison of Income Poverty and Multidimensional Poverty (N=3776)**

Multidimensional poverty	Income poverty	
	Poor ( $X < 2536$ )	Non-poor ( $X \geq 2536$ )
Poor ( $c_i \geq 1/3$ and $k=1/3$ )	7.67	39.77
Non-poor ( $0 < c_i < 1/3$ ; $k=.0001$ )	5.39	47.17

Note: Figures in the table are the proportions of various samples in the total. After CPI adjustment, the national poverty line of 2300 yuan in 2010 equals 2536 yuan in 2011

To further analyze the relationship between income poverty and multidimensional poverty, Table 5 shows income poverty's coverage and the situation of rural households in multidimensional poverty to varying degrees in the form of a matrix. It can be seen from Table 5 that 28.02% of rural households have shaken off income poverty but are still vulnerable poor in terms of multidimensional poverty, 38.08% of rural households have shaken off income poverty but are in ordinary multidimensional poverty, and 1.69% of rural households have been lifted out of income poverty but are still in extreme multidimensional poverty. In other words, according to the national poverty line, 67.79% (28.02%+38.08%+1.69%) of poor households are lifted out of income poverty but they are in vulnerable or ordinary or extreme multidimensional poverty. The fact that 75% of the extreme multidimensionally poor (1.69/2.25) are not income poor is particularly surprising. Thus, in poverty identification, income can hardly capture the comprehensiveness and complexity of poverty. The trends of multidimensional poverty are important and cannot be replaced by income poverty.

In addition, Table 5 shows that 11.48% (3.81%+7.11%+0.56%) of rural households are not only income poor, but also multidimensionally poor in at least one dimension. A total of 19.14% of rural households have shaken off not only income poverty but also multidimensional poverty. In other words, the overlap of income poverty with multidimensional poverty is only up to 30.62% (11.48%+19.14%), ignoring 68.69% of multidimensionally poor households.

**Table 5: Income Poverty's Coverage and Ignorance of the Rural Households in Multidimensional Poverty to Varying Degrees (N=3776)**

Multidimensional poverty	Income poverty	
	Poor (X<2536)	Non-poor (X≥2536)
Non-poor ( $c_i=0$ )	1.59	19.14
Vulnerable poverty ( $0 < c_i < 1/3$ )	3.81	28.02
Ordinary multidimensional poverty ( $1/3 \leq c_i < 2/3$ )	7.11	38.08
Extreme multidimensional poverty ( $c_i \geq 2/3$ )	0.56	1.69

Note: Figures in the table are the proportions of various samples in the total. After CPI adjustment, the national poverty line of 2300 yuan in 2010 equals 2536 yuan in 2011.

#### 4.1.2 Linkages and Discrepancies between Income Poverty and Each of the Dimensions of Poverty

In this paper, the degree of deprivation of each dimension is indicated by the mean of that deprivation dimension, or its headcount ratio. The larger the mean (from 0 to 1), the higher the degree of deprivation in that dimension. Table 6 describes the linkages and discrepancies between income poverty and each dimension of multidimensional poverty for the households in multidimensional poverty (at least 1/3 of dimensions). We can see from Table 6 that every dimension of multidimensional poverty

has a positive correlation with income poverty. In other words, the degrees of deprivation in various dimensions of these income-poor households are higher than that of those non-income-poor households. It is worth noting that this positive correlation is not obvious. Taking health insurance, which has an obvious positive correlation with income poverty, as an example, the degree of deprivation in health insurance of rural households in income poverty is 15.5%, and the degree of the non-income-poor households is 14.9%, with only a slight difference of 0.6%. The difference between these two groups in other dimensions is even less.

**Table 6: Comparison of Income Poverty and the Dimensions of Poverty: Households in Multidimensional Poverty (N=1256)**

Dimensions of poverty	Share who are income poor by deprivation in each dimension	
	Deprived	Non-deprived
Health insurance	0.155	0.149
Education	0.831	0.783
Housing	0.131	0.111
Water and sanitary facility	0.893	0.860
Energy	0.415	0.378
Consumer durables	0.058	0.025

Note: Figures in the table are the average share of income poor in each deprivation group. Each row includes the whole sample, partitioned into deprived and non-deprived by dimension.

## 4.2 Estimation Results and Robustness Tests of the Logit Model

### 4.2.1 Analysis of the Estimation Results of the Logit Model

To further analyze the linkages and discrepancies between income poverty and multidimensional poverty, we use 2011 CHNS data and the logit model for regression of multidimensional poverty and each dimension of it on household income per capita and other characteristic variables. The results, as seen in Table 7, show that, with the improvement of income level, the incidence of multidimensional poverty fell. The increase of one unit in the log of income per capita will lead to a decline in the probability of an incidence of multidimensional poverty by 41.34% ( $e^{0.346}-1$ ). However, the pseudo R2 is only 7.9%. That is to say, rural household income per capita and other household characteristic variables explain only 7.9% of the variation in the MPI, leaving about 92% unexplained.

In addition, rising income levels significantly decreased the probability of incidence of various dimensions of poverty. The increase of one unit in the log of income per capita will lead to a decline of 17.59% ( $e^{0.162}-1$ ) in the probability of incidence of health insurance poverty and a decline of 57.46% ( $e^{0.454}-1$ ) in the probability of incidence of educational poverty. Among the other dimensions, income has the largest impact on consumer durables and water and sanitation, and the least impact on energy and

housing. The increase of one unit in the log of income per capita will lead to a decline of 65.53% ( $e^{0.504} - 1$ ) in the probability of incidence of consumer durables poverty, a decrease of 47.25% ( $e^{0.387} - 1$ ) in the probability of incidence of water and sanitation poverty, a decline of 13.20% ( $e^{0.124} - 1$ ) in the probability of incidence of energy poverty, and a decrease of 3.67% ( $e^{0.036} - 1$ ) in the probability of incidence of housing poverty.

It is worth noting that an increase in income can significantly reduce the probability of incidence of multidimensional poverty and each dimension of it, but the impact is small. When the log of income per capita increases by one unit, the incidence of multidimensional poverty and each dimension of it will fall by no more than 70%.

**Table 7: The Logit Regression Results**

Explanatory variable	Explained variable						
	Multidimensional poverty	Health poverty	Education poverty	Housing poverty	Water & sanitation poverty	Energy poverty	Consumer durables poverty
Log of household income per capita	-0.346 (0.026)	-0.162 (0.023)	-0.454 (0.019)	-0.036 (0.022)	-0.387 (0.028)	-0.124 (0.019)	-0.504 (0.029)
Prob>z	0.000	0.000	0.000	0.054	0.000	0.000	0.000
Number of obs.	3750	3750	3750	3750	3750	3750	3750
Pseudo R <sup>2</sup>	0.079	0.075	0.067	0.012	0.048	0.039	0.030

Note: Figures in the brackets are robust standard errors.

#### 4.2.2 Robustness Tests of the Estimation Results of Logit Model

To test the robustness of the regression results in Table 7, we use the CHNS data in 2009 and the same model, methods, and variables for regression again and obtained the results as shown in Table 8. Regression analysis shows that an increase in income can significantly reduce the probability of incidence of multidimensional poverty and each dimension of it. Thus, the regression results in Table 7 and Table 8 are basically the same. This once again demonstrates the reliability of our model setting and the robustness of the model results.

**Table 8: Robustness Tests of Logit Model**

Explanatory variable	Explained variable						
	Multidimensional poverty	Health poverty	Education poverty	Housing poverty	Water and sanitation poverty	Energy poverty	Consumer durables poverty
Log of household income per	-0.324 (0.024)	-0.038 (0.022)	-0.448 (0.023)	-0.164 (0.025)	-0.299 (0.031)	-0.100 (0.021)	-0.593 (0.030)

capita							
Prob>z	0.000	0.000	0.000	0.052	0.000	0.008	0.000
Number of obs.	2946	2946	2946	2946	2946	2946	2946
Pseudo R <sup>2</sup>	0.069	0.046	0.097	0.008	0.043	0.019	0.078

Note: Figures in the brackets are robust standard errors.

## 5. Conclusions and Policy Implications

This paper attempts to discuss the theoretical correlation between income poverty and multidimensional poverty, focusing on an analysis of the linkages and discrepancies between income poverty and multidimensional poverty using the AF method with 2011 CHNS data. Based on the existing literatures, this paper summarizes poverty as not the mere lack of income, but the deprivation of basic human capabilities, covering both monetary and non-monetary poverty. The income poverty line well captures the monetary aspects of poverty but cannot accurately reflect the non-monetary aspects of poverty. Under normal circumstances, with an increase in people's income and with good social policies, both monetary and non-monetary well-being will be improved to some extent. It is a premise of this paper, however, that non-monetary well-being is usually related to market failure or incomplete markets, because a pure market can hardly provide adequate education and health services for low-income groups. Thus, the government and society of a country are required to provide public goods and public services (such as education and health care). This paper believes that, therefore, setting up the income poverty measure and MPI separately in order to measure the economic and social aspects of poverty will help in the development of a more comprehensive pro-poor strategy and policy system.

The statistical analysis of income and multidimensional poverty measurement shows that the coincidence of income poverty and multidimensional poverty is 30.62% (11.48%+19.14%). In other words, 68.69% of the multidimensionally poor households are not considered as poor in terms of income poverty. According to the national poverty line, nearly 70% of households in multidimensional poverty are not covered by poverty-reduction programs, but they are in a state of vulnerable or ordinary or extreme multidimensional poverty. The regression results of the logit model show that an increase in income can significantly reduce the incidence of multidimensional poverty and each dimension of it, but the impact is small. This implies that income-based poverty measurement can hardly reflect the comprehensiveness and complexity of poverty. Therefore, when measuring poverty, we must take into account various dimensions of multidimensional poverty and pay attention to the essential role of income poverty at the same time.

Based on the above research results, this paper makes the following policy recommendations. Given that income cannot fully reflect quality of life and poverty, and that income measurement is not conducive to multidimensional poverty reduction and exact poverty targeting, this paper proposes to implement poverty alleviation policies with income poverty and multidimensional poverty measures complementing each other. Based on the conclusion of this paper, Figure 3 indicates the poverty alleviation policies with the two poverty lines complementing each other.

**Figure 3: Complementarity of Income Poverty and Multidimensional Poverty: Two Kinds of Poverty**

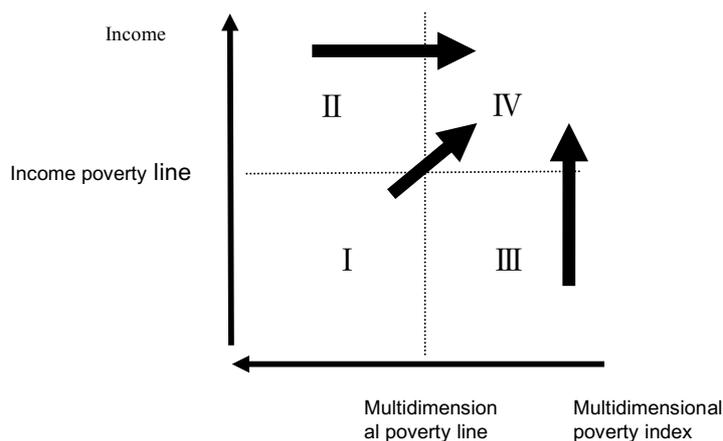
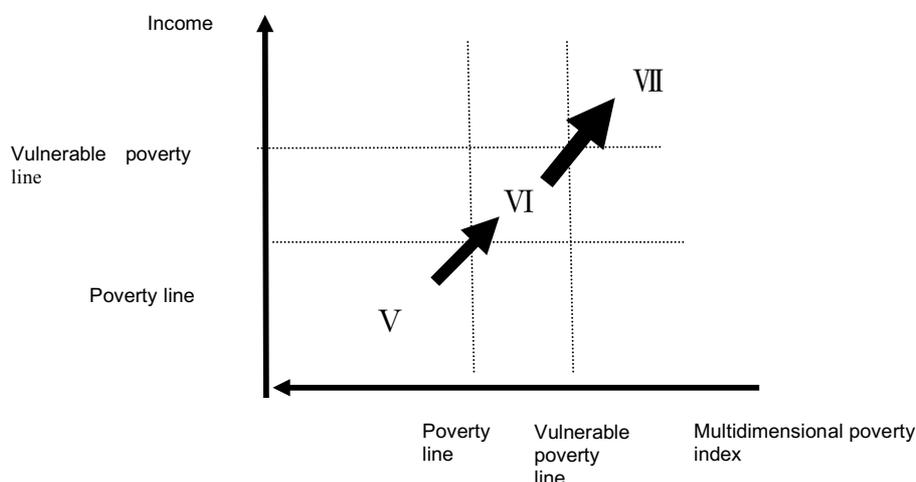


Figure 3 divides rural households into four types – I: Rural households in both income poverty and multidimensional poverty; II: Rural households not in income poverty but in multidimensional poverty; III: Rural households in income poverty but not in multidimensional poverty; IV: Rural households in neither income poverty nor multidimensional poverty. According to Table 4 and Figure 3, we'll ignore some poor rural households if we use either the income poverty line or the multidimensional poverty line. When we use the income poverty line exclusively, the households in Zone II should not be poor, but they are actually in multidimensional poverty. Table 4 shows that 39.77% of rural households are in Zone II. When a MPI is used as the poverty measurement standard, the households in Zone III should not be poor, but they are actually in income poverty. Table 4 shows that 5.39% of rural households are in Zone III. Thus, the aim of poverty alleviation policies should be to move those rural households in Zones I and II and III to Zone IV, in which rural households have shaken off not only income poverty but also multidimensional poverty. The best way to achieve this poverty reduction goal is to combine these two poverty lines rather than ignore either.

Similarly, we divide income poverty and multidimensional poverty respectively into three types, namely non-poverty, vulnerable poverty, and poverty, and then analyze the poverty alleviation policies with the income poverty line and multidimensional poverty line complementing each other. Details are shown in Figure 4. Zone V represents the rural households in both income poverty and multidimensional poverty who are the key targets of poverty alleviation. The short-term poverty alleviation goal is to lift them out

of absolute poverty and make them jump to Zone VI, and the ultimate goal is to make them jump to Zone VII – shaking off not only short-term income poverty and multidimensional poverty, but also long-term and dynamic vulnerable poverty, and intergenerational poverty.

**Figure 4: Complementarity of Income Poverty and Multidimensional Poverty: Three Kinds of Poverty**



In summary, this paper advocates the implementation of poverty alleviation policies with income poverty measures and multidimensional poverty measures complementing each other. It will not only circumvent the shortcomings of income poverty measurement but also reflect the comprehensiveness and complexity of poverty. This will not only help relevant poverty alleviation departments achieve exact poverty targeting more effectively, but also improve the level of income, education, health, and quality of life of the poor.

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