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Multidimensional Poverty and Wellbeing in China

Through the Multidimensional Synthesis of Indicators (MSI)

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Abstract

Recently the topic of multidimensional poverty in China has drawn the attention of many scholars discussing the China's Path to the New Era.
The main goal of this paper is to measure China's achievements in terms of multidimensional wellbeing and poverty in 1989 and 2011. We are interested in measuring and comparing its distribution among different groups (based on geography and socio-economic conditions).
The main originality of this paper is the use of the Multidimensional Synthesis of Indicators (MSI) (a new class of indexes Mauro et al. 2016, 2017) which is applied for the first time using individual level (microdata) and for the first time to China.
For the sake of completeness, we computed also the Multidimensional Poverty Index (MPI) a well-established multidimensional index). In this way we also want to see whether these two poverty measurements are overlapping or not, and in case what triggers the differences.
Poverty alleviation has been an impressive outcome of the reform programs China launched in 1978. According to the Millennium Development Goals report, between 1970 and 2000 the number of rural Chinese population without food and clothing decreased from 250 million (30.7% of the total rural population) to 32 million (3.5%). Equally impressive is the drop in monetary poverty: according to the World Bank data, the proportion of poor people drop from 66.6% in 1990 to 7.9% in 2011. Despite these achievements, the fight against poverty in China remains a target priority, now related to the Sustainable Development Goals (SDGs) and to the 13th Five-Years Plan, which announced the willingness of eradicating poverty from China.
The commitment of the government in poverty alleviation involves monetary subsidies (the 低保 "DiBao" program) as well as medical insurances schemes and education subsidies. On the other hand, especially between 1984 and 2003, Chinese reforms were "unbalanced": the resources were allocated with a bias toward urban and coastal areas, and the central government reduced its commitment to provide social security.
Poverty is not only a matter of money shortage. This fact is nowadays widely recognized by economists. The same SDGs formulation states that "Poverty is more than the lack of income and resources to ensure a sustainable livelihood". Indeed, allowing people to satisfy their needs in terms of health, education, social security etc. is an essential aspect of poverty mitigation. This is even more true in China, where the fast GDP growth recorded in the last decade will not be feasible in the future (the so-called "New Normal").

Most of the recent papers on multidimensional poverty in China adopt the MPI (Alkire and Foster 2011), sometimes with slight changes in the methodology or in the dimensions considered. The MPI applies a double cutoff to a set of poverty indicators to determine how many households are multidimensionally poor and how many deprivations they suffer. Each of these cutoffs, necessary to compute the MPI, implies a loss of information. Moreover, the traditional MPI specification allows to calculate poverty only at household level, without differentiation between genders or age groups.

This paper enriches the literature in a threefold way. Firstly, the multidimensional wellbeing and poverty in China is studied by applying in this context for the first time the Multidimensional Synthesis Indicator (MSI), a multidimensional index proposed by Mauro, Biggeri and Maggino (2016, 2017). Secondly, this paper applies for the first time the MSI technique to micro-data, exploiting its capacity of penalizing the acute deprivation at *individual* level. Finally, we created an original version of the MSI by modifying its underlying equation to address the issue of the role of income in multidimensional wellbeing.

The empirical analysis is based on individual-level data from the China Household and Nutrition Survey (CHNS). The CHNS sample is randomly selected to include about 4,400 households spread over nine provinces (plus three municipal cities) and nine years. The first survey round was carried out in 1989, the last in 2011. The questionnaires investigate several aspects of wellbeing, including the data necessary to replicate the MPI and other information that we considered in the MSI.

The aim of the MSI is to synthetize different information relative to various dimensions of wellbeing in a single index. With this index, we can penalize more the heterogeneity in cases of poorer households, whose coping strategies are likely to be more limited. After synthetizing our information, we used the MSI to investigate the level of poverty over time, across provinces and across different socio-economic groups.

We included 8 dimensions in the MSI. To reduce as much as possible the arbitrariness in the choice of the indicators, we referred to the BMI, the HDI, the Capability Approach (Nussbaum, 2011) and the MPI itself. The dimensions considered thus are: Health, Education, Nutrition, Housing, Sanitation, Work, Free Time, Assets.

Income, deliberately excluded from the eight dimensions, is included in the formula to calibrate the heterogeneity penalization (the poorer the family, the higher the penalization). This derives from the assumption that richer families are more able to cope with a shock in a single dimension.

The paper is structured into six sections. The first section introduce the paper aims and structure. The second section presents the literature and trends of Chinese poverty and wellbeing in the last 30 years. Then, the third section presents the the MSI and the MPI and their properties. Section fourth presents the data. Section fifth presents the main results, while in section sixth the discussion and main conclusions are given.

1. Introduction

Poverty alleviation has been an impressive outcome of the reform programs China launched in 1978. In that year, by launching the reform programs, China undertook a path of rapid monetary growth and poverty alleviation (ref).

Chinese contribution in the fight against monetary poverty is a worldwide phenomenon, fundamental in the campaigns for the Millennium Development Goals (MDGs) and the Sustainable Development Goals (SDGs). According to the MDGs report (China and U.N., 2013), between 1970 and 2000, the rural Chinese population without food and clothing decreased from 250 million (30.7% of the total rural population) to 32 million (3.5%). Equally impressive is the drop in monetary poverty: according to the World Bank data[1], the proportion of poor people decreased from 66.6% in 1990 to 7.9% in 2011. The commitment of Chinese government in poverty alleviation is also a domestic issue. Important policies started before the formulation of the MDGs (2000) and involved monetary subsidies (the most important policy in this perspective was the launching of the 低保 "DiBao" program in the 1990s) as well as medical insurances schemes and education subsidies[2].

Despite the impressive steps achieved, the fight against monetary poverty in China remains a target priority, now related to the SDGs (U.N., 2015). Recently, the commitment in poverty alleviation resulted in the government's decision to include the goal of eradicating poverty announced in the 13th Five-Years Plan (2016-2020). The achievement of this target was thus anticipated of ten years with respect to the international SDGs agenda.

Moreover, inequality increased too, and the achievements in other dimensions of wellbeing did not keep pace with monetary growth. Especially between 1984 and the beginning of the new millennium, the reforms were biased toward urban and coastal areas, while market forces prevailed over the central government capacity of reallocating resources and promoting social security.

For these reasons, Chinese development and poverty alleviation were contrasting phenomena. The picture is even more scattered if we differentiate monetary poverty (considered as only the reference

[1] By adopting the standard poverty headcount ratio at $1.90 a day (2011 PPP).

[2] Gustaffson and Quheng (2011) describe critically the history, the impact and the targeting of the DiBao program. Dealing with insurances schemes, we recall the introduction of the Urban Employee Basic Medical Insurance (UEBMI) in 1998 and the implementation of similar programs for urban (URBMI, in 2007) and rural residents (NCMS, in 2003). For a critical analysis of the evolution of the Chinese healthcare system from the Maoist period to the recent trends, see Aiguo (2006) and Meng et al. (2015). Dealing with education reforms, see Chyi and Zhou (2014).

point by policy-makers and scholars in the earliest phases of the reform) from multidimensional poverty.

Therefore, a comprehensive fight against poverty cannot involve uniquely the monetary aspect. Allowing people to satisfy their basic needs in terms of health, education, social security etc. is widely recognized as an essential aspect of poverty mitigation strategy[3]. Enhancing such capabilities, is valuable for breaking the "poverty traps" (instrumental value) and for its intrinsic value (Sen, 2001).

Moreover, conceive development as a multidimensional target, is particularly important in nowadays China. The Hu Jintao presidency, which took office in 2003 with Wen Jiabao as Prime Minister, promoted the rhetoric about a "harmonious society" (和谐社会 "héxié shèhuì"). This narrative substituted the emphasis about sustained monetary growth which accompanied and sustained the first decade of reforms. The need to promote balanced and inclusive development in a context where the previous fast-growth condition is no longer viable (the "New Normal") has been frankly admitted by the presidency of Xi Jinping.

The paper aims to analyze Chinese multidimensional poverty with two different methods using micro level data (Chinese Health and Nutrition Survey - CHNS). The first method applied is the well-known Multidimensional Poverty Index (MPI) developed by Alkire and Foster (2011). This index is widely used in the literature[4]. The second method applied is the Multidimensional Synthesis Indicator (MSI) developed by Mauro, Biggeri and Maggino (2018, 2017; Biggeri and Mauro 2018 forthcoming) and here for the first time applied to micro data and that we adapted to this purpose. Such measures of poverty are adopted along with information about geographical belonging and socio-economic status to describe how different groups were included (or not) in the development process.

The paper contributes to the literature about multidimensional wellbeing and poverty in China in a threefold perspective.

Firstly, with respect to the Chinese context, previous studies only adopted the MPI or similar methodologies, and usually referred to a shorter time span. This is the first time the Chinese wellbeing is analyzed with the MSI tools. This index is particularly suitable for China, because it measures the

[3] Among the several possible definitions of poverty, we stick to the SDGs, where the "end poverty in all its forms everywhere" is the first goal. The Social Policy and Development Division of the United Nations writes: "*Poverty entails more than the lack of income and productive resources to ensure sustainable livelihoods. Its manifestations include hunger and malnutrition, limited access to education and other basic services, social discrimination and exclusion as well as the lack of participation in decision-making. Various social groups bear disproportionate burden of poverty.*" (https://www.un.org/development/desa/dspd/poverty-social-policy-and-development-division.html)

[4] World Bank's Policy Research Notes welcomed the introduction of MPI in the attempt to achieve a "world free of poverty" (Cruz et al., 2015). The Oxford Poverty and Human Development Initiative also adopted this index. Dealing with the Chinese case, we recall the MPI-based analysis of poverty by Alkire and Shen (2015).

wellbeing in a multidimensional way, stressing not only the traditional deprivation cutoffs, but including indicators of development in other dimensions, consistently with the target of the "moderately prosperous society".

Secondly, with respect to the MSI technique, this is the first application of this index to micro-level data. Until today the MSI has been applied only to macro-data, as in the cross-country level comparison studied by Biggeri and Mauro (forthcoming2018) to improve the HDI of UNDP. Its properties however are suitable also to evaluate the level of wellbeing at individual level. In the Chinese context, as well as in many other emerging and backward countries, the opportunity to measure wellbeing at individual level is particularly interesting. Indeed, it allows us to compare the scores of different subsamples of the population, grouped by gender, ethnicity, etc. It is also possible to compare MSI results with MPI results. MPI is built at household level with a technique based on a dual cutoff, these differences make the comparison interesting also from a methodological perspective, that goes beyond the case of China.

Finally, we present some novelty in the variables and parameters included in the MSI methodology, creating the Income-Multidimensional Synthesis Indicator (IMSI), that departs from the traditional MSI under theoretical and empirical perspectives. The MSI is a flexible tool, since its technique can apply to any dimension we want to consider. In our case, we selected an original set of dimensions, consistent with the relevant aspects of wellbeing in the Chinese context and the prescriptions of other multidimensional indices and the Capability Approach. Dealing with the choice about which dimensions to include, we want to point out the role of income. In the literature about capabilities, income is a controversial indicator of wellbeing[5], excluded by some indices (e.g. the Alkire and Foster's MPI) and included by others (e.g. the HDI). In the IMSI, as discussed later, income is not one of the dimensions included and it is included for its relevant instrumental role (Sen, 1999). It measures how much a household is wealthy, and thus able to compensate the deprivation in a dimension with the abundance of wellbeing in a different one.

A detailed description of the components of the dimensions and the formulas adopted to calculate the MSI in this paper is reported in the methodological section.

The remaining of the paper is divided as follows.

[5] Amartya Sen revived the (Aristotelic) idea that economist should consider income as a mean, rather than as an end. In the book "*Development as Freedom*" (1999, p.14), he writes: "*An adequate conception of development must go much beyond the accumulation of wealth and the growth of gross national product and other income-related variables*." How to implement the idea of going "*beyond*" income is still an open question. Sen (1999) at the same time recognizes the income relevant role as a mean.

The next section briefly reviews some of the most recent investigations about multidimensional wellbeing in China.

In the third section, we present the dataset and the methodologies behind the indices adopted to aggregate multiple dimensions of poverty and wellbeing: the MPI and the MSI. Each index is described in detail in two specific subsections. The MPI subsection resumes the variables selected for the MPI and the aggregation technique, along with the merits and shortcomings associated to the 'double cutoff' strategy, necessary to calculate the MPI. In the second methodological subsection, we present the traditional MSI and our version, the IMSI. This subsection describes also our original contribution to the literature about multidimensional wellbeing, because we slightly modified the index introduces by Mauro, Biggeri and Maggino (2018, 2017), taking into account various non-monetary dimensions of wellbeing but at the same time introducing the instrumental role of income in the synthesis formula.

The fourth section describes the results of the analyses related to the MPI and the MSI in two different subsections, one for each index. The results are decomposed according to geographical and socio-economic characteristics to provide a better picture of winners and losers of the reforms. In the case of MPI, the whole 1989-2011 is considered, while the analysis of MSI is limited to 2011.

Conclusions and policy implications follow.

2. Multidimensional Poverty Indices in China

The reduction of monetary poverty in China is a well-documented phenomenon[6]. Recently, consistently with the increasing sophistication of Chinese government goals, many scholars diverted their attention from monetary to multidimensional achievements. In this section, we present a brief literature review focusing on the most significant empirical analyses of Chinese multidimensional poverty. The main characteristics of these studies are summarized in Table 1.

Labar and Bresson (2011) adopt the multidimensional stochastic dominance criterion to see whether multidimensional poverty has significantly reduced between 1991 and 2006. Based on the China Health and Nutrition Survey (hereafter CHNS), the trend in the poverty reduction in health, education and income, are considered both individually (unidimensional case) or jointly (multidimensional). In the multidimensional case, the reduction of poverty was significant between 1991 and 2004, and non-significant thereafter (unidimensional trends, on the contrary, have different shapes).

Yu (2013) applies the Alkire-Foster methodology to the CHNS database between 2000 and 2009. The dimensions considered include: income; education; health (Body Mass Index); social security (medical insurance) and living standard (in turn based on four different indexes). Multidimensional poverty reduced in this time span, triggered especially by the drop of income and social security (which used to be the main determinant of inequality) deprivation. On the contrary, the relative contribution of education increased over time; this fact exacerbates the multidimensional poverty in rural areas, abandoned by more educated individuals. The rural/urban and the inner/coastal divides are indeed serious issues also in terms of multidimensional poverty.

Alkire and Shen (2015), apply the MPI method (adopting nine out of the original ten indicators) to the China Family Panel Studies (CFPS) database. Their study indicates a low and reducing level of multidimensional poverty between 2010 and 2014. This index was calculated in relation to the household location (rural/urban and western/central/eastern) and to some characteristics of the household head (gender, education, marital status, ethnic group etc.). As expected, groups as rural people and citizens of western provinces suffer a higher poverty rate. The same is not true for women-lead households. Further information about the results by Alkire and Shen (2015) are available in

[6] Monetary poverty is not the main topic of this analysis, we therefore just report a short number of fundamental references, including: the official statistics provided by the already mentioned MDGs report (China and UN, 2013); the critical analysis of causes and limits of poverty reduction by Ravallion and Chen (2007) and by Montalvo and Ravallion (2010), which gave emphasis to fundamental issues as inequality, rural/urban and regional divides, sectorial differences..

subsection 4.1, where these results are compared with our long-term investigation about multidimensional poverty.

Qi and Wu (2015) also apply the MPI method. Their sample includes children (aged 0-18) and a group of indicators relative to 7 dimensions (Nutrition, Water, Sanitation facilities, Shelter, Education, Health, Information) in the period 1989-2009. To check the poverty thresholds were robust, the authors run logit regression that show deprived individuals are more likely to suffer monetary poverty. The trend of poverty reduced in every province and for each dimension. Poverty reduction was stronger in rural areas and in provinces with middle economic growth rate. It was also stronger in the period 1993-1997, reducing thereafter.

Wang and Wang (2016) apply the MPI methodology to Hechi city (Guanxi), a city comprising 11 counties which is part of the 14 contiguous destitute areas. Data come from the poor households' census data (2013). The MPI is calculated over 4 dimensions (Housing, Health, Education, Living conditions), 10 indicators and several possible poverty thresholds. The indicators with the highest contribution to poverty are: 'dangerous housing', 'poor health' and 'adults' illiteracy'. The 11 counties were divided in subgroups according to various possible classifications. By applying to the MPI the Theil-T index, the inequality in poverty achievements was decomposed in its inter-classification and intra-classification components: with intra-group inequalities resulting stronger. Finally, the rocky desertification degree and the topographic fragmentation degree appear both positively correlated with multidimensional poverty, in any of its specifications.

Feng et al. (2016) use gray correlation method to investigate the trend of multidimensional poverty in poverty-stricken areas of China. Their measure of poverty considers twenty macro-level indicators, grouped in five dimensions equally weighted (Economic Development, Living Standard, Social Development Ability, Poverty Situation, Protection of Resources and Environment). By evaluating (at multidimensional level) the 2014 level and the 2010-2014 growth in these poor areas, the authors distinguish three groups. The first group (Desertification Area of Yunnan, Guangxi and Guizhou) exhibits favorable outcomes both in current development and in growth. In the second group (Quinba, Wuling and Dabie Mountain Areas), despite satisfying a satisfying level, the growth is unsteady. In the last group (Tibet, South Xinjiang and Daxing'anling Mountain Areas) multidimensional poverty is high and slightly decreasing.

Yang and Mukhopadhaya (2017) apply the MPI methodology to the 2010 CFPS data, considering 5 dimensions (analogue to Yu, 2013) and 13 indicators, and different possible poverty thresholds. Poverty results are decomposed to distinguish between provinces and rural/urban areas, while the contribution of the different dimensions and indicators is observed separately. Their analysis points

out that multidimensional poverty is more serious than income poverty, especially serious is the contribution of social security deprivation. Central and Western provinces (and especially Guizhou and Sichuan) are poorer than the coastal ones.

Nicholas et al. (2017) apply to the Chinese context (2000-2011) a combination of the A-F MPI with a time dependent measure of poverty. Including both dimensional and durational convexity, their index summarizes information about longitudinal deprivations in a single value. The dataset (from the CHNS) includes individual-level and household-level indicators, both numerical and categorical. With this poverty measure, it is possible to rank the intertemporal, multidimensional wellbeing in the nine provinces surveyed and across social groups (female and rural people appear more disadvantaged). It is also possible to see which deprivations are more likely to come jointly, representing therefore a bigger issue (as lack of proper fuel and illnesses). By incorporating the dynamic aspect, this index is unable to measure the trend of poverty over time (on the contrary poverty-reduction and poverty-increase are considered in a specular way).

Beside the peculiarities described above, these investigations owe much to the discussion about multidimensional poverty by Bourguignon and Chakravarty (2003). Based on this work, several indices were proposed to synthetize a matrix with information from different dimensions of wellbeing from different individuals into a single value, representing the level of multidimensional poverty in the society. Among these indices, we recall the measurement of social exclusion by Chakravarty and D'Ambrosio (2006)[7] and the MPI by Alkire and Foster (2011), which we will describe in the third section.

Table 1: Recent Studies about Multidimensional Inequality in China

Authors (Year)	Dimensions Included	Dataset Source	Methodology	Findings
Nicholas, Ray, Sinha (2017)	Toilet; Fuel; Electricity; Drink Water; Vehicle; Radio/TV; BMI; Illness; Blood Pressure; Compulsory Education	CHNS 2000-11	Dynamic multidimensional poverty: "Dimensional convexity" and "Durational convexity" penalize individuals with sevaral deprivations across time and dimensions.	Rural residents, female and inhabitants of Guizhou and Henan provinces are particularly disadvantaged groups. High blood pressure, lack of education and lack of drinking water are the most severe issues.

[7] The measurement of social exclusion considers whether each individual is excluded (1) or not (0) from a series of functionings, summing these information in a single value.

Yang Mukhopadhaya (2017)	Income; Living standard; Education; Health; Social security	CFPS 2010	MPI	Rural areas and inner provinces are poorer. Monetary poverty is lower than multidimensional poverty. Social security is the main cause of poverty.
Wang Wang (2016)	Housing; Health; Education; Living conditions	2013 census Hechi city	MPI (considering several possible poverty cutoffs); Theil-T coefficient; GIS	Unsafe housing, family health and adults' illiteracy are the main determinants. Poverty is related to rocky desertification. The inequality in poverty is mainly caused by intra-classification components.
Feng, Chu, Chen (2016)	Economic Development; Living Standard; Social Development Ability; Poverty Situation; Protection of Resources and Environment	CPAD 2012-14	Gray correlation method to compare multidimensional current developemtn and growth in 14 contiguous poor areas	Multidimensional poverty reduction is heterogeneous in different poor areas. There is "a big gap in the current poverty reduction ability between areas"
Alkire, Shen (2015)	Education; Health; Living Standard	CFPS 2010-14	MPI	Rural areas and inner provinces are poorer. Economic growth does not perfectly predict multidimensional poverty. Nutrition, schooling, fuel, drinking water are the main causes of poverty.
Qi; Wu (2015)	Nutrition; Water; Sanitation facilities; Shelter; Education; Health; Information	CHNS 1989-09 child. only	MPI based on variables and thresholds chosen by authors and checked in comparison with income	Children poverty reduced in every dimension and every year. The most critical dimension is 'Sanitation facilities'; the biggest poverty reduction occurred in 1993-97.
Yu (2013)	Income; Living standard; Education; Health; Social security	CHNS 2000-09	MPI methodology, with parameters adapted to the 5 dimensions included.	Multidimensional poverty alleviation, but income poverty fell faster than other types of poverty. Wide disparities across provinces and rural/urban gap.
Labar, Bresson (2011)	Income per capita; years of education: BMI	CHNS 1991-06	Sthocastic dominance criterion to evaluate the poverty reduction in the multidimensional domain (intersection)	Reducation of multidimensional poverty more sensitive in the initial period and for urban dwellers. Inequality issue can soo the poverty reduction.

Source: Author's elaboration

3. Data and Methodologies

The dataset selected for our purpose is the Chinese Health and Nutrition Survey (CHNS). Several investigations about Chinese economic conditions already adopted this dataset, including various studies about multidimensional poverty (among the others, Labar and Bresson, 2011; Yu, 2013; Qi and Wu, 2015; Nicholas et al., 2017). Indeed, CHNS is appreciated for the variety of information available and its time span, lasting more than twenty years.

The CHNS is a panel survey conducted by the by the Carolina Population Center (University of North Carolina at Chapel Hill) and the National Institute for Nutrition and Health. The first round of the survey was collected in 1989, while the last available data refer to 2011 (the nine rounds of the survey also include 1991, 1993, 1997, 2000, 2004, 2006 and 2009). The sample was randomly selected in a limited group of Chinese provinces, spread over the three macro-regions of China (East, Centre and West). In 1989 the survey included 8 provinces[8], an amount gradually enlarged up to 12 provinces in 2011[9].

The survey includes all the information about the ten indices[10] necessary to build the MPI in nine years between 1989 and 2011, except for flooring (one of the six indices in the "Living Standard" dimension), only collected in the first seven rounds.

The MSI is indeed based on a different set of eight indicators (see the subsection 3.2), which we selected among the variables collected by CHNS in the 2011 round. Five of these variables are collected at individual level, 3 at household level. In addition to these indicators, we consider the household total income inflated to 2011. In selecting the proper sample to compute the MSI, we run in a trade-off between the amount of years considered and the wideness of dimensions included. Indeed, the questionnaire adopted in 2011 is more detailed than those of previous years; extending the analysis to the whole period would have implied a significant reduction in the observable indicators.

In the literature, several indices are suggested to measure the multidimensional poverty and wellbeing. We adopt the MPI to have a picture of the evolution of the multidimensional poverty over

[8] Those are: Guangxi and Guizhou (West), Henan, Hubei, Hunan (Centre), Liaoning, Shandong, Jiangsu (East).
[9] Beside the provinces mentioned above, Heilongjiang was added in 1997 and Beijing, Shanghai and Chongqing in 2011. Liaoning provinces was not surveyed in 1997, but its panel data were again collected since 2000 (the following wave).
[10] These are: Years of Schooling; School Attendance; Child Mortality; Nutrition; Electricity; Sanitation; Water; Flooring; Cooking Fuel; Assets.

a long time-span (1989-2011), while the MSI was chosen to have a more punctual representation of individual wellbeing. The MPI is a well-established methodology, and its underlying indicators are available for the whole 1989-2011 period, allowing a comparison between years and with other works based on the same index. The MSI is a more recent tool, its flexibility allows to include several variables in the computation. Due to changes in the questionnaires, we decided to apply the MSI technique only to 2011 data, selecting an original set of individual-level indicators from several different domains of wellbeing, which makes impossible a comparison across years or with different studies, but allows to enter in the details of individual wellbeing in several different dimensions. For the sake of completeness, we decided to compare these indices. In this way we want to see whether they are overlapping or not, and in case what can trigger the differences.

The next subsections go into the details of these two indices, pointing out their preconditions, their adaptation to the CHNS dataset and the differences in their interpretation. Moreover, we discuss the theoretical assumption underlying the formulation of the IMSI.

3.1 Multidimensional Poverty Index

In their analysis about multidimensional poverty, Alkire and Foster (2011) proposes a new FGT class of indices to measure multidimensional poverty. The two most famous indices of this class are H and M_0. H is an headcount ratio, the percentage of individuals we consider multidimensionally poor (analogously to the unidimensional Poverty Headcount Ratio). M_0 (sometimes referred to as Global MPI or simply as MPI), gives a measure of *how much* poverty exists (similarly to the poverty gap in the unidimensional poverty analysis). The Oxford Poverty & Human Development Initiative (hereafter OPHI) adopted these two indices as main tools to measure and compare multidimensional poverty around the world.

The MPI operates through a 'dual cutoff' counting approach, similar to the measurement of social exclusion by Chakravarty and D'Ambrosio (2006). Given a matrix $N \times D$, where i are the surveyed individuals $(i = 1 \dots N)$ and d are the aspects of wellbeing we care about, the indicators or dimensions $(d = 1 \dots D)$, two cutoffs determine which individual i is multidimensionally poor. These cutoffs are the dimension cutoffs and the poverty cutoff. The individuation of poor individuals through the 'dual cutoff' immediately allows to calculate the multidimensional poverty headcount ratio H; it is also at the basis of the technique to calculate M_0.

The deprivation cutoff z_d is specific for each dimension and tells whether the performance of individual $\boldsymbol{i}$ in dimension $\boldsymbol{d}$ is good enough not to be considered deprived. The vector z_d is used as

reference target to replace the matrix $M_{N\times D}$ with the matrix $M'_{N\times D}$ through a formula that relates to each element m_{id} of the matrix, an element m'_{id}, which is alternatively in 0 (no deprivation) if the element is sufficiently high, or 1 (deprivation) if the element is too low. The parameters z_d, that determine the specific cutoff for each dimension, can be applied also to ordinal data (assuming lower values correspond to poorer achievements). Mathematically:

$$m'_{id} = \begin{cases} 0 \; if m_{id} < z_d \\ 1 \; if m_{id} \geq z_d \end{cases}$$

The poverty cutoff k $(0 < k \leq 1)$ indicates the "minimum deprivation count" (Alkire and Foster, 2011, p.483) an individual should suffer in order to say he is multidimensionally poor. This deprivation count is calculated at individual level and correspond to a weighted average of the deprivations m'_i. The weights w_d $(\sum_{d=1}^{D} w_d = 1)$ are assigned to each dimension/indicator according to the importance we assign to it; they make it possible to evaluate the deprivation count c_i with the formula:

$$c_i = \sum_{d=1}^{D} w_d m'_{id}$$

An individual i will be multidimensionally poor if $c_i \geq k$. In this way we obtain a column vector that tells whether every individual is poor or non-poor. Each element of the vector summarizes the performances in every dimension alternatively in 0 (the individual is not deprived in enough dimensions to be considered multidimensionally poor) or 1 (the individual is multidimensionally poor, because he is deprived in more than k dimensions). In the MPI, the second cutoff is generally $k = {}^{1}/_{3}$.

The poverty headcount ratio H is the percentage of individuals with $c_i \geq k$ over the total number of individuals N. H describes *how many* individuals are poor but is blind with respect to *how much* poor they are. The MPI, M_0, considers both this information summing up the c_i for all and only the individuals with $c_i \geq k$; this summation is divided by N to get a value $0 \leq M_0 \leq 1$.

Along with M_0 and H, another interesting variable is the average "deprivation count" of the poor, A. A indicates how many (weighted) deprivations poor people (on average) suffer. Note that mathematically $H \times A = M_0$, therefore A measures the changes in M_0 not explained by H.

The MPI technique is intuitive and immediate in its representation of poverty, because each person results univocally either completely poor or non-poor. However, each of the two cutoffs implies a loss of information.

The first cutoff will group together all the poor (not poor) household who are (are not) poor in each dimension, irrespectively of *how much* below (above) the poverty threshold they are. The indifference toward achievements "above" the threshold can be justified or even advocated[11] in a Rawlsian perspective. However, such way of proceeding does not account for the wellbeing of non-deprived individuals who, approaching or getting away from the deprivation cutoff can increase or decrease the risks for future poverty. The goal of obtaining a binary outcome -deprived or not- is more justified and less disputable in the case the phenomenon we observe was not measurable by a cardinal variable (e.g. not having access to …; having experienced …; give a bad evaluation to … etc.). Note that in its measurement of MPI, the OPHI only adopt non-cardinal indicators.

Relatively to the Chinese context and the target of a "moderate prosperous society" (小康社会 "xiǎokāngshèhuì"), increasing the wellbeing also beyond the deprivation cutoffs seems a fundamental target. On the other hand, considering in the same way all the deprivations, irrespectively of their severity can be an even more disputable. Note that this generalization occurs both in H and in M_0, since in both cases deprivations, if any, are considered with the value $m'_{id} = 1$ and associated to an ex-ante established weight w_{id}.

The second cutoff will group together as multidimensionally poor (not poor) all the individuals whose score is above (below) the 1/3 threshold, irrespectively of how much the number of deprivation is higher (lower) than the threshold. Having a deprivation count slightly higher or extremely higher than the cutoff will have no impact on H It will be however significant in the calculation of M_0. However, the summation at the basis of M_0 considers in the same way the deprivation count of each individual (as far as he is poor), without giving priority to the poorest among the poor[12]. Individuals without "enough" documented deprivation(s) will be considered in the same way of people with any deprivation as far as their deprivation count is $c_i < {}^1/_3$, so that the harmful effects of these deprivations are totally neglected both in H and in M_0.

Dealing with poverty, it is important to emphasize the coexistence of several different deprivations, but not necessarily this has to result in a complete neglecting of single-dimension deprivation. Indeed, with reference to China's "moderate prosperous society" target, the presence of a limited number of

[11] Bourguignon and Chakravarty (2003) define the Strong Focus property (SF), which makes the poverty index independent from variations in non-poor attributes.

[12] As an example, think about an improvement in the deprivation count c_i alternatively in an individual whose c_i is exactly ${}^1/_3$ or in an already extremely poor individual, whose c_i is ${}^2/_3$. The same improvement would have the same effect in terms of H and M_0, despite in the second case the improvement is affecting a poorer household. This issue is addressed by the measurement of inequality in deprivation scores (Seth and Alkire, 2014) and by the adjusted FGT class of multidimensional poverty measures (Alkire and Foster, 2011).

deprivations ($c_i < {}^1/_3$) does not seem an issue to be overlooked. This is particularly true in backward contexts, where household have difficulties in overcoming these deprivations because of poorer social security schemes.

Another limitation of the OPHI's MPI, common to other indexes, lies in its indicator, all the 10 indicators traditionally included are collected at household level, not individually. With such indicators, it is difficult to catch the within-household unequal achievements (e.g. differences between male and females). Note that this limitation is only caused by the OPHI's decisions about the relevant dimensions, and it is not intrinsically connected to the MPI methodology.

Theoretically, the MPI methodology can apply also at individual level, or mixing individual and households indicators, a method adopted by various researches[13]. However, in our opinion, the fact that the standard MPI (the formulation promoted by the OPHI) only includes household-level data is not by chance, and the selection of the dimensions seems coherent with the methodology adopted. Indeed, the application of the MPI requires a straight division between deprived and non-deprived dimensions; this force scholars to clear away the "mild" shortages of wellbeing, considering only the more extreme conditions. On the other hand, these conditions (as the death of a child or his school dropout) indicates a shortage involving the whole family.

In our MPI analysis, we stick to the standard MPI formulation, leaving the investigation of individual-level indicators to the MSI calculation. Therefore, the indicators included are 10: Years of Schooling; Child School Attendance; Child Mortality; Nutrition Electricity; Improved Sanitation; Improved Drinking Water; Flooring; Cooking Fuel; Assets ownership. The poverty cutoff is $k = {}^1/_3$; the deprivation cutoffs and the weights are indicator-specific (see Table 2 for more information). The deprivation cutoffs were interpreted relatively to the Chinese context: if necessary we made slight changes in their definition to be coherent with the information available. The biggest deviation is in the Flooring indicator, which was available only for 7 (out of 9) waves. Therefore, we replaced this indicator with an indicator about near house excreta removing in 2009 and in 2011 waves. Its deprivation cutoff considers households with "some excreta" or "much excreta" around the dwelling place as deprived. We pick this indicator for its theoretical and statistical proximity to the "Flooring" variable[14]. Note that the difficulty in obtaining floor information is common to Alkire and Shen

[13] With reference to the Chinese case, see Yu (2013); Qi and Wu (2015); Yang and Mukhopadhaya (2017); Nicholas et al. (2017)

[14] The deprivations in flooring and in excreta removing are positively correlated, and their combination shows a decreasing trend, consistent with that of other indicators. The table below shows the percentage of deprivation in the flooring (1989-2006)/excreta removing (2009-2011) indicator over the years. For a comparison note that, by adopting the excreta removing criterion, deprivation in 2006 would have resulted in 0.108% rather than 0.127%.

(2015), that excluded tout-court this indicator (so their MPI is based only on 9 indicators out of 10), having no information at all.

Dealing with the missing values, we excluded the missing indicators in the compute of H and M_0, calculating the minimum deprivation count only among a narrower set of indicators. In this case, the weights given to each indicator was set to maintain the principle that the three dimensions – education, health and living standard – are equally weighted, and available indicators referring to the same dimension are equally weighted.

Table 2: Dimensions, Indicators, Weights and Deprivation Cutoffs in the MPI

Dimension	Indicator	Weight	Deprived if (standard MPI)	Deprived if (our calculation)
Education	Years of Schooling	1/6	No household member aged 10 years or older has completed five years of schooling	No household member aged 10 years or older has completed five years of schooling
	Child School Attendance	1/6	Any school-aged child is not attending school up to the age at which he/she would complete class 8.	Any child *between 7 and 15 years old* is not attending school.
Health	Child Mortality	1/6	Any child has died in the family in the five-year period preceding the survey.	Any child has died in the family *in any previous year*.
	Nutrition	1/6	Any adult under 70 years of age or any child for whom there is nutritional information is undernourished in terms of weight for age.	Any adult *(i.e. 18 years old or more)* or any child is undernourished *according to the WHO definition*.
Living Standard	Electricity	1 / 18	The household has no electricity.	The household *does not normally use electric-type lightning*.
	Improved Sanitation	1 / 18	The household's sanitation facility is not improved (according to MDG guidelines) or it is improved but shared with other households.	The household's sanitation facility is *a cement/earth openpit or the household has no bathroom at all*.
	Improved Drinkin Water	1 / 18	The household does not have access to improved drinking water (according to MDG guidelines) or safe drinking water is at least a 30-minute walk from home, roundtrip.	The householddoes not have access to drinking water from in-house or in-yard tap water, nor from in-yard dwell.
	Flooring	1 / 18	The household has a dirt, sand, dung, or 'other' (unspecified) type of floor.	The household has a *earth (or other material not-in the list)* type of floor *(1989/2006); near the house there is some or much excreta (2009-2011)*.
	Cooking Fuel	1 / 18	The household cooks with dung, wood, or charcoal.	The household cooks with *sticks, straw*, wood, or charcoal.
	Assets Ownership	1 / 18	The household does not own more than one of these assets: radio, TV, telephone, bicycle, motorbike, or refrigerator, and does not own a car or truck	The household does not own more than one of these assets: *cellphone*, TV, telephone, bicycle, motorbike, or refrigerator, and does not own a car or truck

Source: Standard MPI is based on Alkire et al. (2017).
Note:our calculation is an original contribution, that modifies slightly to MPI to make it compatible with the CHNS data.

3.2 Multidimensional Synthesis Indicator

Mauro, Biggeri and Maggino (2018) introduced the MPI to better aggregate data from different dimensions, abandoning the hypothesis of perfect substitutability in the wellbeing deriving from different domains, allowing instead this parameter to vary according to individual characteristics. These motivations, and the malleability of the MSI methodology, led us to adopt (and adapt to the Chinese context) this index for our investigation. An important advantage of this index compared to the MPI, is the capacity of considering and measuring the fulfillment of the basic needs as a continuous variable rather than a dummy variable. This means the MSI can measure the Chinese progress beyond the satisfaction of some basic needs; this as we argue in the above subsection, seems more consistent with Chinese government current development aspirations.

Methodologically, shifting from an index based on dummy variables to an index based on continuous variables implies new challenges. The issues to be addressed are:

- the harmonization of the different indicators included. Different variables can have very different distributions, and we need a specification which makes possible the aggregation of values relative to different dimensions. Note that the first cutoff in the A-F MPI carried out this task;
- a function that aggregates the harmonized indicators into a single value. Note that the second cutoff in the A-F MPI carried out this task. Such aggregation can occur through a summation (as in the cases of H and M_0), a simple mean, a geometric mean etc., depending on our belief about complementarity/substitutability among different types of deprivations.

The United Nations Development Programme faced a similar problem in the formulation of another index based on various continuous variables, the Human Development Index. Dealing with the harmonization, they adopted a standardization based on maximum and minimum values. Dealing with the aggregation of different dimensions, they firstly opted for an arithmetic mean, recently transformed in a geometric mean (Klugman et al. 2011). This change was introduced to penalize heterogeneity among multidimensional outcomes[15]. However, the geometric mean conduces to some well-known problems of calculations and interpretability (Klugman et al. 2011, p.24). The HDI is traditionally based on three dimensions; theoretically it is possible to adapt this methodology to include a larger variety of indicators, undermining the comparability with previous literature. Another limit of the HDI (in the specification characterized by the geometric mean), is the risk of collapsing toward zero if a single dimension is zero. Note that this risk of collapsing grows by including the variety of dimensions considered. Finally, both the MPI and the HDI, in their standard specification,

[15] If two samples A and B have the same average, but the sample A have a lower variance, the arithmetic mean will be the same, while the geometric mean of A will be higher: the geometric mean assign a lower value to the sample B. This 'heterogeneity penalization' can be precious in the analysis of multidimensional wellbeing. Indeed, if we subtract a certain amount of wellbeing from a non-deprived dimension and we add the "same amount of wellbeing" in a deprived dimension, we can make the hypothesis the overall wellbeing increase (i.e. the marginal improvements in a single dimension of wellbeing have a decreasing contribution on overall wellbeing).

are characterized by indicators at household or community level, which make it difficult the analysis of inequality within the household/community.

For all these reasons, to analyze more deeply the individual multidimensional wellbeing in China, we prefer to accompany the MPI with the "Multidimensional Synthesis Indicator" (MSI). This index, based on Mauro et al. (2018), satisfies the proprieties of strict monotonicity, continuity and heterogeneity penalization. The criterion to aggregate the different dimension of wellbeing responds to the formula:

$$I_i = 1 - \left[\frac{1}{k}\sum_{j=1}^{k}\left(1 - x_{ij}\right)^{g_i}\right]^{\frac{1}{g_i}}$$

Where I_i is the Synthesis Indicator of individual *i*'s conditions; x_{ij} is a standardized performance of individual *i* in dimension *j*; *k* represents total number of dimensions j considered; g_i is a parameter that determine the way of aggregating the *j*-dimensions. This parameter must be a positive number, $g_i > 0$, and restricting its range to $0 < g_i \leq 1$ allows to guarantee heterogeneity penalization (instead of fostering heterogeneity).

Indeed, the parameter g_i is crucial in the computation of the MSI, because it indicates how we can aggregate the indicators x_{ij}. In case g_i is a constant, the same aggregation criterion decided *a priori*[16] applies to all the individuals. A special case is $g_i = 1\ \forall i$, which correspond to the case of arithmetic mean. If the formula is equal to a constant higher than 1, the aggregation criterion, similar for each individual, penalize heterogeneity, and the higher the constant, the higher the penalization. Mauro et al. (2018) suggests heterogeneity penalization should vary from individual to individual, according to their multidimensional achievement: in cases of poorer (on average) households, whose coping strategies are likely to be more limited, heterogeneity will be penalized more (i.e. it will be more difficult to compensate shortages in one dimension with abundance in a different one). Although, it can be any function, in the original computation of the MSI the function g(x) is calculated as simple mean among all the performances measured by the index itself, that is $g_i = \frac{1}{k}\sum_{j=1}^{k} x_{ij}$.

We want to enrich the literature about MSI by suggesting an alternative method to determine g_i, by considering taking into account income for its instrumental role in determining the wellbeing. Consistently with the idea of considering income as a mean rather than as an end, we exclude income from the dimensions of wellbeing *j*, on the other hand we base our parameter g_i on this (and only

[16] Anand and Sen (1997, p.16) refer to this issue as the ''inescapable arbitrariness in the choice of α''.

this) variable. The theoretical foundation of this strategy is the assumption that income-poor individuals are less able to substitute deprivation in a dimension with abundance in another. On the other hand, the scarce achievement of income-rich individuals in a single dimension can be triggered by their preference structure and not by a real deprivation. Rather than being an immediate source of wellbeing, in this framework, income is a proxy of the capacity to arbitrage freely between different domains of wellbeing, "emancipating" from an exogenous allocation of wellbeing.

As an example, we can compare the MSI of two individuals, P, who is income-poor and R, who is income rich based on two dimensions, Housing (H) and Leisure (L). If P and R have homogeneous achievements, their MSI measure will be identical: both of them will have MSI=30% if H and L record 30% of satisfaction, they will have MSI=40% if H and L record 40% of satisfaction and so on. In this case income cannot affect wellbeing (a person with perfect satisfaction in every dimension will have full wellbeing independently from her income and vice versa). In case P and R are equally strongly deprived in *H*, and not deprived in L, the MSI of P will be lower than the MSI or R. In this case we assume that the low score H of R is the result of preferences that favored L over H. On the contrary P, independently from his preferences, has less means to compensate the deprivation in H, which constitute then a more serious deprivation.

These considerations led us to base the parameter g_i over the variable y_i, where y_i is the natural logarithm of the income per capita. Furthermore, since the parameter g_i must be higher than zero, differently from y_i[17], we decided to set a lower bound, under which heterogeneity penalization cannot decrease. Rather than imposing arbitrarily a lower bound, we adopted a threshold equal to half of the poverty line[18], considering everybody below this level equally (un)able to operate arbitrage among multiple dimensions.

After synthetizing our information x_{ij} in MSI_i, we can use these individual values to investigate the level of poverty across provinces and across different socio-economic groups. An extension of this approach is the adoption of the MSI_i to measure growth (in case MSI is computable across several years) and inequality.

Any measurement of multidimensional wellbeing highly depends on which dimensions, indicators and aggregation methodology the researcher chooses to apply. To reduce as much as possible the

[17] The CHNS compute the income per capita, starting from the variable income, which in turns is given by the sum of several potential sources of income (business; farming; fishing; gardening; livestock; wages; retirement; subsidies; other), minus the expenditure. For this reason, income per capita can assume also values below zero (45 out of 13041 observations). Further details can be obtained from the CHNS website: http://www.cpc.unc.edu/projects/china/data/datasets/Household%20Income%20Variable%20Construction.pdf

[18] More information in the Appendix.

arbitrariness in such choices, we preserve -when possible- the dimensions included previous literature, with particular reference to the OPHI BMI, the HDI and the Capability Approach (Nussbaum, 2011). Indeed, we include in our MSI Education, Health, and Living Conditions (the pillars of MPI and HDI). ***Nutrition*** is another dimension considered, separating it from ***Health*** (considered as the presence of sicknesses/illnesses). Living Conditions is instead divided into three dimensions: ***Housing***, ***Sanitation***, and ***Assets***. Two other dimensions, ***Work*** and ***Leisure***, consider two aspects related to the quality of life and interpersonal relations. These aspects, crucial in the Capability Approach, are often overlooked in the studies on multidimensional poverty, but are included here in two dimensions, built on the quality of job position and on the time devoted to sleeping and recreative activities. The last variable is the already mentioned ***Education***.

We maintain the methodological assumption that any of the included dimensions is a-priori more (or less) important with respect to the others. All the variables can range between 0 and 1 (respectively, the worst condition of wellbeing and the level at which a wellbeing dimension is considered fully satisfied). The details about how we build these eight variables are described in the appendix. Dealing with missing variables, we excluded from the sample those individuals who answered "too less" individual sections[19]. Moreover, some imputation through the Multiple Imputation by Chained Equations (MICE) were adopted among the remaining 13041 individuals to have complete information. More information about the selection of the MSI sample and about the imputation are provided in the appendix. Table 3 describes the achievements in the eight dimensions included in the MSI.

Table 3: Achievements in eight dimensions of wellbeing in China, 2011

Dimension	Obs.	Mean	Std. Dev.	Min	Max
Education	13041	0.46	0.24	0	1
Health	13041	0.85	0.25	0	1
Nutrition	13041	0.79	0.16	0	1
Housing	13041	0.38	0.22	0.04	1
Sanitation	13041	0.83	0.22	0.11	1
Assets	13041	0.54	0.16	0	1
Work	13041	0.71	0.35	0	1
Leisure	13041	0.74	0.15	0	1

Source: Author's elaboration based on CHNS, 2011

[19] More information in the Appendix.

4. Results

The following subsections analyze separately the results obtained from the analysis of MPI and MSI indices. Later, we discuss the comparison between these two indices.

4.1 MPI

By applying the standard MPI methodology, described above, to the available nine waves of the CHNS data, we calculated M_0, H and A in from 1989 to 2011. Table 4 summarizes the MPI achievements in each year in the whole sample.

Table 4: MPI in China, 1989-2011

	M_0	H	A
1989	0.070	0.174	0.401
1991	0.073	0.186	0.394
1993	0.054	0.132	0.408
1997	0.042	0.105	0.401
2000	0.028	0.070	0.403
2004	0.016	0.040	0.396
2006	0.015	0.039	0.401
2009	0.015	0.040	0.373
2011	0.010	0.026	0.383

Source: Author's elaboration based on CHNS, 1989-2011. The indices are calculated on the overall sample. Note that, as recalled in the above section, some provinces were added over the years. It is important to highlight that Shanghai, Beijing and Chongqing are included only in 2011[20].

The trends of H and M_0 indicate a rapid decrease in poverty. According to both the indices the poverty in 2011 is only around 15% of the 1989 level. The trend of the two variables is similar (the former lying above by construction), and highlights that poverty reduction occurred every year, with the significant exception of 1991 and a small uptick in 2009 H. The 1991 peak emphasizes the harmful

[20] These three provinces have lower-than-average multidimensional poverty. Therefore, 2011 are biased upward with respect to previous estimates. By removing these three provinces, M_0, H and A would be respectively 0.012, 0.031 and 0.384. Other changes in the sample are the exclusion of Liaoning in 1997 and Heilongjiang in 1989, 1991 and 1993. Both these provinces are less poor than the average in terms of M_0. Their exclusion pushes upward the indices in the first waves. The overall trend of poverty is robust to the exclusion of these five provinces.

consequences of the 1989 Tiananmen events, which were followed by a freezing of the reforming process. Looking at the trend of inflated income per capita, we also have a (downward) peak in 1991.

Looking at the intensity of deprivations (the deprivation score among poor individuals), A, we can note that in most of the time-span this variable ranges around the value 0.40. Note that, by construction, this value must be greater or equal to 0.33[21]. A seems to have a long-term trend, and the drop of M_0 has been mostly led only by a reduction of H: poverty reduced because the number of poor reduced, while dealing with the condition of poor people, this has not improved much. A slight change in this condition could emerge from the data of the last two waves, reporting a value of A below 3.9. If confirmed, this trend implies that poverty reduction is affecting also most deprived individuals, not by immediately pushing them out of poverty, but improving however their conditions.

A "raw headcount ratio" can tell how many people suffered a deprivation in each of the 10 indicators included in any time. All the deprivations became less widespread in our time span, but the starting levels, the arriving levels, and the rates of reduction varies widely. This variety stresses the importance of adopting a multidimensional perspective, since any indicator alone can resume the complexity of the Chinese development. In 1989 the most severe indicators were 'Improved Sanitation' (62% deprivations) and 'Asset Ownership' (49%). In 2011, 'Improved Sanitation' remains the most widespread deprivation (32%), followed by two other deprivations that decreased below the average: 'Nutrition' (20%) and 'Cooking Fuel' (14%).

The MPI can be compared with Alkire and Shen investigation (2015) based on the China Family Panel Studies (CFPS), covering three waves in the 2010-2014 interval. The two studies differ both in the dataset and -to a lower extent- in the methodology[22]. Our results show a lower level of M_0 and H: in the 2009-2011 period, our data indicates a poverty headcount ratio below 4%, on the contrary such ratio ranges between 5% and 8% in 2010-2012 CFSP. Consistently with the lower level of poverty recorded in our analysis, also the speed of poverty reduction reduces.

Important geographical divides appear between areas with more multidimensional poverty and less deprived areas. Table 5 summarizes the results in rural and urban areas, as well as in the three macro-regions that constitute China (East, Center and West). We also point out the performance of Shandong

[21] Any individual with a lower deprivation score (i.e. $c_i < k$) is automatically excluded from the sample of poor individuals.

[22] CFPS includes 25 provinces and is nationally representative. Dealing with the methodology, Alkire and Shen (2015) main deviation from the standard MPI technique is the exclusion of the 'flooring' indicator from the Living Standard dimension.

and Guizhou provinces, showing respectively particularly low and particularly high levels of poverty. The last column shows the overall trend of M_0 and can be used as reference point.

Table 5: M_0 in different parts of China, 1989-2011

	Urban Area	Rural Area	Region East	Region Center	Region West	Shandong Province	Guizhou Province	Total
1989	0.033	0.086	0.028	0.076	0.109	0.023	0.141	0.070
1991	0.033	0.090	0.033	0.082	0.106	0.028	0.119	0.073
1993	0.026	0.065	0.031	0.061	0.070	0.024	0.077	0.054
1997	0.015	0.054	0.023	0.041	0.059	0.020	0.084	0.042
2000	0.014	0.034	0.013	0.032	0.041	0.011	0.057	0.028
2004	0.007	0.020	0.009	0.014	0.027	0.007	0.039	0.016
2006	0.005	0.020	0.008	0.014	0.026	0.006	0.040	0.015
2009	0.008	0.017	0.006	0.011	0.029	0.004	0.043	0.015
2011	0.003	0.013	0.003	0.007	0.021	0.002	0.040	0.010

Source: Author's elaboration based on CHNS, 1989-2011.

Dividing rural and urban areas, we observe that poverty reduction occurred in both cases. Rural areas have always been more disadvantaged, but the gap has not closed yet. The differences between rural and urban areas were straightforward in the Nineties (a period of strong poverty reduction), but also in the new millennium. Indeed, since 2004 urban areas register a M_0 below 0.01, which makes it difficult further poverty reduction[23]; nevertheless, in the same period rural poverty reduction seems to have stabilized too. Moreover, rural areas record a lower intensity of multidimensional poverty A in all the observed periods. This means that rural areas suffer a double disadvantage: poverty is more widespread and, when it hits, its intensity is stronger. A persistent rural/urban gap was also found with CFPS data, both in terms of H and A (and consequently in M_0 too).

East, Central and West China have different economic structures, the former being the most advanced area, and the latter the weakest one (similar results were found with CFPS data). Such differences were already evident in 1989 and persisted over the decades. However, it is interesting to note that poverty reduction has been stronger in Central China than in the West, especially in the new millennium, suggesting a divergence of the two zones.

As expected, the provinces with the lowest average M_0 overlap to the provinces with the higher per capita income and vice versa. An exception in this negative correlation is Henan. Henan, in the central region, records one of the lowest level and growth rate of income per capita; it also records a good performance in terms of poverty level and (especially) poverty reduction. This case recalls the

[23] An exception is the 2011 wave, which saw richer areas as Beijing and Shanghai entering in the sample, causing a drop in the poverty indices

importance of measuring multidimensional poverty with its proper indicators, which cannot be estimated simply on the basis of income achievements.

Gender differences are more difficult to be measured in the MPI framework, since its indicators are measured at household level, making intra-household gender differences unobservable. In our sample (as in Alkirie and Shen, 2015) male and female samples do not differ significantly in terms of multidimensional poverty[24]. Despite an average lower poverty rate among women, this difference is not significant at 5%, neither with respect to M_0, nor to H, neither in the first waves of the survey nor in the last. To overcome this issue, Alkirie and Shen (2015) analyze separately households with male and female head, but they find again non-statistically significant results. In our sample, women-led households appear to have had significantly lower poverty rate between 1989 and 1997; on the other hand, men-led households have significantly lower poverty in 2011. This difference is not statistically significant in the intermediate years. The 1989-1997 differences do not necessarily deny the discrimination of women, because of endogeneity problems. Richer and more educated families, as well as households where the husband migrated in a different village, could be more likely to have a female household head, moreover omitted variables (as the size, the type of job and the age structure of the household) can contribute to explain the different performances.

Two other characteristics that influence multidimensional poverty in China are ethnicity and party affiliation. CHNS collected such sensible information only in some waves: the affiliation to Chinese Communist Party is available only in the first five waves, between 1989 and 2000. The information about belonging or not to the Han ethnic group (the majority, who is likely to be less discriminated) contains many missing values. We build a household-level variable about having at least one non-Han member exploiting the time invariance of this characteristic: every household in which at least one member ever declared belonging to an ethnic group, is considered entirely and for the whole period as ethnic minority. Such simplification is clearly inaccurate, and only allows to draw rough results. A more complete analysis, would require an ad hoc investigation.

However, the performances of all these groups, party members and non, ethnic minorities and non, are in line with our expectations. Party members are much less affected by multidimensional poverty in the 1989-2000 period. They were particularly able to avoid the deleterious consequences of the 1989 event. It is important to underline that the direction of causality in the party affiliation is not

[24] Dealing with the gender differences tackled in this paragraph, as well as in the cases of ethnic and other dichotomies analyzed subsequently, we refer to a two-sample t-test with equal variances. The results of the tests are not reported in detail for space constraints. The null hypothesis of this test is that the mean of the two sample is the same, versus the two-tail alternative hypothesis (the mean is different). The null hypothesis is accepted when the t-value is higher than the critical value at 0.05 significance level (i.e. the p-value is lower than 0.05).

explored, and this trend can have different explanations. Ethnic minority families, on the other hand, were more affected by multidimensional poverty. Since 1991, poverty reduction occurred both in Han and minority families, but a clear convergence trend has not appeared yet.

Table 6 summarizes the average level of M_0 according to the social characteristics described above. Note that families in which nobody ever declare its ethnicity were excluded by the relative columns; the same applies for individuals who did not answer to the question about party membership (not asked from 2004 onwards). The last column shows the overall trend of M_0 and can be used as reference point.

Table 6: M_0 in different social groups, China, 1989-2011

	Gender		Household Head		Ethnic Group		Official Cadre		Total
	Male	Female	Male	Female	Han	Minority	Yes	No	
1989	0.070	0.070	0.074	0.046	0.062	0.113	0.017	0.027	0.070
1991	0.074	0.073	0.078	0.046	0.068	0.104	0.015	0.072	0.073
1993	0.055	0.053	0.057	0.036	0.050	0.078	0.015	0.053	0.054
1997	0.043	0.041	0.045	0.029	0.036	0.085	0.004	0.044	0.042
2000	0.028	0.028	0.029	0.026	0.025	0.046	0.003	0.029	0.028
2004	0.015	0.016	0.016	0.015	0.014	0.028			0.016
2006	0.014	0.016	0.015	0.016	0.012	0.033			0.015
2009	0.014	0.015	0.015	0.014	0.013	0.029			0.015
2011	0.010	0.010	0.009	0.012	0.008	0.025			0.010

Source: Author's elaboration based on CHNS, 1989-2011.

4.2 MSI

The MSI index is based on the performance n eight dimensions of wellbeing (see the Appendix for a detailed description). Before analyzing the wellbeing with the MSI index, we check the average fulfillment of the eight indicators separately and their correlation between each other.

Table 7 shows the average achievement in the eight dimensions for the whole sample (as already done in Table 3) and in 5 specific subgroups: Female, Rural, Coastal, Young (age ≤ 30), Old (age ≥ 60). Note that three of these subgroups (Female, Young, Old) were difficult to apply on the OPHI's MPI, which is based on household-level data.

The "horizontal" comparisons, among values in the same line, tell whether there are differences in the specific achievement between different samples; the "vertical" comparisons, among values in the same column, are less interesting because they refer to different dimensions, calculated with different methodologies. Note that all indicators run from 0 (the worst level of wellbeing) to 1 (the best level

of wellbeing). Below these dimensions, we point out their simple average. This value corresponds to an elementary version of the MSI, where the function $g(\cdot)$ assumes constantly the value 1.

Table 7: Eight dimensions of wellbeing, average achievements, China, 2011

Dimension	Whole Sample	Female	Rural	East	Age 30-	Age 60+
Education	0.616	0.563	0.547	0.685	0.832	0.425
Health	0.832	0.856	0.850	0.802	0.947	0.716
Nutrition	0.794	0.790	0.794	0.787	0.769	0.785
Housing	0.573	0.572	0.606	0.539	0.528	0.608
Sanitation	0.832	0.833	0.756	0.881	0.853	0.818
Assets	0.694	0.690	0.684	0.750	0.757	0.621
Work	0.711	0.653	0.719	0.765	0.728	0.557
Leisure	0.739	0.734	0.739	0.734	0.792	0.708
Mean	0.724	0.711	0.712	0.743	0.776	0.655

Source: Author's elaboration based on CHNS, 2011.

These results are generally consistent with our expectations.

Women have a lower average achievement; this difference appears particularly in the fields of Education and Work. On the other hand, women record a higher achievement in the Health dimension. Housing, Sanitation and Assets, by construction, are calculated at household level, and therefore presents small difference between men and women.

Dealing with the rural-urban gap, rural people are generally worse off. Interestingly, they have lower level of education but higher employment opportunities, they also have larger houses (in terms of room per capita), which are less equipped of sanitation facilities. They have a lower amount of assets but report better health conditions. Dealing with the last issue, it is worth to note that the foundation of the Health indicator are self-reported information and other information related to medical diagnosis. Therefore, the lack of medical infrastructures and a (related) scarce awareness of health conditions, can lead to overestimate the value of health[25].

[25] Consider the case of highly aware/sensitive individual, who considers much more seriously the same symptoms of an illness with respect to a less concerned individual. Ceteris paribus, the former is more likely to self-report higher severity of diseases, to devote more days to recover from an illness and to provide more complete information about his (permanent) disease history. To an extreme, communities where hospitals are scarcely accessible and the public awareness about health security is lacking, will have fewer diagnosis of chronic diseases. While the individuals of these communities will be less concerned (then happier), the risk for their health will be higher. Therefore, our measure of health is more suitable to catch the subjective aspect of the health dimension, which only partially overlaps to the objective aspect of the health dimension (and partially can be even negatively related, as just explained).

The eastern region (coast), generally richer than the rest of China, has smaller but better endowed houses. It also records higher assets and employment, but worse health conditions (the case of the good health performance in rural areas described above, can be symmetrical to the poor performance along the coast).

Finally, age matters in terms of wellbeing. Younger individuals (i.e. between 18 and 30 years included) have particularly high levels of health and education, but their performance is above the average in all the dimensions with the notable exception of housing. Symmetrically, older people (i.e. above 60 years old) are worse off in all the dimensions but housing. The different behavior of the Housing dimension with aging can be explained by two non-excluding factors: consumption behaviors and household size, as well as by the increasing difficulty for young Chinese people to find a spacious house[26].

The correlation between the eight dimensions of the MSI, reported in Table 8, indicates the capacity of Chinese people to spread their wellbeing across different dimensions in a balanced way.

Table 8: Correlation Matrix of Eight dimensions of wellbeing, China, 2011

Correlation Matrix	Education	Health	Nutrition	Housing	Sanitation	Assets	Work	Leisure
Education	1							
Health	0.112***	1						
Nutrition	0.038***	0.075***	1					
Housing	-0.126***	-0.041***	0.005	1				
Sanitation	0.345***	-0.065***	0.001	-0.061***	1			
Assets	0.330***	0.045***	0.005	-0.045***	0.230***	1		
Work	0.263***	0.119***	0.057***	-0.010***	-0.010	0.187***	1	
Leisure	0.142***	0.084***	0.027***	-0.013	0.054***	0.086***	0.050***	1

Source: Author's elaboration based on CHNS, 2011. Significance levels 0.01, 0.05 and 0.10 are indicated respectively by ***, **, *.

[26] Housing is an issue of growing concern, especially for young people living in big cities (consistently with the trend of Housing in Rural, East and Young subsample of our estimations). Further analysis at provincial level (not reported here for space concern) shows that coveted municipalities as Beijing and Shanghai have the lowest Housing scores (on the other hand they also record the highest scores in terms of sanitation facilities and assets). For this reason, it is included in the "new three big mountains" (三座大山), showing the renewal of China's biggest concern in present era (the original 三座大山 in Maoist China were imperialism, feudalism and bureaucrat-capitalism).

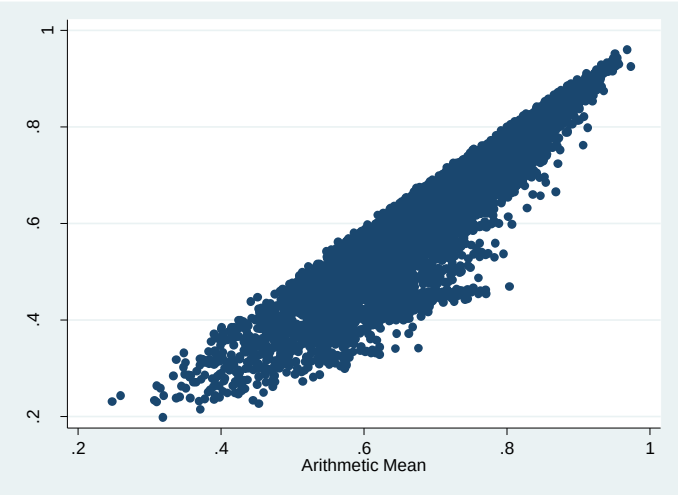
We consider highly correlated variables those with a correlation coefficient above 0.2 (or, in case of negative correlation, below -0.2). Among our dimensions, highly correlated variables are: Education and Sanitation; Education and Assets; Education and Work; Sanitation and Assets. All these correlations are positive and suggest that the more educated individuals are usually those better endowed in terms of sanitation facilities and assets; they are more able to avoid unemployment too. Other remarkable correlations are between Leisure and Education; Work and Health; Work and Assets; Health and Education; Housing and Education. The last correlation is negative, meaning that more educated people live on average in worse houses (in terms of rooms per capita and house ownership); this result is likely driven by age differences[27]. Note also that Work and Leisure are positively correlated, signaling that being employed not necessarily results in a trade-off with the time devoted to leisure. The relation between Sanitation and Assets is instead negative and week. Theoretically two contrasting effects could cause this weak relation: on one hand, are two normal goods, and the expenditure on both of them increase with income. On the other hand, richer areas endowed with better sanitation facilities, have higher floor prices, making it more difficult to own large apartments; therefore, there is a trade-off between the availability of sanitation and the availability of (cheap) housing[28].

The Mean-based Multidimensional Synthesis Indicator (MMSI) and the Income-based Multidimensional Synthesis Indicator (IMSI) are both based over these eight dimensions of wellbeing. The MMSI is on average lower than the IMSI: in the whole sample, the average MMSI is 0.684, while the average IMSI is 0.659. This difference comes from the fact that the parameter g_i calculated on the basis of the income is on average higher than the average of the 8 indicators.

The difference between the two indicators is not only in their average level. By incorporating income (with an instrumental role) in its computation, the IMSI differs from the MMSI, especially in the case of poorer individuals, where the sensibility to unequal performance among the indicators is higher. In Figure 1 we can see that with a growing average level of wellbeing, the dispersion of the IMSI values reduces. This means that high wellbeing average level, are associated with scarce heterogeneity penalization (because individuals are more able to obtain a homogeneous – and high-wellbeing, because individuals are richer, therefore less penalized for heterogeneity, or for both these reasons). The IMSI methodology led also to a higher variance in the outcomes with respect to the MMSI[29].

[27] As mentioned above, older people have lower Education scores, but higher Housing scores.
[28] More details about the housing issue are provided in the footnote 24.
[29] The standard deviation of MMSI and IMSI are respectively: 0.124, 0.129.

Figure 2: IMSI and Arithmetic Mean, 8 dimensions of wellbeing, China, 2011



Source: Author's elaboration based on CHNS, 2011.

Apart from the MSI, the arithmetic and the geometric mean are two other techniques that can synthetize multiple indicators in a single index. The former, that can be also considered as a special case of MSI, will always provide the higher average outcomes, because it does not carry on any heterogeneity penalization. It is also associated to lower variance and standard deviation. All these indices are based on the same indicators, and their only difference lies in the aggregation technique.

Table 9 and Table 10 shows the average level of MMSI, IMSI, Arithmetic and Geometric mean applied to the eight dimensions of wellbeing considered. Table 9 focuses on geographical subgroups: rural and urban inhabitants, households from the Eastern, Central and Western region, households from Beijing[30] and from Guizhou[31]. Table 10 focuses on individual characteristics, as gender, age, being the household head.

The rural-urban gap appears in term of multidimensional wellbeing, triggered by the differences in Education and Sanitation (see Table 7). Irrespectively on the aggregation technique, the difference between the two areas is statistically significant[32]. The Western region records lower levels of multidimensional wellbeing, particularly in Chongqing and in Guizhou. The Eastern region records higher levels of multidimensional wellbeing, particularly in Beijing and in Shanghai. The advantages

[30] Irrespectively from which synthesis methodology we decide to apply, Beijing is the province with the highest level of multidimensional wellbeing.
[31] Guizhou is the province with the lowest level of multidimensional wellbeing according to arithmetic mean and MMSI. Interestingly, according to the IMSI Henan has the lowest level of wellbeing, while according to the Geometric mean, Chongqing has the lowest level of wellbeing. Indeed, these three provinces are those with lower multidimensional wellbeing irrespectively of the synthesis methodology adopted, but their ranking changes in the different specifications. We recall that Guizhou is also the province with the highest level of multidimensional poverty as calculated with the MPI.
[32] T-tests show the difference is significant at 1% level (in favor of urban areas) in all the four cases. The test is not reported here for space concerns.

related to urban communities is similar to the advantage of Eastern provinces; the disadvantage of living in the West is higher also win comparison to rural and Central locations.

Table 9: Multidimensional Wellbeing in China, geographic subgroups, 2011

	Urban Area	Rural Area	Region East	Region Center	Region West	Beijing Province	Guizhou Province	Total
IMSI	0.68	0.64	0.69	0.64	0.63	0.73	0.62	0.66
MMSI	0.70	0.67	0.71	0.67	0.66	0.75	0.65	0.68
A. Mean	0.74	0.71	0.74	0.72	0.70	0.78	0.69	0.72
G. Mean	0.63	0.57	0.65	0.56	0.54	0.72	0.49	0.59

Source: Author's elaboration based on CHNS, 2011.

Table 10: Multidimensional Wellbeing in China, individual characteristics, 2011

	Gender Male	Gender Female	Age 30-	Age 60+	Non-head	Head	Total
MMSI	0.68	0.64	0.71	0.58	0.66	0.66	0.66
IMSI	0.70	0.67	0.75	0.60	0.69	0.68	0.68
A. Mean	0.74	0.71	0.78	0.65	0.73	0.72	0.72
G. Mean	0.64	0.55	0.70	0.43	0.59	0.59	0.59

Source: Author's elaboration based on CHNS, 2011.

A gender gap exists and is significant according to all the four indices. The magnitude of this gap is comparable with the rural-urban gap, despite the geographical issue is more tackled in the Chinese literature. Among the drivers of this gap, we recall the higher educational level of men and their higher employment rates (as described in Table 7). Dealing with age, younger cohort report higher level of multidimensional wellbeing. Value judgement on this advantage, triggered by better health and education, are not straightforward. On one hand, the age differences determine inequalities within Chinese society; on the other hand, they are the symptoms of Chinese multidimensional development. Household heads, who are more likely to be men, older and to live in smaller households, have a slightly lower multidimensional wellbeing index.

4.3 MPI and MSI in China: A comparison of their results

Chinese development in the multidimensional space can be described both by MPI and MSI; in turns these two indices comprise different computation methodologies and variants. The MPI is more widely adopted, also because of its easy interpretability and a foundation based on indicators

(relatively) easy to find. In our case, for example, we were easy to retrace the information necessary to calculate the MPI since 1989, documenting its evolution up to 2011.

On the other hand, the MSI can broaden the aspects of wellbeing included and aggregate these indicators taking into account individual characteristics. In our case, the identification of relevant and measurable aspects of wellbeing has been has entailed difficulties, which resulted in the capacity to compute properly the MSI only for the year 2011.

On the practical level, adding the MSI to the analysis is noteworthy only if this index catches aspects of wellbeing that are relevant for the individuals but are overlooked in the MPI. Moreover, also in case the dimensions included in our MSI are noteworthy, the aggregation technique typical of the MSI, which is more complex and less straightforward than traditional methods (as arithmetic or geometric means), becomes relevant in an empirical perspective only if it allows a better evaluation of multidimensional wellbeing. To test these hypothesis, we compare the MSI and the MPI measures with the self-reported level of wellbeing.

Life self-reported evaluation is a variable obtained from the answers to the question "*How do you rate your life at present?*" (recorded in CHNS as item u420). It ranges between 1 (answer: "*very good*") and 5 ("*very bad*"), in decreasing order of wellbeing. Therefore, negative correlations indicate higher indices correspond to better life self-evaluation.

Table 11 shows the correlation between Life Self-Evaluation and different measures of wellbeing. In particular, we include: IMSI and MMSI as MSI indices, M_0 and H as MPI indices, Geometric and Arithmetic Means of the indicators at the basis of the MSI, the per capita income (in logarithmic form[33]), which is the most widespread interest variables considered by the literature.

We recall that the two indices were computed in the previous sections over two different samples[34]. In Table 11, as well as in the following comparisons, we consider only the "common support" (i.e. the individuals for which both MPI and MSI were available).

Table 11: Correlation between life self-evaluation and wellbeing indicators, China, 2011

	IMSI	MMSI	M_0 (MPI)	H (MPI)	Arithmetic Mean	Geometric Mean	Income
Life Self-Evaluation	-0.245***	-0.228***	0.083***	0.086***	-0.230***	-0.172***	-0.188***

Source: Author's elaboration based on CHNS, 2011.
Significance levels 0.01, 0.05 and 0.10 are indicated respectively by ***, **, *.

[33] A lower bound was fixed at zero, to assign a real value to individuals whose income was negative.
[34] We recall that, dealing with the MSI, our sample is restricted to adult individuals in year 2011 who answered to at least three of the five subsections of the questionnaire utilized in the computation.

All the index suggested are significantly correlated with the self-reported Life Evaluation. As expected, the correlation is positive for the index measuring poverty (MPI and H), and negative for the others. This result confirms that all these measures catch important elements for the personal wellbeing, not only responding to value judgements, but also to individuals self-reported perceptions. Stronger correlations (higher absolute values, which can be compared irrespectively of the sign), indicates a higher effect on life self-evaluation.

MSI indices are more strongly correlated with Life Self-Evaluation. This fact, suggest a MPI-MSI trade-off, in which the MPI is more suitable for immediate interpretations and comparison among values based on different datasets, and the latter is more able to account for several dimensions of wellbeing. Among the traditional aggregation techniques, the geometric means, is less correlated with Life Self-Evaluation too (largely because of its numerous zeroes), and the score of the arithmetic mean is similar to the MMSI. Among the two MSI indices, the IMSI – based on an additional underlying variable used as parameter – has a higher correlation. To sum-up, less straightforward aggregation techniques result more efficient in predicting the self-reported wellbeing. This is true comparing MSI with means as well as comparing MMSI with IMSI, and give rise to a trade-off in the choice about empirical measurement of multidimensional wellbeing[35].

Interestingly, M_0 does not correlate with Life Self-Evaluation better than H. Comparing these two indicators typical of the MPI analysis, we can note that the more elaborated one (M_0) is also the one with the weaker correlation with Life Self-Evaluation. This fact means that separating the individuals considered multidimensionally poor from the remaining of the sample is informative in terms of self-reported wellbeing, but the MPI tools could be not suited to further elaborate within the poor group. However, we have to recall that the question about self-reported wellbeing was not designed to investigate poverty effects, and the capacity of MPI to measure properly life conditions within the poor group (not in the purpose of this work) would requires an *ad hoc* analysis

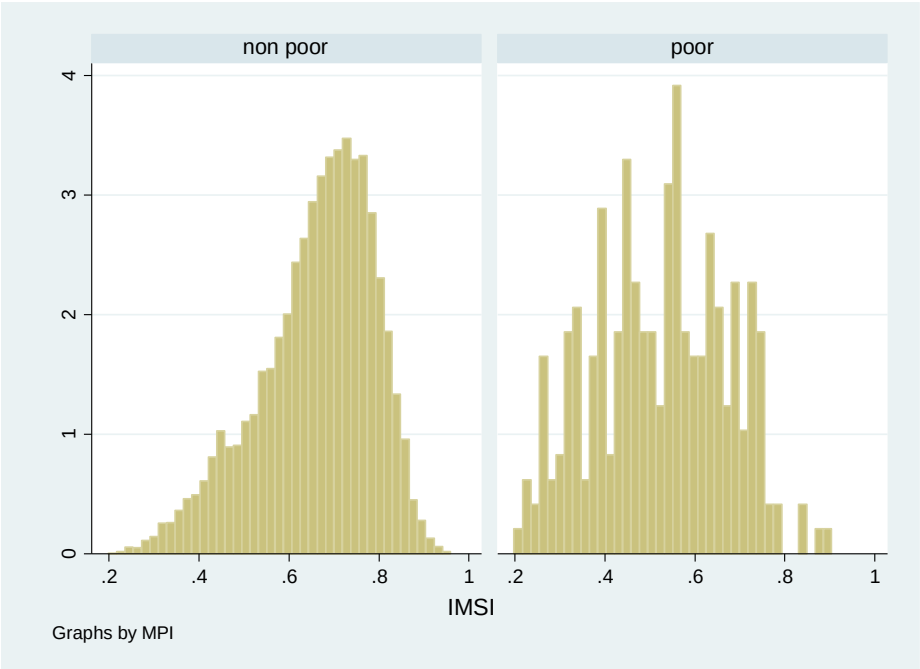
Similarly, we compute the correlation between Life Self-Evaluation and the eight variables underlying the MSI. All these correlations, not reported here for space concerns, were negative and significant at 1%, with the only exception of Nutrition (negative but non-significant correlation). That between life-evaluation and Nutrition is indeed the weaker correlation, while the highest correlation is with Assets (this correlation is also higher than the correlation with income mentioned above).

[35] The analysis of the correlation between self-reported wellbeing and A (not reported here for space constraint) confirms this incapacity.

For simplicity, in the remaining of this section, we will compare MPI only with IMSI (which had the highest correlation in Table 11), therefore excluding MMSI and arithmetic/geometric means indexes.

It is interesting to note that, among the individuals classified as multidimensionally poor according to the MPI criteria ($c_i > {}^{1}/_{3}$), the wellbeing level, as measured by the IMSI varies markedly. As expected, the IMSI of these individuals is significantly lower with respect to non-poor (we recall that many of the underlying indicators of MPI and MSI are in common, as years of schooling or access to water), but the two groups are largely overlapping. Figure 2 describes the distribution of the MSI in the two groups, non-poor (on the left) and poor (on the right), as individuated by MPI criteria.

Figure 2: IMSI among multidimensionally poor and poor individuals, China, 2011



Source: Author's elaboration based on CHNS, 2011.

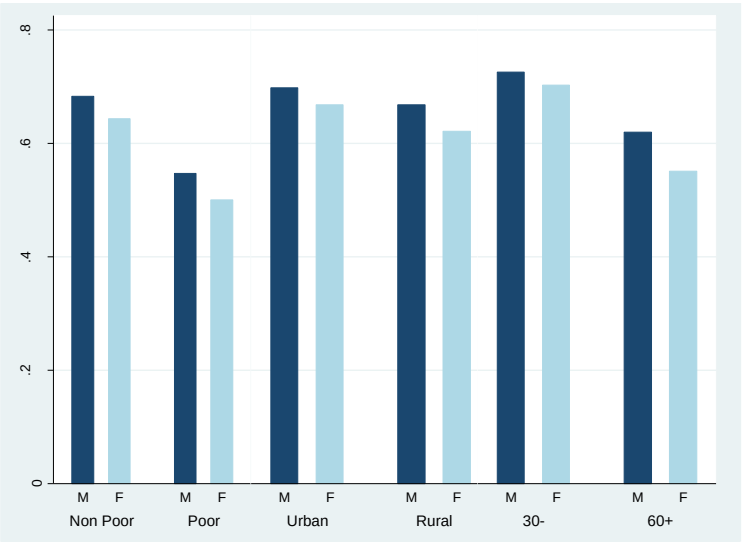
Another advantage of MSI is its capacity to observe differences within families[36]. This advantage is related uniquely to the indicators that we included in its computation, largely measured at individual level. Theoretically, it is possible to apply different techniques, including the MPI, to a set of individual-level variables (even if, as we argued previously, the MPI technique could be intrinsically more suitable to adopt household-level variables).

[36] The average standard deviation of MSI within households is 0.060. The standard difference is even higher if we include only the multidimensionally poor households (according to MPI classification). This confirms that the MSI can measure differences existing not only between poor households, but also within each of them. Moreover, since in many cases the entire population of the family is surveilled – and not only a sample of its members – this value can be underestimated.

Indeed, important differences emerge according to age and gender. The MSI is particularly precious to analyze the gender differences, which are mostly overlooked by household-based indicators (as those used by the MPI).

The wellbeing performance of males is significantly higher than that of females (see Table 10 in the previous subsection). This advantage, calculated in the overall sample, emerges clearly also if we look at subgroups, and in particular among the most deprived subsamples. Figure 3 shows the average MSI outcome in advantaged and disadvantaged groups, differentiating the average performance between males (dark blue) and females (light blue). Advantaged and discriminated groups are defined according to three different variables: multidimensional poverty (defined according to the MPI technique), age (in this case we point out the performances of young people, i.e. those below 30 years old, considered more advantaged, and the performances of old people, i.e. those above 60 years old, considered disadvantaged).

Figure 3: IMSI among advantaged and disadvantaged subgroups, males and females, China, 2011



Source: Author's elaboration based on CHNS, 2011.

In all these six subgroups, male have higher performances than female. We define here the "gender-gap" as the absolute difference between the average MSI among a subgroup composed of male individuals and the corresponding subgroup of female individuals. It is interesting to note that, in all the three advantaged/disadvantaged couples, the gender gap is higher in the discriminated subgroup. Indeed, gender gap is higher among poor individuals, among rural households and (especially) among

old cohorts. A similar result applies also to richer and eastern provinces (advantaged) with respect to poorer and inner provinces (disadvantaged)[37].

These findings seem to confirm and generalize the existence of a "sticky floor" affecting Chinese women, as denounced first by Chi and Li (2008). This concept refers to a gender gap that is wider for the lowest quintiles of the population, discriminating poor women more than their better-off counterparts. Chi and Li considered earnings as interest variable and as variable underlying the population distribution. The results represented in Figure 3 suggest a generalization of the Chinese "sticky floor" in two directions. Firstly, we considered as interest variable an index of multidimensional wellbeing rather than a unidimensional variable; secondly, multidimensional poverty, rural-urban differences and age are all feasible criteria to distinguish the top and the bottom of the population distribution.

[37] As an example, in Beijing the MSI is 0.733 among men and 0.717 among women, while in Guizhou it is 0.651 among men and 0.594 among women.

5. Conclusions

In this work we analyzed the multidimensional wellbeing in China adopting two alternative indicators: the MPI and the MSI.

The MPI focuses on the issue of poverty, which is defined at dimension level, and distinguishes individuals belonging to poor and non-poor households (who in turn are differentiated according to the amount of deprivations they experience). In the selection of the relevant dimensions and their relative thresholds, we adopted the specifications provided by the OPHI. The analysis of this index allowed us to represent Chinese trajectory in terms of multidimensional poverty reduction on a time span of more than 20 years. It is important to underline that, after an increase in poverty between 1989 and 1991, during all the Nineties and the first decade of the new millennium, poverty in China strongly reduced, a reduction that has been particularly strong in the Nineties, while in the new millennium it continued with a slower pace.

The properties of the MPI allow a decomposition of the index in comparable subgroups. Therefore, we computed the level and the trend of poverty in specific geographic areas and for individuals with similar characteristics. At geographical level, the rural/urban divide and the inner/coastal divide both influence the MPI, with coastal and urban areas registering a significantly lower level of multidimensional poverty. These differences do not seem to reduce over time, on the contrary the rural gap is increasing. At individual level, individuals belonging to the Han ethnicity (i.e. the ethnic majority) and members of the Chinese Communist Party have lower poverty. The existence of a gender gap is instead hardly caught by this methodology, based on household-level indicators.

The MSI was adopted to have a more punctual representation of multidimensional wellbeing, able to measure not only the (extreme) deprivation but the whole range of satisfaction in a variety of dimensions. Two main differences exist relatively to the MPI: the selection of the relevant dimensions (based on a wider and individual-based set of indicators) and the aggregation technique (which instead of summing deprivation, takes into account the individual capacity of substituting wellbeing in a dimension with wellbeing from a different one). While the second difference is methodological, the first one is related to the selection of dimensions operated by the OPHI. However, the OPHI selection seems consistent with the MPI technique, individuating extremely serious deprivations that, when occur, affect the whole household. The set of dimensions included in the MSI do not allow a calculation of the index in the whole period, and we limit our analysis to the year 2011.

Another original contribution of this work is the way of computing the parameter g_i, that we related to the income of the individual. Indeed, income has a peculiar role in determining the wellbeing: our version of the MSI, the IMSI, consider income as a mean, rather than an end, and consider income as a tool influencing the individual interdimensional arbitrage capacity. The correlation with self-reported life evaluation suggests that the MSI in general is more able than the MPI to catch self-reported wellbeing, and in particular the IMSI is better than other aggregation techniques (as arithmetic and geometric mean and the previously adopted version of the MSI).

The IMSI values indicates significant differences based on geography (confirming what already found with the MPI), highlighting also important differences based on gender and age: women and old people have on average a lower multidimensional wellbeing. Interestingly, the gender-bias is stronger in the more backward context. This result suggests that the "sticky floor" theory can be generalized beyond the boundaries of monetary wellbeing, and has important policy implication in terms of poverty alleviation. Individuals classified as multidimensionally poor with the MPI technique are indeed a group much more heterogeneous than the MPI suggest, where women in particular have, on average, a lower IMSI score.

Dealing with the Chinese goal of building a 小康 society, the MSI -and the IMSI in particular- seems particularly relevant for its capacity to evaluate the wellbeing going beyond the strictly monetary aspect and the measurement of overt deprivations. Promoting the introduction of this tool in the economic debate is important under several perspectives. At theoretical level, the IMSI provides a new and more sophisticated answer to the question whether to include or not income in the calculation of multidimensional wellbeing. At practical level, the IMSI proved to be more efficient than the MPI and other aggregation techniques in providing an objective calculation of multidimensional wellbeing that reflects the subjective evaluation – however, this result cannot be generalized across time and countries without further investigations. Finally, dealing with the policy implications, individual-level measuring is important to improve the targeting of the poor in the design of social policies.

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