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How Serious is the Neglect of Intra-Household Inequality in Multi-dimensional Poverty Indices?

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How Serious is the Neglect of Intra-Household Inequality in Multi-dimensional Poverty Indices?[1]

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Abstract

Income-based as well as most existing multidimensional poverty indices (MPI) assume equal distribution within the household and thus are likely to lead to yield a biased assessment of individual poverty, and poverty by age or gender. In this paper we first show that the direction of the bias depends on how these measures use individual data to determine the poverty status of households, while the impact of these assumptions on inequality between individual cannot be determined a priori. We then use data from the 2012 Indian Human Development Survey to create a standard household-based MPIs closely related to the MPI proposed by Alkire and Santos (2014) as well as UNDP (2014), and compare that to an individual level MPI that individualizes education and nutrition and some aspects of the living standards dimensions. We find that the poverty rate of females is 14 percentage points higher than that of men in our individual MPI measure but only 2 percentage points higher when using the household-based measure. Similarly, the age differentials in poverty are much larger using the individual-based measure. Using a decomposable inequality measure, we find the contribution of intrahousehold inequality to the total inequality in the individual deprivation score inequality to be 30% and total inequality is also some 30% *higher* using the individual-based measure, while inequality among the poor is found to be 5% *smaller* using the individual measure.

Keywords: multi-dimensional poverty, poverty measurement, intra-household inequality, India

JEL Codes: I3, I32, D1, D13, D6, D63, O5, O53

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Introduction

The ultimate objective of measuring poverty and inequality is to determine the well being of individuals. But most empirical analyses of poverty assume that resources are distributed equally, or according to need, within the household and equate poverty status of the household with the poverty status of all individuals in the household. Such household-based poverty measures are then often used to track trends in well-being, target social and economic programs, and measure the impact of interventions.

But the assumptions of equal or needs-based distribution is inconsistent with the theoretical literature on intra-household bargaining, which has shown that well-being outcomes depend on the bargaining power (and associated sharing rule) within the household where equal distribution would be more of the exception than the rule. These bargaining models have received overwhelming empirical support in the literature (e.g. Lundberg & Pollak, 1993; Lundberg, Pollak, & Wales, 1997; Manser & Brown, 1980; McElroy & Horney, 1981; Grossbard-Shechtman 1993; Gersbach & Haller, 2001; Edlund & Korn 2002, Chiappori 1988, 1992).

More generally, there is overwhelming evidence collected across multiple contexts over the last two decades on intrahousehold inequalities against the need-based or equal distribution assumption (e.g. Haddad et al., 1997; Quisumbing & Maluccio 2000; Aronsson, Daunfeldt, & Wikström, 2001; Alderman, Chiappori, Haddad, Hoddinott, & Kanbur, 1995). In particular, substantial and consequential gender inequalities in the allocation of resources have been shown to exist in many contexts, with particular sizable gaps existing in some regions of the developing world, particularly parts of South Asia and the Middle East (e.g. World Bank, 2011; Klasen & Wink, 2002; 2003, Asfaw, Klasen, & Lamanna, 2010; Rosenzweig & Schultz, 1982; Hazarika, 2000).

As a result of this it is likely to be the case that household-based assessments of poverty by gender understate the gender gap in poverty, at least in some parts of the developing world.[2] And similarly, often-done analyses of child poverty or poverty among the elderly will yield biased results as the equal distribution assumption is unlikely to hold (e.g. Dreze & Srinivasan, 1997; Corak, Fertig & Tamm, 2008; Deaton & Paxson, 1998). More generally, poverty rates might be biased and their distribution by region or household type distorted, leading to biased assessments of well-being and policies, and biased targeting.

Even though this has been long recognized there have been only few attempts at measuring poverty and inequality using truly individual level achievements. The dominant approaches in both unidimensional income and multi-dimensional poverty measurement (MPI) use the household as the unit of analysis to determine poverty status of individuals.

In 1990, Haddad and Kanbur assessed how serious the neglect of intra-household distribution is when considering poverty in calorie intake (Haddad & Kanbur, 1990). Using Philippine data they show that 30 to 40 percent of all inequality is intra-household inequality and would be

[2] At the same time, there have also been some unverified claims about gender gaps in poverty, such as the widely made claim in the 1990s that 70% of the world's income poor are female. If one assumes equal distribution at the household level, it is impossible to arrive at such a figure; but since no information existed on the actual unequal distribution of poverty, this number was a pure conjecture. See Marcoux (1998) for a discussion.

missed if individual data was ignored. They also find that ranking between males and females reverses when using individual data, with poverty rates among women being higher when using some poverty measures.

Several methods have been developed in recent years that allow one to estimate intra-household inequality using only household-level monetary information. (Lise & Seitz, 2011, Chiappori, Fortin & Lacroix, 2002, Dunbar, Lewbel & Pendakur, 2013, Browning, Chiappori & Lewbel 2013). Case & Deaton (2002) and Chiappori & Meghir (2014) provide an excellent review of the various approaches used in the literature. But first and foremost they note the serious challenges when doing so. This is due to the presence of public goods within the household, the difficulty in identifying the sharing rule within the household given limited data and varying preferences across household members; and lack of sufficient data on individual consumption and time use for household members all of which complicates the estimation of intra-household inequality. Case & Deaton (2002) in their review conclude that most methods in the literature rely on controversial, easily challenged and non-transparent assumptions. Also none of these methods have gained widespread acceptance. They suggest that the best way forward might be collection of more data on individual consumption and interviewing multiple people in the household. But even such improved data will not solve the conceptual problem of determining how the use of household-specific public goods can be attributed to its members.

In contrast to the income dimension where household-specific public goods make an assessment of individual income poverty particularly difficult (e.g. Klasen, 2007), many non-income deprivations, e.g. in the health and education dimensions, can, in principle, be attributed to individuals so that an individual multidimensional poverty measure appears more feasible at first sight. And in fact, these individual-level data are typically available in standard survey instruments. Yet in existing popular multi-dimensional poverty measures such as the Multidimensional Poverty Index (MPI) used by UNDP and OPHI (see Duclos 2011; Alkire & Foster, 2011; Alkire & Santos, 2014, d'Ambrosio & Chakravorty, 2010), deprivations are also determined at the household level; and all individuals within the household are assigned the deprivation and poverty status of the household without any differentiation within the household. In cases where the household is deemed deprived or poor then all individuals in the household are deemed to suffer equally from these deprivations. Consequently, the gender or age-segregated poverty numbers obtained from these calculations are unreliable at best, and deeply misleading at worst. And even overall poverty numbers, trends, and correlates might be similarly affected.

A poor household might have individuals who are not deprived in any or most dimensions to be actually deemed as non-poor, and vice versa. The bias this generates in household-based multidimensional poverty assessments depends on how the thresholds for household poverty in a dimension are set, or how the individual-level data is used to create a household-level indicator. The deprivation thresholds can be defined in a *restrictive* way where the achievement of the worst-off member of the household has to be above the threshold for the household to be non-deprived. In these cases the deprivation rates among individuals are *overestimated* by household measures as long as not all households are indeed equally deprived in that dimension. But deprivation thresholds could also be defined in an *expansive* way, where only the achievement of the best-off individual has to be above the threshold for the household to be non-deprived. In such cases, the deprivation rates among individuals are *underestimated* by household measures if not all are as well off as the best-off. UNDP and OPHI's MPI use a mix of indicator threshold definitions – restrictive and expansive – so that the net bias of their neglect of intra-household inequality is not clear a priori.

There have been some survey-based multidimensional measures proposed exclusively for different demographic groups within the population (Alkire et al., 2013; Roche, 2013), but most focus only on a subset of the population like women or children. Ramaya, Lahoti & Swaminathan (2014) construct an individual level multidimensional poverty measure for adults in Karnataka, India. They found substantial gender differences in poverty that are absent when using household measures. Bessell (2015) proposes an individual deprivation measure for adults based on custom-made surveys in the Philippines, finding rather little gender inequality in this deprivation measure. While these studies are instructive, they are only focused on particular groups and thus cannot assess poverty at the individual level for the entire population or assess to what extent household-based analyses under- or overstate individual poverty and inequality. Also, they are based on particularly detailed, unique, and often custom-made surveys using small samples, making replication at higher scales and across contexts difficult (and costly).

To our knowledge, ours is the first paper to present a framework to measure multi-dimensional poverty and inequality at the individual level that accounts for intra-household inequality across the entire population. Using data from India, we use this framework to estimate individual poverty and inequality as well as the size of the bias of household-based analyses.

In our application, we find that women and older individuals in India are far more deprived and poor than men and younger individuals. This simple fact is obscured and gender and generational differences are absent when measuring poverty and inequality using the standard household-based approach. In particular, the poverty rate of females is higher by 14 percentage points than men in our individual MPI measure but only 2 percentage points higher when using the household-based measure. The poverty rate among individuals aged fifty and over is higher by 46 percentage points than among children aged between 7 and 18 years of age in the individual measure, compared to only 2 percentage points when using the household-based measure. Using a decomposable inequality measure, we find the contribution of intrahousehold inequality to the total inequality in the individual deprivation score inequality to be 30% and total inequality is also some 30% higher using the individual-based measure, while inequality among the poor is found to be 5% smaller using the individual measure.

At the same time, we note that our approach to individualize poverty measurement can only be seen as a first attempt in this direction and is hampered by insufficient data on individual well-being in standard household surveys; improved data would likely lead to even larger differentials in poverty by age and gender, at least in a country such as India. The paper is organized as follows. In the next section we discuss our theoretical framework, section three discusses data and methods, section four results, and section five concludes.

2. Theoretical Framework

We adapt the theoretical framework for assessing the impact of neglecting intra-household differences in the uni-dimensional setting presented in Haddad & Kanbur (1990) to a multi-dimensional setting.

Let's assume that wellbeing of individuals is measured by y. In a uni-dimensional setting, wellbeing is generally measured by consumption, income or nutrition. In a multi-dimensional scenario let d (≥ 2) represent the number of dimensions in which well-being is assessed and y_{ij} (≥ 0) represent the achievement of individual i in dimension j. Let the total number of individuals be N (i = 1,2,….N) belonging to H households (h=1,2…H). The dimensions used in multi-dimensional poverty analysis commonly include education, health, and indicators of standard of living. Each dimension j is assigned a weight w_j. The weights represent the relative importance assigned to each dimension by the analyst. Let z_j denote the threshold below which an individual is deemed deprived in dimension j, and let z be the row vector of dimension thresholds. For each individual i, let g_i^0 denote the deprivation vector of d elements, whose elements g_{ij}^0 are defined by $g_{ij}^0 = w_j$ when $y_{ij} < z_j$, while $g_{ij}^0 = 0$ otherwise. We assume that information on individual's deprivation with respect to any particular dimension is binary i.e. 1 if deprived and 0 if non-deprived.

As discussed above, in household-based multidimensional poverty assessments thresholds are not defined based on achievements of each individual but collectively for the household, denoted by z_j^h. All members of the household then are assumed to have the identical deprivation vector g^{0h}. We can construct a weighted deprivation count vector c, whose entry for the ith individual is the sum of the weights for the dimensions in which the individual is deprived, $c_i = \sum_{i=1}^{d} g_{ij}^0$. When using household data, the deprivation score for all individuals in the household is identical and given by $c^h = \sum_{i=1}^{d} g_j^{0h}$. The difference between c and c^h for individuals within and across households and their distribution is the main object of interest in this paper.

Are the levels of c and c^h systematically different, and are individuals of certain groupings favored to have higher well-being in one over the other? Do the differences in c and c^h impact multi-dimensional poverty analysis? The answers to these questions depend on how the underlying dimension thresholds are defined in the household-based analysis and the extent of within-household disparity in achievements for the dimensions and the poverty line.

Household deprivation thresholds can be defined in various ways. For some indicators, there exists only a household-based indicator and the implicit assumption is that, in this dimension, we are dealing with a household-specific public good. This is, for example, the case the standard of living dimensions of UNDP's MPI that examine electricity and water and sanitation access for the household, or the ownership of durable goods to determine household-level deprivation in these dimensions. In these cases, individual data is not available on these household-specific public goods. While of course one cannot be sure that all household members profit equally from access to these public goods (esp. use of some of the durable goods might be quite unequal), it is very hard and information-intensive to assess intra-household inequality in access to these public goods. As a result, most surveys do not contain individual-level information on these dimensions. We will return to this issue in the empirical assessment below.

More important for our purposes here, however, is that for some dimensions, household-level assessments and thresholds are built up from individual-level data that *is* available in the surveys. We classify the most commonly used thresholds of using individual-level data to assess household-level deprivation into two types, restrictive and expansive.

The deprivation threshold is said to be *restrictive* when the achievement of the *least* well-off person (or the overwhelming majority of members) has to be above the threshold for the household to be non-deprived. For example, in UNDP's MPI, the threshold that deems the entire household to be deprived in nutrition if any one member of the household is undernourished, is such a *restrictive* one . This could generally be represented by a deprivation function defined as $g_j^{0h} = w_j \; if \; \min(y_j^h) \leq z_j^h \; and \; 0 \; otherwise.$

In such instances the average value of the deprivation score across the population for the dimension would be higher than if individual data were used to define deprivations i.e. $\mu(c_j^h) \geq \mu(c_j)$, as long as there is no perfect equality among all household members in this dimension. In other words, the number of individuals with the deprivation would be *overestimated* using household thresholds. Individuals within the household who are better off would be deemed deprived due to deprivation of the worst-off household members. In the Indian example below, men on average are better off than women in most well being-dimensions, and would more likely be misidentified as deprived in such dimensions.

The deprivation threshold is said to be *expansive* when the achievement of only one (or a minority of individuals) has to be above the threshold for all individuals in the household to be non-deprived. For example, in the MPI, the entire household is deemed non-deprived in education if at least one household member has five years of education. This can be generally represented as $g_j^{0h} = w_j \; if \; \max(y_j^h) \leq z_j^h \; and \; 0 \; otherwise$. In such instances the average value of the deprivation score across the population for the dimension would be higher than if individual data were used instead to define deprivations i.e. $\mu(c_j^h) \leq \mu(c_j)$. The number of individuals with the deprivation would be *underestimated* using a household-based assessment. For example, women in India, who on average are worse off than men, are likely to be misidentified as non-deprived using such thresholds.[3]

The extent of the disparity in individual deprivation status within the household in each dimension would determine amount of under- or overestimation. For example, if the within household disparity in nutrition deprivation, which is defined in a restrictive way, is large and many households have only one undernourished person while others in the household are not undernourished then the extent of overestimation would be large. On the other hand, if within household disparity is small and in deprived households most members are undernourished then the extent of overestimation would be small. An analogous argument can be made in case of more expansive deprivation thresholds. The aggregate impact of various dimensions on difference between c and c^h would depend also on the type of thresholds, weighting and to what extend each deprivation misidentifies individuals. In most popular multi-dimensional measures some indicators are defined restrictively while others are defined expansively, so some of the over- and under estimation of deprivation rates would lead to opposing biases and thus partially cancel each other in the aggregate measure. For example, in the MPI proposed by OPHI and UNDP, the educational achievement dimension is defined in an expansive way, while the educational enrolment, and the undernutrition dimensions are defined in a restrictive way.

[3] The household-based MPI uses third methods to assess household-level deprivation based on individual-level achievement. In the mortality indicator, a household is deemed deprived if a child has died in the last 10 years. We use the same procedure for that component in the individual MPI.

To create an aggregate measure of the incidence of multi-dimensional poverty based on these dimensional deprivation data, a recently proposed influential approach by Alkire and Foster (2011) is to select a cutoff value `k' and any individual with a weighted deprivation score above `k' is considered multidimensionally poor i.e. $\rho_k(y_i, k) = 1 \; if \; c_i \geq k \; and \; \rho_k(y_i, k) = 0 \; if \; c_i < k$ where ρ_k is the identification function. For aggregating poverty over the population one simple approach is to measure the percentage of population that is poor. The headcount can be formally defined as H(y) = q/n where q = $\sum_{i=1}^{n} \rho_k(y_i, k)$ is the number of persons who are identified as poor. UNDP's MPI has, for example, adopted this approach for identification and aggregation.

The impact of differences between c and c^h on the poverty headcount or any of the other poverty measures depends on the distribution of deprivation scores, especially with respect to k.

Does the pattern of poverty incidence across groups change when taking intra-household differences into account? Suppose we divide the population into *m* mutually exclusive groups population proportion δ_l with l =1…m. The multidimensional headcount of poverty can be written as

$$H(y) = \sum_{l=1}^{m} \delta_l H_l\,(y); H(y^h) = \sum_{l=1}^{m} \delta_l H_l\,(y^h)$$

and the contribution of a group to poverty in the two cases can be shown to be

$$C_l(y) = \frac{\delta_l H_l(y)}{H(y)}; C_l(y^h) = \frac{\delta_l H_l(y^h)}{H(y^h)}$$

For the contributions to poverty to be different the intra-household inequality has to be very different across the two groups, similar to the uni-dimensional case (Haddad and Kanbur 1990). If we divide the population by regions and find that intrahousehold inequality is substantially higher in rural areas as compared to urban regions and most of the dimension thresholds are defined in expansive way (leading to underestimation of poverty in household measure), then the rural contribution to poverty might increase when using individual data. In such cases there is a possibility of change in poverty rankings across the two regions i.e. if $H_U(y^h) > H_R(y^h)$ then with substantially higher intra-household inequality we can get $H_R(y) > H_U(y)$.

What about inequality in deprivation scores? Is the distribution of the total deprivation score of individual deprivation scores c more or less unequal than compared to when deprivation scores are based on a household-level assessment c^h? And how do the intra-household and inter-household components of inequality change? In the uni-dimensional case Haddad and Kanbur (1990) show that inequality (using all Lorenz-consistent inequality measures) is understated when using household-level data. The individual level c can be seen as the result of a mean-preserving spread that is bound to increase inequality.

This is, however, not always true in the multidimensional case. When using household data there is no intra-household inequality by definition and all inequality is inter-household inequality. So the intra-household inequality is underestimated. But when moving from a household-based assessment to an individual assessment, *inter*-household inequality is also affected. The change in inter-household inequality depends on the distribution of deprived individuals across the households in the population.

If the deprivation thresholds are restrictive and deprived individuals are concentrated in some households so that households either have all deprived individuals or no deprived individuals, then the inter-household inequality is the same when using household and individual data. In simple terms, if there is no misidentification of deprivation status of individuals when using household thresholds, then total inequality is the same in household and individual analysis. But if deprived individuals are spread more widely across households so that deprived and non-deprived individuals live in the same household then inter-household inequality could be under- or over-estimated by a household-level assessment (that deems everyone deprived as long as a single individual is deprived) depending on the exact dispersion of deprived individuals across households, with examples for under- and overestimation provided in the footnote.[4] Similar considerations hold when the expansive definition is used so that again it is an empirical question whether total inequality is higher in an individually-based or a household-based assessment of multidimensional deprivation.

What about the pattern of inequality across groups? How does between and within inequality among groups change with use of household vs. individual data? For illustration and in our empirical analysis we use an inequality measure based on a positive multiple of the variance proposed by Seth & Alkire (2014). This is an absolute inequality measure as opposed to a relative inequality measure more commonly used in assessing income inequality. An absolute inequality measure is invariant to any additive changes to deprivation scores, while a relative inequality measure is invariant to any proportional changes to deprivation scores. As discussed in Seth & Alkire (2014), a relative inequality measure for counting based poverty measurement approaches will provide contradictory conclusions depending on whether one measures attainment or deprivations, which is not the case in absolute measures. Also each deprivation has a direct or intrinsic importance justifying the normative assessment of inequality in absolute distances (see also Klasen, 2008). Since deprivation scores do not have any units, the property of unit consistency of relative measures does not hold any advantages. The measure can be expressed as

$$V(c) = \frac{4}{n} \sum_{i=1}^{n} [c_i - \mu(c)]^2$$

[4] Consider a small hypothetical population consisting of two households (A and B) each consisting of three members. We assess MPI poverty for this population based on achievements in five dimensions, which have restrictive thresholds and are equally weighted. In the first scenario (S1) each member of household A is deprived in one indicator and one member of household B is deprived in four indicators while other two members are deprived in one and three indicators, respectively. In the household assessment all members of household A will have deprivation score of 0.2 and due to restrictive thresholds, all members of household B will have deprivation score of 0.8, resulting in a Gini coefficient of 0.3. In the individual assessment the six individuals will have deprivation scores of 0.2, 0.2, 0.2, 0.2, 0.6 and 0.8 and the Gini of the individual deprivation score will be higher at 0.32. Let consider another plausible scenario (S2) with two members of household A with no deprivations and the third with deprivation in one dimension, and each member of household B is deprived in four dimensions. In the household assessment of MPI the deprivation scores and Gini of deprivation score remains the same as scenario S1, due to restrictive thresholds. But in the individual assessment the Gini of deprivation scores decreases to 0.17. So the exact dispersion of deprivation scores across individuals and households determines whether inequality is under- or over-estimated.

This can decomposed into within-group and between-group components as below:

$$V(c) = \frac{4}{n}\sum_{l=1}^{m}\sum_{i=1}^{t^l}[c_i(k)^l - A^l]^2 + 4\sum_{l=1}^{m}\delta_l\,(A^l - A)^2$$

The first part of the equation is the total within-group component of total inequality. It can be viewed as a positive multiple of the sum of variance within each group. A^l is the average deprivation score in the group l i.e. $A^l = \mu(c^l)$ and A is the average deprivation across the entire population. The second component is the total between group inequalities. The between group contribution is defined as

$$C_B(c) = 4\frac{\sum_{l=1}^{m}\delta_l\,(A^l - A)^2}{V(c)}$$

The within group component is just 1 - $C_B(c)$. If we are using household level thresholds and data, then

$$V(c^h) = \frac{4}{t}\sum_{l=1}^{m}\sum_{i=1}^{t^l}[c_i^h(k)^l - A^{hl}]^2 + 4\sum_{l=1}^{m}\delta_l\,(A^{hl} - A^h)^2$$

$$C_B^h(c) = 4\frac{\sum_{l=1}^{m}\delta_l\,(A^{hl} - A^h)^2}{V(c^h)}$$

As discussed earlier the difference in $V(c)$ and $V(c^h)$ depends on the type of deprivation thresholds and distribution of deprived individuals across households. So the direction or extent of difference in the between-inequality contribution by the two methods, and its impact on group-based inequalities, remains an empirical question.

In sum, household-based assessments of multidimensional will provide a biased account of individual multidimensional poverty. It will then also bias the assessment of poverty by groups as well as the measured total inequality in deprivations. While for some definitions of household-based assessments and levels of intra-household inequality in deprivation, one can assess the sign of the bias, for others this is not possible a priori and will essentially become an empirical exercise to which we now turn.

3. **Data and Methodology**

We use data from the 2012 Indian Human Development Survey (IHDS) to construct the multidimensional poverty measures. IHDS is a nationally representative, multi-topic panel survey of 42,152 households across India covering all Indian States. Most of the households interviewed were part of an earlier round of IHDS survey in 2005. IHDS covers a wide range of topics, which include health, education, employment, economic status, marriage, fertility, gender relations and social capital. The survey also asked a few sex-disaggregated time-use questions about common household chores like collecting water and cooking. Unlike most household surveys, IHDS recorded individual level asset ownership information for land and principal residence. This individual level information allows one, for example, to calculate gender asset gap within households (see Lahoti, Suchitra & Swaminathan, 2016)

3.1 Dimensions and Indicators

We construct a Household MPI measure (henceforth called Global Household MPI), which is based on the Global Multidimensional Poverty Index developed by the Oxford Poverty and Human Development Initiative (OPHI) and also used, in a slightly amended version, by UNDP (2014). An individual MPI measure is constructed using the same dimensions as the Global Household MPI, but by directly measuring individual achievements in some dimensions as opposed to household-level deprivation indicators. The individual MPI measure uses slightly different indicators than the household measure. In order to facilitate ease of comparisons we construct a second household MPI measure which uses exactly the same indicators as the individual MPI. This new household MPI measure is referred to just as the comparable household MPI. All the MPI measures incorporate education, health and standard of living as the three dimensions. A list of the various indicators, deprivation thresholds and weights used in each of the measures is presented in Table 1.

Education

The education dimension is commonly seen as a central capability Sen's and Nussbaum's versions of the capability approach (e.g. Nussbaum, 2003; Sen, 1998). It also impacts other capabilities such as future employment opportunities, self-confidence and the ability to participate in public and political life.[5] There is near-universal acceptance of the importance of education in measuring multidimensional poverty and it is used in all the major MPI measures.

The indicators used to measure education in the global household MPI are proximate literacy and children's enrollment in school. Basu and Foster (1998) argued that presence of a literate person provides positive externality for the entire household. In the global MPI a household with at least one member who has completed 5 years of education is considered non-deprived (UNDP's MPI sets the threshold at 6 years but assumes the same externality). This is an expansive threshold and would lead to underestimation of deprivation rate for this indicator. Despite this externality, education provides first and foremost a benefit to the person who possesses it so that an individual perspective seems warranted. In addition, Ramaya, Lahoti & Swaminathan (2014) argue that differences in literacy among household members might impact power dynamics. So in the individual MPI measure we measure education separately for each person in the household. We deem an individual above 12 years of age as deprived if she/he has not completed five years of education. For children below age 12, we use a different procedure that we outline presently.

The Global MPI uses children's enrollment[6] as a second indicator for education. The right to education is a central right of the international Convention on the Rights of the Child. Since the

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[5] A recent example is a law passed in the Indian states of Rajasthan and Haryana prohibiting anyone without certain minimum years of education to contest local level elections.

[6] In addition to enrollment IHDS also measures children's achievement in reading, arithmetic and writing. In 2005-06 more than 42% of children enrolled in grade 5 could not read a simple story, indicating the poor quality of schooling (Desai et al., 2010). We do not include this in our MPI measures to maintain comparability with the Global

passage of the Right to Education (RTE) Act in 2009, education is also recognized as a fundamental right of every child in India. A child not enrolled in school indicates acute distress and curtailment of opportunities for that child.

In the individual MPI measure we do not use this indicator (as there would be no equivalent indicator for adults and children outside of this age window). Instead, children between the ages of 7 to 12 are deemed deprived if they have not completed the expected age-adjusted years of schooling. The expected age-adjusted years of schooling is calculated so that children should be on track by age of 12 years[7] to complete five years of education. Since children below 7 years of age have not started schooling, we have no information on them for the schooling indicator. In these cases, we use information on schooling status of other household members as proxy for their potential status. Specifically, children below seven years of age are deemed deprived in education in the individual measure if half or more of household members 12 or more years of age have not completed five years of education. We also test, in later sections, robustness of our results to modifying the schooling threshold for children below seven.

Health

Health is another central capability. The capability refers to being able to have good health, including reproductive health; to be adequately nourished; and to have adequate shelter (Nussbaum, 2003). It also directly and indirectly impacts other capabilities – malnourishment reduces the ability of children to learn (UNICEF 1998), limits ability to participate in social life (e.g. disability) and might increase the need for material resources (Rippin, 2012).

We use nutrition and child mortality as the two indicators for health dimension, the same as the ones used by the Global MPI[8]. Nutrition is an especially important indicator for India given the overall poor state of nutrition (both among children and adults) in the country (e.g. Klasen, 2008). In the household measures, an individual is considered deprived in the nutrition indicator if any of the adult household members (18 years or more) for whom data is collected are underweight (have a BMI less than 18.5), or if any children are malnourished. Individuals 6 to 17 years of age are undernourished if their BMI-for-age is two or more standard deviations below the median of the reference population. Children between 0 to 5 years of age are deemed deprived if their weight for height is two or more standard deviations below the median of the reference

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MPI, but ideally this should be part of measuring poverty as enrollment (even though high) is not indicative of actual schooling.

[7] The age of joining school in India is 6 years. So children are expected to complete five year of education by 11 years of age. We provide a buffer of one year to account for later entry into schools. (Dotter and Klasen, 2014)

[8] We had also experimented with using major morbidity and disability as health indicators. One issue with using major morbidity and disability as indicators for health is that they are partially subjective. As Sen (2002) has argued, self-reported health status maybe seriously limited by the respondent's social experience. A respondent brought up in a community with woeful medical and educational facilities might take certain symptoms as "normal" when they clinically might be symptoms of major morbidity. A second issue is that the elderly experience several of the diseases defined as major morbidity, even though we have limited the list to exclude life style diseases like heart disease. Life expectancy among the poor is less than among richer respondents and hence rich are more likely to live long to experience these diseases. We find that individuals in higher consumption quantiles are slightly more likely to be deprived in these two indicators than individuals in poorer consumption quantiles. Hence, we dropped these two indicators from our MPI measure.

population[9]. We use the reference population defined by WHO to calculate the nutritional status for children.

For the individual MPI measure, we use individual data whenever available to define nutrition deprivation. If weight or height data is not collected for an individual then the status of the group to which the person belongs defines her or his status.[10] Each age group 0-5, 6-17 and 18 and above are divided into two based on sex. If half or more individuals in the household from the group are nutritionally deprived (based on individual data) then the group is deemed as deprived. All individuals in the group for whom nutritional data was not collected get the status of the group.[11] In cases where data is not collected for any individuals of a particular group then all the members of the group within the household get the status of the age group. The age group status is deprived if half or more individuals in the age group (male or female) are deprived based on individual data. In the previous example if nutritional data is not collected on any of the 5 adult male individuals then they are all deprived if half or more of the adult females for whom data is collected are deprived. Lastly, if data is not collected for an age-group then all individuals for that age group within the household are deprived if half or more individuals in the household for whom data was collected are deprived.

All individuals in the household are considered deprived in child mortality, if the interviewed women in the household report one or more child deaths. There is no difference between the household MPI and individual MPI deprivation status for this indicator. Unfortunately, do not have other reliable individual level health indicators to replace the child mortality indicator.

Standard of Living

The standard of living dimension partly captures 'control over one's environment' central capability. It represents some of the material means necessary to achieve many of the basic capabilities. We use the same indicators for our Global household MPI as used by Alkire &

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[9] IHDS data on birth history providing the exact age in months has not been released yet, only age in years is available. Using age in years would yield inaccurate measure of weight-for-age but this should not have large impact weight-for-height measure. The levels of the two would certainly be different (wasting vs. underweight) and the extent of gender bias might differ, but the bias is likely to be in the same direction. Given the limitation of data, for now, this seems like best measure for 0-5 age group.

[10] These imputation procedures have little impact on deprivation scores in these dimensions, including gender gaps. Specifically, BMI information is collected directly for 60 percent of all adults. Among those with direct observations on BMI 22 percent of males females are deprived in nutrition. In the overall adult sample, after using our assumptions to impute information on adults for whom BMI was not collected, still 22 percent of males and females are deprived in nutrition. The differences in gender bias in nutrition deprivation for children under six for whom we have direct measurement of weight and height (for 69 percent of all children below age of 6) and the entire population below six years of age (after imputing nutrition status based on their group's status for children) is very small (1% vs. 0.10%). Our assumptions for imputing status of children between 6 and seventeen years of age with no information on nutrition reduces the gender bias (that is in favor of girls) as compared to those with direct nutrition information. We have individual nutrition information on 78 percent of all children in 6-17 age group, and 23 percent of boys and 16 percent of girls are deemed deprived in nutrition. For all children 6 to 17 years of age the corresponding numbers are 24 percent and 20 percent.

[11] For example, if a household has five adult males, and individual nutritional data is collected for three adult men, then the HH adult male group is deprived if two or more of the individuals for whom data is collected are deprived. The two individuals for whom data was not collected get the status of the group and the other three have status based on their own individual data.

Foster (2011). As discussed above, several of the goods are public in nature within the household. This makes it difficult to determine individual ownership or differential access to these goods. Hence for the individual measure we assume living standards as public goods accessible equally by everyone within the household, similar to assumption made by Ramya, Lahoti & Swaminathan (2014). At the same time, IHDS collects sex disaggregated time use data on some of these indicators and we include those separately in our individual MPI measure. For example, if adult women or men as a group spend more than an hour collecting water daily then that group is deemed additionally deprived. To maintain the same overall weight on the standard of living dimension with the addition of indicators, we lower the weight on the household indicator for the same living standard to accommodate the time-use individual indicator. The comparable household MPI also includes the household time use indicator for water collection. A household is deprived in the indicator if the collective time spent by all household members is greater than one hour. [12]

Other possible dimensions that could be included are empowerment, physical safety and subjective wellbeing among others. In many of these dimensions there is documented gender disparity in favor of men, particularly in countries such as India (Ramya, Lahoti & Swaminathan, 2014; Bessell, 2015) We do not include these so as to maintain comparability with the OPHI Global MPI and also most surveys lack data for measuring these dimensions. Excluding these will result in understating the gender disparity in poverty.

3.2 Weighting

We follow the Global MPI in adopting an equal weighting approach across dimensions. Various studies have looked into the impact of alternative weighting schemes on multidimensional poverty measures (Alkire & Santos, 2014, Decancq, Van Ootegem & Verhofstadt, 2013). But since our main goal is to investigate the gender and generational disparity in poverty we adopt the most common and simplest weighting scheme. Each of the three dimensions is assigned an equal weight of one-third and all indicators within the dimensions are weighted equally, except for cases where time-use indicators are used for a standard of living measure. Each standard of living indicator gets a weight of 1/18, but if a time-use indicator is used then the each of the indicators for that aspect of standard of living gets a weight of 1/36. For example, the safe water indicator gets a weight of 1/18 in the Global Household MPI, but since time use for water collection is also used as an indicator in individual and comparative household MPI the weight is halved – the safe water indicator gets a weight of 1/36 and the time-use indicator gets a weight of 1/36. In robustness analysis we vary the weighting structure across the three dimensions to test our results to different weights.

Households without eligible population

Dotter and Klasen (2014) discuss the various approaches to deal with so-called ineligible populations in the MPI. Several of the indicators used in MPI measure refer to the achievement

[12] We also initially included asset ownership indicators (land and residence) in the MPI measures as done by Ramya, Lahoti & Swaminathan (2014). But these indicators do not necessarily reflect deprivation but are more correlated with location. Urban households are less likely to own land or residence as compared to rural households, but that is not necessarily a result of deprivation in urban areas.

status of a particular group within the household. For example, the child mortality indicator refers to death of a child in a household of a woman of reproductive age. But as pointed in Dotter and Klasen (2014), if a household never had children then the household cannot suffer from this deprivation. In cases with no eligible population for a particular indicator in a household, the Global MPI assumes that the household is non-deprived in that indicator. This reduces the possibility of a household with missing eligible population from being deemed multidimensionally poor. A household which has never had children would be non-deprived by definition in children's enrollment indicator and child mortality indicator, making it less likely to be judged as poor even if it is deprived in some other indicators. Based on possible solutions to this suggested by Dotter and Klasen (2014) we substitute the missing indicator with an indicator from the same dimension, i.e. substitute the nutrition indicator for the child mortality indicator for a household that never had any children. This would double the weight on the nutrition indicator for those households.[13]

3.3 Limitations

With our approach we succeed in at least partly individualizing our multidimensional poverty measure. But we also note that, due to difficult conceptual issues as well as data limitations, we face some challenges. The most serious conceptual challenge is the adequate treatment of children in the health and education dimensions where we need to rely on comparisons with other groups; we thoroughly investigate the impact of these choices on our individual multidimensional MPI. The most serious data limitation relates to the health dimension where we need to rely on a household-level mortality indicator and do not have a reliably individual health indicator beyond nutrition. Finally, by mostly relying on the household-level information in the standard of living dimension, we may underestimate inequality in access and use of household-specific public goods, including particularly also durable goods and assets.

3.4 Poverty and Inequality Measures

For both household MPI's, each individual within the household is assigned the deprivation status of the household. The multi-dimensional poverty index M_0 developed by Alkire & Foster (2011) is the sum of the weighted deprivations suffered by the poor divided by the maximum possible number of deprivations. It can be expressed as

$$M_0 = \frac{\sum_{i=1}^{n}\sum_{j=1}^{d} g_{ij}^{0}(k)}{nd}$$

MPI though simple, has a problem in identification of the poor. Both the usual identification methods – union and intersection – are not usable in this approach. According to the union approach, an individual is deemed poor if she/he is deprived in at least one indicator. This leads to unreasonably high poverty headcounts – on order of more than 85%. As discussed in Dotter &

[13] This is not without problems. It assumes that nutrition indicator is substitute for child mortality indicator and also we can no longer decompose the MPI measure by indicators. But given the lack of data on any other equivalent indicator for the missing information this is a reasonable compromise. We can still decompose MPI by dimensions. In cases where there is no information on any of the indicators within a dimension we chose to drop the household from the sample. We find only a small number of instances of this in our data; hence it does not impact the representativeness of the sample.

Klasen (2014) the headcount ratios are not only difficult 'political' sell but also the approach is very sensitive to measurement error or cases where indicators do not cover the deprivations well. On the other hand, the intersection method deems an individual poor only if she/he is deprived in all indicators. This leads to unreasonably low poverty rates.

Alkire & Foster (2011) suggested a compromise between the two methods – the dual-cutoff approach. A person is considered poor only if the sum of weighted deprivations for the person exceeds an additional cutoff k. In case of OPHI Global MPI the value of k is 0.33. So any person whose weighted deprivation count is greater than one third is considered poor. But the choice of k is completely arbitrary and the poverty levels and comparisons across regions change for different values of k. Also the use of dual-cutoff leads to assumptions about correlation between poverty indicators that are difficult to justify. Poverty indicators are perfect substitutes below the cutoff k but perfect compliments if the weighted sum of deprivations is more than k (Rippin, 2012).

The MPI measure can be decomposed into the product of (censored) headcount (H) or poverty incidence and (censored) average poverty intensity (A):

$$M_0 = \frac{q}{n}\frac{\sum_{i=1}^{n} c_i(k)}{qd} = H.A$$

where q is the number of poor i.e. number of individuals for whom the sum of weighted deprivations is above the cutoff k.

As Rippin (2012) notes this decomposition has two issues: first the censored poverty intensity is dependent on the arbitrary cutoff k; and second, the MPI measure is not sensitive to changes in inequality among the poor. Amartya Sen (1976) defined as one of the properties of good poverty measures to be decomposable into three components: poverty incidence, intensity and inequality. The MPI measure does not satisfy this property. A regressive transfer between two poor individuals that makes the poorer of the two individuals more deprived and the other less deprived but still poor will not cause the MPI measure to change. An inequality sensitive poverty measure should increase upon such a regressive transfer. There are a few counting-based measures which define poverty measures so that they are sensitive to inequality (Bossert, Chakravarty & D"Ambrosio, 2009, Jayaraj & Subramanian, 2009, Rippin 2012). A critique of these measures has been that they appear to lose the property of factor decomposibility and are difficult to interpret (Seth & Alkire, 2014).

Rippin (2012) proposes a measure that in the identification step assigns different degrees of poverty to a household while using the union method to identify the poor. The degree of poverty is calculated by taking the square of the weighted share of deprivations suffered by the household.

$$CSPI = \frac{\sum_{i=1}^{n}[\sum_{j=1}^{d} g_{ij}^{0}]^2}{nd}$$

Similar to FGT2 measure in uni-dimensional case, this takes into account inequality in the distribution of deprivations. Any regressive transfer among the poor would now result in an increase in the poverty measure since the additional deprivation to a highly deprived household counts as more than to a less deprived household. The Correlation-Sensitive Poverty Index can be decomposed into the three I's (Jenkins & Lambert, 1997): incidence, intensity and inequality while still being factor decomposable.

$$CSPI = \frac{q}{n}\left[\frac{\sum_{i=1}^{n} c_i}{qd}\right]^2 + 2\left(\frac{\frac{1}{2q}\sum_{i=1}^{n} c_i}{\frac{1}{qd}\ \sum_{i=1}^{n} c_i}\right) = HA^2(1 + 2GE)$$

We use a variety of measures in our empirical application. To identify the poor we use two different methods –union and dual-cutoff approach. In the union approach an individual is deemed poor if she or he is deprived in any one indicator. In the dual-cutoff approach we use a cutoff of 33 percent as per the methodology of the Global MPI. We test the robustness of our results to changing values of cutoff. The union and dual-cutoff leads to vastly different poverty headcount ratios using the two approaches. An individual whose weighted deprivation count is 0.25 would be deemed poor using the union approach but not considered poor using the dual-cutoff approach. For our headline measure we use the incidence obtained using the dual-cutoff approach. We calculate MPI using the dual cutoff approach and CSPI measure that uses the union approach. MPI and CSPI are decomposed into their various components to investigate incidence, intensity and inequality among the poor. We also use the variance based inequality measure to study within and between group inequality.

4. Results

We first analyze the deprivation levels by sex and age group (Table 1) in the various indicators before delving into the poverty and inequality measures. As the schooling indicator used in household MPI is defined in a expansive way, we should find that the individual deprivation level should be higher than the deprivation level when using household data. Indeed, we find that 26 percent more individuals are deprived when using the individual data. As hypothesized, adult women, who are the worst-off group, are more likely to be misclassified as non-deprived when household data is used. Access to schooling for women was very poor in India up until very recently, which is reflected in the higher gender differential and also overall higher level of deprivation in the adult age group, and particularly high deprivation among the oldest age group (50+). There is no gender differential in schooling achievement among children in the age group 7 to 18 age group. This is likely because of concerted push in the last decade by the government to increase school enrollment and the passage of right to education act, which makes education compulsory for this age group. The higher level of deprivation among the below 7 age group children is because their deprivation status is determined by older members of the household, who tend to be more deprived; but note that there is no gender gap here suggesting that our method does not impute a gender gap into the data. We conduct robustness analysis to test the sensitiveness of our results to changing deprivation level for this age group. As expected, the gender and the age differentials are substantially reduced when using the household measure.

The household nutrition indicator is defined in a restrictive way, with all household members considered deprived if any adult or child is undernourished. As predicted, this results in the household measure indicating substantially higher overall deprivation levels (25 percentage points) than the individual nutrition indicator. There is no significant gender differential in the nutrition indicator among adults. Among the age group 6 to 17 years boys are slightly more deprived than girls. Across all age groups, between 20 to 25 percent of the individuals are undernourished. The level for children below six years of age is lower because we are using the weight-for-height indicator (wasting) instead of the more common weight-for-age measure (underweight)[14]. According to NFHS-3 conducted in 2005-06 about 20 percent of children below five were undernourished as per the weight-for-height measure, but just over 40 percent were undernourished if we use the weight-for-age measure (Table 10.1, Page 270, IIPS 2007)[15]. But there is no substantial gender differential reported for both the measures and hence, even though our levels are lower, the conclusion on gender differentials won't be impacted due to the use of weight-for-height measure[16].

Several household standard of living indicators have witnessed declines in deprivation rates as compared to data reported in National Family Health Survey in 2006 (see Table 1, Alkire and Seth (2015) for more details). Electricity deprivation has reduced from 33 percent to 17 percent, safe water deprivation from 16 to 10 percent, and sanitation deprivation from 70 to 63 percent among the directly comparable indicators. The time use indicators indicate the extra burden on women of not having access to basic amenities. 39 percent of adult women below 50 years of age are directly impacted due to smoke from unclean cooking stoves, while none of the men of this age group suffer directly as a result of unsafe cooking stoves in the household (Ezzati & Kammen, 2002). Women are also more likely to spend time collecting water from outside the household. Better data on time use and access to household public standard of living resources among household members is needed to differentiate their impact on individuals in the household. The household-level time use indicator on water collection gives an incorrect picture of no gender differential in time spent which can be discerned from the individual time use indicator. Even though we do not account for it, lack of access to private toilets is also likely to impact women more severely than men. Diane Coffey et al. (2015) find in a survey of Indian villages in some northern and central states that women are more likely to use toilets if they have access to one than men, indicating the greater need among women for better sanitation facilities.

Table 3 presents the multi-dimensional poverty measures for the three different MPI definitions. The Global Household MPI measure is directly comparable to Global MPI constructed by OPHI. Comparing our estimates to OPHI estimates based on 2005-06 NFHS survey points to substantial reductions in all poverty multi-dimensional measures. The headcount ratio has declined from 54 percent to 40 percent and the MPI from 0.283 to 0.19The comparable household MPI measure uses only the schooling indicator for education and adds household water collection time use indicator to make it more comparable with the individual MPI measure. There is no change in the MPI between Global and Comparable measures, only minor changes in the headcount the poverty intensity. Headcount and MPI are slightly higher for females across age group in these two household-based measures. But using individual data the MPI is substantially higher among adult women than men; as intimated in Table 2, this is mostly related to higher education deprivation among adult women. The higher MPI is mostly driven by differences in headcount ratios as

[14] This is due to lack of data on the exact age (in days) of children from IHDS-2. These data will likely be released later and then this can be updated.
[15] These estimates broadly match the estimates from IHDS-1 (Gaiha, R et al., 2010)
[16] 20.5% of boys and 19.1% of girls below five years of age have weight-for-height below 2 standard deviations of the median of the reference population and the corresponding numbers for weight-for-age are 41.9% and 43.1% according to NFHS-3.

poverty intensity varies only slightly across gender and age groupings (see also Dotter and Klasen, 2014). There is no gender differential among children in the MPI which is a promising development and driven by lack of education differentials between boys and girls. The overall levels of poverty are higher when using individual as compared to household data. This suggests that the expansive definition used for education is more important for the overall MPI than the restrictive definition used for nutrition.. This is not really surprising given the strong age-dependence of educational deprivation. Even households where many people are uneducated will often have one young person with at least 5 years of education, making the entire household non-deprived in the household-based MPI. This clearly shows the problems associated with such an expansive definition.

The MPI is sensitive to the arbitrary poverty cutoff `k', and is not sensitive to inequality among the poor. To address this, we present results for CSPI (Table 4) that takes inequality into account and uses the union method for identification of the poor. The headcount for the union method is above 85 percent, as anyone deprived in one indicator is considered poor. There is very little variation in headcount across gender-age groupings but the poverty intensity is higher among adult women. Overall inequality in deprivation scores among the poor is higher in the individual than in household MPI, but inequality among poor adult women is less than among poor adult men. Overall the CSPI among adult women is substantially higher than adult men, reflecting the pattern found in MPI analysis.

We calculate absolute inequality measures in deprivation scores across the entire population and among the poor using the measures proposed by Seth and Alkire (2014) and described in section 2 (Table 5). Total inequality is decomposed into within and between components for various socio-economic groups. For India we find that inequality in deprivation scores is higher by about 30% when using individual rather than household data. Also of the total inequality 30 percent of inequality in individual MPI is due to intra-household disparity. This component of inequality, which is the focus of this paper, is totally absent from household MPI by definition.

When considering within/between decompositions between age, age-gender, states, caste, and place of residence groups, within group inequality is always much higher than between group inequality. In the individual MPI, the relative contribution of between age-gender groups is higher than in the household MPI (7 vs. 2 percent) while the reverse is the case for states, caste-religion, and place of residence.

Inequality among the poor is actually higher in the household than the individual MPI,[17] contradicting our finding from CSPI analysis. The contradiction in results of the two inequality measures is likely because the positive-multiple of variance measure is an absolute measure, whereas the inequality component in CSPI is a relative measure. Inequality among the poor is also dependent on the value of `k' and might change for different values.

We also calculate Ginis for achievement scores (defined as 1 - deprivation score) for both the individual and the household-based MPI. The household MPI Gini is lower than the one

[17] This is not comparing the same group of individuals as those who are identified as poor by the two measures are not completely the same, even though there is a large overlap. See discussion below on overlap.

estimated using individual data (0.16 vs. 0.2). The Gini among women is higher than among men for the individual MPI (0.21 vs. 0.18).[18]

We also investigate gender differentials in poverty measures across various socio-economic groups (Table 6). In all groups females are more likely to be poor and have a higher individual MPI than men. The extent of the differentials between them varies by groups but is always larger for the individual measure than the comparable household MPI. The difference in the adjusted headcount ratio is 0.04 points in metropolitan areas, but doubles to 0.08 points in least developed villages. *Adivasis* (tribals) and *dalits* (lower caste) are among the poorest groups and Christians, Jains and others are the least poor group. Individuals belonging to four member households are the least poor. Single member households are the poorest and most of these are composed of individuals who are widowed or divorced (91%) and are predominantly women (81%). Individuals in female-headed households are more likely to be poor as compared to from male-headed households. The overall rankings of groups do not change much between the household and individual MPI, as the intra-household differences would have to be significantly different for individual measures to change rankings.

Southern, Northern, and North-Eastern states have the lowest household and individual MPI and Central and Eastern states the highest in both. While the individual MPI shows higher levels in all regions, the differential between the regions is smaller in the individual measure than in the household measure which is likely related to high levels of deprivation among older population groups even in states with a low MPI; this shows up in the individual MPI but is masked in the household one. Table 7 lists MPI by gender for states for both household and individual measures. The ranking of states are very similar across the two measures with a spearman rank correlation of greater than 0.97. Kerala with an adjusted headcount ratio 0.05 is the best performer and at comparable levels to several middle-income Latin American countries, while Bihar is the worst performing state in India and worse than several sub-Saharan countries like Nigeria, Tanzania and Sudan.[19] The state rankings broadly match the rankings obtained by Alkire and Seth (2015) for India for the year 2005-06.

Another way to assess the bias of a household-based measure is to investigate the classifications of individuals into poor and non-poor categories using the household and individual MPI to ascertain the degree of overlap between the two (Table 8). 22 percent of men and 27 percent of women are misclassified by the household measure. Men are equally likely to be misclassified as poor or non-poor, while women are more likely to be misclassified as non-poor when using household data. This confirms our hypothesis that the worse off group is more likely to be misclassified as non-poor in the household measure when expansive thresholds are used. Since most disparities are in the expansive education dimension (while there are few gender disparities in the restrictive nutrition category), the education dimension drives the misclassification among women.

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[18] These results are available on request.
[19] Based on household MPI calculated for 101 countries in 2015 by Oxford Poverty and Human Development Initiative. Available at http://www.dataforall.org/dashboard/ophi/index.php/mpi/country_briefings

In Table 9 we decompose MPI to obtain the contribution of each dimension[20]. The health dimension is the biggest contributor to household MPI, while education is the biggest contributor to the individual MPI. This is partly because in the household MPI health is defined in the restrictive fashion leading to higher deprivation rates than with the individual MPI, while the education indicator thresholds are defined in an expansive fashion leading to underestimate of deprivation rates in household as compared to individual MPI. Thus the household-level MPI overemphasizes the health dimension and underplays the education one, explaining the large differences in the decomposition.[21]

To delve into the multivariate correlates of the individual versus the household MPI we run a regression of deprivation scores on a range of individual and household characteristics with various fixed effects (Table 10 and 11). The regression model can be expressed as:

$$c_i = \alpha + \beta_1(Female) + \beta_2 Age + \beta_3 Age^2 + \beta_4 Age^3 + \gamma X + \varepsilon$$

where X is a set of individual, household controls and fixed effects (state, PSU or HH).

In all our specifications we find that females have a significantly higher deprivation score than males even after controlling for various other parameters. Even with household fixed effects, which eliminates all inter-household variation in estimation and controlling for other individual characteristics like age, occupation, marital status and relationship to head we find females to be worse off. But this effect in the household MPI deprivation score is driven entirely by differences in household composition and not directly due to gender disparities within households. The gender effect is also substantially higher for the individual MPI than for household MPI, even when controlling for other covariates and fixed effects.

In the absence of individual analysis most gendered poverty analysis have relied on comparison of sex of household head to proxy for gender. This is a flawed approach, since even male-headed households have female members who might have different level of deprivations than the male head. Several studies have claimed that female-headed households are more likely to be poor than male-headed households and hence females are poorer than males (e.g. Dreze and Srinivasan, 1997; Chant 2004; Klasen, Lechtenfeld and Povel 2015). Our regression analysis finds that after controlling for other factors, most importantly the education of head of household, female-headed households on average have *lower* deprivation scores than males. This finding holds true for both individual and household MPI measures. Thus while adult women *are* disadvantaged in poverty in India, as demonstrated by our individual MPI, this has nothing to do with household headship, but is an intra-household inequality issue.

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[20] We reweight the indicators within the dimension when data is missing for some indicator due to lack of eligible population in the household. This has the side-effect that we cannot decompose MPI by indicators, but still can do it by dimensions.

[21] In rural areas standard of living and health are almost equal contributors to the household MPI and it plays a bigger role than health in individual MPI. In urban areas standard of living indicators play a smaller role in MPI. This is partly because access to basic services like electricity, sanitation, water and cooking fuel are more readily available in urban areas. But some other aspects of standard of living as density of housing are not captured in the indicators and likely to be worse in urban areas than rural areas. Using 2005-06 NFHS data Alkire and Seth (2015) find standard of living to be highest contributor of household MPI. This seems to have changed with better provision of several public goods like electricity, water, cooking fuel etc and increased standard of living during the high economic growth period between 2006 and 2012.

Age of the individual has a stronger impact on deprivation scores in the individual MPI measure. The combined partial effect of age and gender on the household versus individual MPI is substantial a shown in Figure 1. While in the household-based measure, the deprivation scores fall uniformly with age for males and females and there is little gender difference, there is a pronounced U-shape in age for both genders in the individual measure, with females being much more deprived in the individual measure.[22]

In addition, widowed women's deprivation score in the household measure is not significantly different from that of married women for most specifications, but in the individual measure they have significantly higher deprivation scores. Married women are significantly better off in the individual measure than all other women, while that's not always the case in the household-based measure. The wife or husband of the head of the household is always significantly worse-off than the head in individual-based deprivation score, while they are better-off in the household-based measure. Muslims are significantly worse-off than OBC's when comparing their individual deprivation scores, but this does not hold in the household-based measure. Single-member households are worst-off than bigger households and metropolitan areas are best-off in both the individual and household measures. [23]

Besides the impact of various individual and household characteristics, the fixed effects regression provide useful information on state-specific differences in deprivation scores after controlling for other factors.

Figure 2 shows the estimate of fixed effects for both household and individual MPI measures from these regressions. The pattern across states is similar for both individual and household MPI measures, confirming our earlier finding based on summary statistics that ranking of states does not change substantially when using either of the measures. Bihar, Uttar Pradesh and Madhya Pradesh have the highest deprivation scores after controlling for other parameters and north-eastern on average have the lowest deprivation scores. Even though state per-capita GDP and economic growth rates for north-eastern states are lower than in western and southern states, they perform better in multi-dimensional poverty measures. In sum, these regressions indicate that the individual MPI measure leads us to substantially different conclusions on deprivation by age, gender, marital status, relationship to the head of the household, and caste/religion groups.

Robustness Analysis

Designing a poverty measure involves a selection of various parameters, and we are interested in determining how sensitive our major results of gender differential in poverty are to these parameter choices. We investigate the robustness of our results to i) change in deprivation thresholds for education dimension for children under seven years of age ii) weights assigned to the three dimensions (w) and iii) poverty cutoff (k).

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[22] Note that the high deprivation among young children in both measures is related to the imputation of education scores of adults to children below 6 and should therefore be treated with caution.

[23] We also analyze differential impact of gender across various groups. Gender differences in deprivation scores are significant only among adults; they are absent in urban areas and substantial in the rural population; absent in northeastern and several southern states and large among central and eastern states. Detailed results are available upon request.

Table 12 presents the poverty headcount, intensity and MPI for four different individual MPI measures constructed by changing the parameters. In our benchmark individual measure children under seven years of age are deemed deprived in schooling if half or more members in the household above 12 years of age have not completed five years of education. We do not have any alternate information on education potential of these children and chose to define the deprivation based on other household members. But since access to primary schools is expanding rapidly the likelihood of these children completing five years of education is higher than adults in the household. One alternative assumption we could make in defining deprivation threshold for children below seven would be to assume that they are non-deprived. We do this in our first alternate measure and find that even though the level of MPI decreases from our benchmark individual measure the differential between men and women still exists. The absolute differential between men and women in MPI remains the same and the relative differential increases slightly.[24]

Next, we ask if our conclusions are robust to a range of weights. To test this, we estimated individual MPI using three additional weighting schemes: i) giving 50 percent to education and 25 percent each to health and standard of living, ii) giving 50 percent to health and 25 percent each to education and standard of living, to equalize the weight of the expansive education indicator and the restrictive nutrition one to 25% each and iii) giving 50 percent to standard of living and 25 percent each to education and health. Within each dimension all indicators got equal weights, except aspects that had time use indicators[25]. We find that the levels of MPI and the extent of difference between deprivation scores of men and women changes for the different weighting schemes, but women are significantly worse off than men in all the three alternative weighting schemes; also poverty rates are larger than in the household measure, demonstrating that this is not only related to weights. The differences are larger and overall poverty is higher when education is given higher weight as the differences in schooling between men and women are large.

Finally, we investigate if our findings are robust to changes in the poverty cutoff (k). To do that we use the complementary cumulative distribution function (CCDF) – the complement of a cumulative distribution function introduced for this analysis by Alkire et al (2015). The CCDF tells us the proportion of population above any value b and helps us determine the proportion of the population who will be deemed poor if the poverty cutoff is set to b i.e. k=b. Alkire et al (2015) show that if we find first order stochastic dominance between CCDF's for two distributions c and c', then we can claim that distribution c has no lower multidimensional headcount ratio H and adjusted headcount ratio than distribution c' for all values of k. Figure 3 plots the CCDFs for men and women for various values of k and we find that the distribution for women dominates that of men. In other words, women's headcount ratio and adjusted headcount are not lower than men's for all values of k. For values of k between 0.1 and 0.8 women have a higher poverty headcount than men. We should also note that the differential is particularly

[24] Using the benchmark measure we find a small gender differential in children below seven years of age. 54 percent of boys and 56 percent of girls below seven years of age are deemed poor in the benchmark measure (Table 3). The corresponding numbers when using the no education deprivation assumption are 18 percent and 19 percent respectively.

[25] In case of water and cooking the access indicator and time use indicator got half of the weight assigned to each standard of living indicator.

pronounced around the cut-off of 0.33 which we chose, following the practice of the MPI. It is slightly smaller at higher and lower cut-offs, and becomes very small as we move get close to the union (k=1) or the intersection (k=0) approach.

5. Conclusion

In this paper we contribute to the literature on multidimensional poverty measurement by proposing and applying an individual multidimensional poverty measure for India. We find that existing multidimensional poverty measures use household-based assessments for multidimensional poverty measurement, even though individual achievement data are available for some dimensions of well-being. The use of household-based thresholds based on individual achievement data lead to biases in multidimensional poverty assessment. In the Indian case, we find that household-based MPIs substantially understate poverty, gender inequality, inequality in deprivation across the population, and differentials by age groups. Such misclassification could also affect assessments of poverty trends and targeting. While targeting based on regions or groups other than age or gender would not be very seriously biased when using a household-baed measure, targeting based on gender and age groups would. And using the incidence of female-headship as a sign of gendered poverty would be deeply misleading.

Our analysis can only be seen as a first step in this direction. We are only able to individualize deprivation data in some dimensions where available data allow such disaggregation. Following our findings from India, we are therefore likely to understate inequalities in deprivation, particularly in a developing country context. More data would be required, for example, the individualize deprivation in morbidity as well as possession and use of assets. Moreover, our assessment relies on some assumptions about group-based deprivations that are required to create individual deprivation measures for everyone in the household. Clearly here, alternative approaches (such as assessment of individual deprivation by groups) are a possible alternative, as are different assumptions to create deprivation scores for everyone.

But we have demonstrated that the neglect of intrahousehold inequality is a serious issue and actually underestimates in the Indian case poverty and inequality in deprivation by some 30 percent.

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Tables

Table 1: Dimensions, Indicators and Weights for various MPI measures.

Dimension	Indicator	Deprived if ..	Weight
		Global Household MPI	
Education	**Years of Schooling**	No member of Household completed 5 years of education	1/6
	Children's school enrollment	One or more HH members between 7 to 15 years of age not enrolled in school	1/6
Health	**Nutrition**	One or more adult HH member is underweight, or any children is undernourished	1/6
	Mortality Among Children	One or more children born to interviewed women in the household died after birth	1/6
Standard of Living	**Electricity**	No access to electricity at home	1/18
	Floor	House Floor made of mud	1/18
	Sanitation	No access to private toilet	1/18
	Water	No access to Safe Water Source within 15 minutes one-way distance from the residence	1/18
	Cooking Stove	HH uses open fire or traditional chulha without chimeny to cook	1/18
	Consumer Durables	Owns less than 2 of list of assets (TV, Phone, cycle, refrigerator, motorized vehicle)	1/18
		Comparable Household MPI	
Education	**Years of Schooling**	No member of Household has completed 5 years of education	1/3
Health		**Same as Global Household MPI**	
Standard of Living	**Electricity**	No access to electricity at home	1/18
	Floor	House Floor made of mud	1/18
	Sanitation	No access to private toilet	1/18
	Access to Safe Water	No access to Safe Water Source within 15 minutes one-way distance from the residence	1/36
	Water Collection Time	Time taken to collect water by all household members is one hour or more	1/36

	Cooking Stove	HH uses open fire or traditional chulha without chimeny to cook	1/18
	Consumer Durables	Owns less than 2 of list of assets (TV, Phone, cycle, refrigerator, motorized vehicle)	1/18
		Individual MPI	
Education	**Years of Schooling**	Not completed threshold years of education**	1/3
	Nutrition	Individual is malnourished*	1/6
Health	**Mortality Among Children**	One or more children born to interviewed women in the household died after birth	1/6
Standard of Living	**Electricity**	No access to electricity at home	1/18
	Floor	House floor made of mud	1/18
	Sanitation	No access to private toilet	1/18
	Access to Safe Water	No access to Safe Water Source within 15 minutes one-way distance from the residence	1/36
	Water Collection Time	Time taken to collect water by Individual's group in the Household is one hour or more	1/36
	Cooking Stove	HH uses open fire or traditional chulha without chimeny to cook	1/36
	Cooking Time	person does most of the cooking with unsafe stove	1/36
	Consumer Durables	Household owns less than 2 of list of assets (TV, Phone, cycle, refrigerator, motorized vehicle)	1/18

* Adult ages for 18 years or older is undernourished if BMI is less than 18.5. Individuals 6 to 17 years of age are malnorusiehed if BMI-for-age is two or more standard deviations below the median of the reference population. Children between 0 to 5 years of age are deemed malnourished if their weight for height is two or more standard deviations below the median of the reference population.)

** The threshold years of education for individuals 12 or more years of age is 5 years of education, for children between 7 to 11 years of age is the age-adjusted years of schooling so that they complete five years of education by age of 12. Children below 7 years of age are deprived if half or more household members 12 or more years of age have not completed 5 years of education.

Table 2: Proportion of individuals deprived in various indicators.

Deprivation	Male 0-6	Female 0-6	Male 7-18	Female 7-18	Male 19-50	Female 19-50	Male 50+	Female 50+	Total
Education									
Household Schooling	0.15	0.16	0.08	0.08	0.07	0.08	0.14	0.17	0.1
Individual Schooling	0.48	0.5	0.14	0.14	0.23	0.42	0.49	0.77	0.36
Children Enrollment	0.06	0.07	0.08	0.09	0.07	0.06	0.07	0.06	0.07
Health									
HH Nutrition	0.53	0.53	0.52	0.53	0.44	0.45	0.41	0.42	0.47
Individual Nutrition	0.2	0.2	0.25	0.22	0.21	0.22	0.23	0.23	0.22
Child Mortality	0.21	0.23	0.23	0.25	0.19	0.2	0.21	0.19	0.21
Standard of Living									
Access to Electricity	0.22	0.22	0.19	0.2	0.14	0.14	0.15	0.15	0.17
Type of House Floor	0.48	0.49	0.46	0.46	0.36	0.37	0.36	0.36	0.4
Access to Sanitation	0.7	0.71	0.68	0.68	0.61	0.61	0.59	0.6	0.63
Access to Safe Water	0.1	0.1	0.1	0.1	0.09	0.1	0.1	0.1	0.1
HH Water Collection Time	0.16	0.15	0.18	0.19	0.14	0.13	0.12	0.11	0.15
Individual Water Collection Time	0.01	0.01	0.02	0.04	0.03	0.07	0.03	0.06	0.04
Access to Clean Cooking Stove	0.66	0.67	0.64	0.64	0.56	0.56	0.56	0.56	0.59
Time with unclean Cooking Stove	0	0	0	0.05	0	0.39	0.01	0.21	0.12
Consumer Durables	0.27	0.29	0.22	0.24	0.18	0.19	0.23	0.27	0.22

Table 3: Comparison of various multi-dimensional poverty indicators constructed using dual-cutoff approach (k=33%) by age-sex categories.

	Male 0-6	Female 0-6	Male 7-18	Female 7-18	Male 19-50	Female 19-50	Male 50+	Female 50+	Total
Global Household MPI									
Headcount	0.47	0.49	0.44	0.46	0.34	0.36	0.39	0.41	0.4
Intensity	0.48	0.5	0.47	0.47	0.47	0.47	0.52	0.52	0.48
MPI	0.23	0.24	0.21	0.22	0.16	0.17	0.2	0.21	0.19
Comparable Household MPI									
Headcount	0.46	0.48	0.42	0.43	0.33	0.35	0.38	0.4	0.38
Intensity	0.51	0.52	0.48	0.49	0.48	0.48	0.52	0.53	0.49
MPI	0.24	0.25	0.2	0.21	0.16	0.17	0.2	0.21	0.19
Individual MPI									
Headcount	0.54	0.56	0.29	0.29	0.33	0.48	0.54	0.78	0.44
Intensity	0.55	0.56	0.5	0.5	0.52	0.55	0.55	0.54	0.53
MPI	0.3	0.31	0.14	0.15	0.17	0.27	0.3	0.42	0.24

Note: Headcount is measured as the proportion of population that is deemed poor.

Table 4: Comparison of various multi-dimensional poverty indicators and measures constructed using union approach by age-sex categories.

	Male 0-6	Female 0-6	Male 7-18	Female 7-18	Male 19-50	Female 19-50	Male 50+	Female 50+	Total
Global Household MPI									
Headcount	0.91	0.91	0.9	0.9	0.85	0.85	0.83	0.84	0.87
Intensity	0.31	0.32	0.29	0.29	0.24	0.25	0.27	0.28	0.27
Inequality	0.3	0.3	0.31	0.31	0.48	0.45	0.56	0.53	0.42
CSPI	0.14	0.15	0.12	0.13	0.1	0.1	0.13	0.14	0.12
Comparable Household MPI									
Headcount	0.91	0.91	0.9	0.9	0.85	0.85	0.83	0.84	0.87
Intensity	0.31	0.33	0.29	0.29	0.24	0.25	0.27	0.28	0.27
Inequality	0.33	0.33	0.34	0.34	0.5	0.48	0.58	0.54	0.44
CSPI	0.15	0.16	0.12	0.13	0.1	0.11	0.13	0.14	0.12
Individual MPI									
Headcount	0.9	0.9	0.88	0.88	0.82	0.84	0.83	0.9	0.86
Intensity	0.35	0.36	0.24	0.24	0.24	0.32	0.33	0.44	0.3
Inequality	0.35	0.34	0.47	0.48	0.66	0.5	0.49	0.24	0.49
CSPI	0.18	0.19	0.1	0.1	0.11	0.17	0.18	0.25	0.15

Note: Headcount is measured as the proportion of population that is deemed poor.

Table 5: Inequality (variance based measure) across the population and among the poor.

	Total Inequality		Gender	Age-Gender	Household	States	Caste & Religion	Place of Residence
			Contribution of within and between components by various groupings (%)					
Inequality across the entire population								
Household MPI	0.171	Within	100	98	0	82	91	80
		Between	0	2	100	18	9	20
Individual MPI	0.228	Within	99	93	30	87	91	84
		Between	1	7	70	13	9	16
Inequality among poor								
Household MPI	0.096	Within	100	98	0	95	98	98
		Between	0	2	100	5	2	2
Individual MPI	0.091	Within	100	98	35	91	97	92
		Between	0	2	65	9	3	8

Table 6: MPI measure for household and individual indicators by sex and various household and individual characteristics

	Comparable HH MPI			Individual HH MPI		
	Male	Female	Total	Male	Female	Total
Area						
Metro urban	0.02	0.03	0.03	0.05	0.09	0.07
Other urban	0.07	0.08	0.08	0.1	0.15	0.13
More developed villages	0.19	0.2	0.19	0.21	0.28	0.25
Less developed villages	0.28	0.29	0.28	0.28	0.36	0.32
Caste & Religion Groups						
Brahmin	0.11	0.11	0.11	0.09	0.15	0.12
Forward caste	0.09	0.1	0.09	0.1	0.16	0.13
OBC	0.18	0.2	0.19	0.19	0.28	0.24
Dalit	0.24	0.25	0.24	0.26	0.33	0.3
Adivasi	0.29	0.3	0.3	0.3	0.38	0.34
Muslim	0.19	0.2	0.2	0.24	0.28	0.26
Christian, Sikh, Jain	0.03	0.04	0.03	0.05	0.08	0.07
Regions						
North	0.09	0.1	0.09	0.11	0.18	0.14
Central	0.29	0.29	0.29	0.28	0.35	0.32
East	0.25	0.27	0.26	0.26	0.34	0.3
North-East	0.08	0.09	0.09	0.14	0.18	0.16
West	0.12	0.12	0.12	0.13	0.2	0.17
South	0.08	0.09	0.08	0.13	0.19	0.16
Consumption Quintiles						
First	0.34	0.35	0.35	0.35	0.41	0.38
Second	0.24	0.24	0.24	0.26	0.32	0.29
Third	0.18	0.18	0.18	0.2	0.27	0.23
Fourth	0.12	0.12	0.12	0.14	0.21	0.17
Fifth	0.06	0.07	0.06	0.07	0.13	0.1
Household Size						
Single member HH	0.36	0.52	0.48	0.36	0.52	0.48
Two member HH	0.32	0.31	0.32	0.3	0.4	0.35
Three member HH	0.17	0.18	0.17	0.19	0.28	0.23
Four member HH	0.15	0.15	0.15	0.17	0.23	0.2
Five member HH	0.17	0.18	0.17	0.19	0.26	0.22
Six member HH	0.2	0.2	0.2	0.21	0.28	0.25
Seven member HH	0.2	0.21	0.2	0.22	0.29	0.25
Eight or more member HH	0.2	0.2	0.2	0.21	0.27	0.24
Household Head						
Female-Headed HH	0.19	0.22	0.21	0.18	0.3	0.26
Male-Headed HH	0.19	0.19	0.19	0.2	0.27	0.23

Table 7: MPI measure for major states in India by gender

	Comparable Household MPI				Individual MPI			
	Male	Female	Total	Rank	Male	Female	Total	Rank
Kerala	0.01	0.02	0.02	1	0.04	0.07	0.05	1
Delhi	0.03	0.04	0.04	2	0.06	0.12	0.09	2
Himachal Pradesh	0.1	0.11	0.1	5	0.1	0.16	0.13	3
Punjab	0.08	0.07	0.07	3	0.11	0.15	0.13	3
Tamil Nadu	0.07	0.08	0.07	3	0.1	0.16	0.13	3
Maharashtra	0.1	0.11	0.11	9	0.12	0.18	0.15	6
Jammu & Kashmir	0.1	0.1	0.1	5	0.13	0.2	0.16	7
Haryana	0.11	0.12	0.12	11	0.13	0.21	0.17	8
Uttarakhand	0.15	0.17	0.16	13	0.14	0.23	0.19	9
Assam	0.1	0.11	0.1	5	0.16	0.21	0.19	9
Karnataka	0.1	0.1	0.1	5	0.16	0.22	0.19	9
Andhra Pradesh	0.11	0.12	0.11	9	0.16	0.24	0.2	12
Gujarat	0.15	0.16	0.15	12	0.17	0.25	0.21	13
West Bengal	0.19	0.2	0.2	14	0.24	0.28	0.26	14
Orissa	0.22	0.24	0.23	15	0.23	0.31	0.27	15
Jharkhand	0.25	0.26	0.25	17	0.25	0.33	0.29	16
Chhattisgarh	0.28	0.28	0.28	18	0.25	0.33	0.29	16
Rajasthan	0.24	0.24	0.24	16	0.25	0.36	0.3	18
Madhya Pradesh	0.29	0.29	0.29	19	0.27	0.35	0.31	19
Uttar Pradesh	0.3	0.3	0.3	20	0.29	0.36	0.33	20
Bihar	0.33	0.36	0.35	21	0.32	0.42	0.37	21

Table 8: Classification of individuals by household and individual MPI.

	Individual MPI		
Comparable HH MPI	Non-Poor	Poor	Total
Male			
Non-Poor	0.51	0.11	0.62
Poor	0.11	0.27	0.38
Female			
Non-Poor	0.42	0.19	0.61
Poor	0.08	0.31	0.39
Total			
Non-Poor	0.47	0.15	0.62
Poor	0.09	0.29	0.38

Table 9: Contribution of each dimension to MPI measure (%) (Dual cutoff method with k=0.33).

	Rural			Urban			All		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Household MPI									
Education	17	16	17	20	29	17	17	21	17
Health	42	44	42	60	43	50	44	42	44
Standard of Living	42	40	42	20	29	33	39	37	39
Individual MPI									
Education	46	50	47	67	64	64	50	52	52
Health	25	21	23	22	21	18	25	22	22
Standard of Living	29	29	30	11	14	18	25	26	26

Table 10: Determinants of Household MPI deprivation score

	(1)	(2)	(3)	(4)
	OLS	State FE	State FE with Interactions	PSU FE
	b/se	b/se	b/se	b/se
Female	0.004***	0.007***	0.119***	0.007***
	0.001	0.002	0.016	0.001
Male Headed HH	0.030***	0.029***	0.028***	0.026***
	0.001	0.005	0.005	0.003
Age	-0.007***	-0.006***	-0.006***	-0.004***
	0.000	0.000	0.000	0.000
Age # Age	$.007*10^{-2}$***	$0.007*10^{-2}$***	$0.007*10^{-2}$***	$0.006*10^{-2}$***
	0.000	0.000	0.000	0.000
Age # Age # Age	$-0.002*10^{-4}$***	$-0.002*10^{-4}$***	$-0.002*10^{-4}$***	$-0.002*10^{-4}$***
	0.000	0.000	0.000	0.000
Marital Status (base:Married)				
Married, spouse absent	0.013***	-0.003	-0.001	-0.009***
	0.003	0.003	0.003	0.003
Unmarried 2	-0.002	0.003	0.004	0.006***
	0.002	0.005	0.005	0.002
Widowed 3	0.002	-0.001	-0.001	-0.004*
	0.002	0.003	0.003	0.002
Separated/Divorced 4	0.035***	0.034***	0.036***	0.029***
	0.007	0.008	0.008	0.006
Married no gauna 5	0.064***	0.036***	0.037***	0.010
	0.010	0.009	0.009	0.010
Relationship to Head (base:Self)				
Wife/Husband 2	-0.008***	-0.002	-0.004	-0.003***
	0.002	0.002	0.002	0.001
Son/Daughter 3	-0.058***	-0.043***	-0.044***	-0.029***
	0.002	0.004	0.004	0.002
Child-in-Law 4	-0.080***	-0.058***	-0.059***	-0.042***
	0.002	0.005	0.005	0.003
Grandchild 5	-0.140***	-0.110***	-0.111***	-0.077***
	0.003	0.009	0.009	0.004
Father/Mother 6	0.014***	0.019***	0.018***	0.012***
	0.003	0.003	0.004	0.003
Other	-0.055***	-0.035***	-0.036***	-0.022***
	0.002	0.007	0.007	0.003
Caste & Religion (base:OBC)				
Brahmin 1	-0.016***	-0.024***	-0.022***	-0.026***
	0.002	0.006	0.006	0.004
Forward caste 2	-0.041***	-0.028***	-0.027***	-0.023***
	0.001	0.004	0.004	0.003
Dalit 4	0.018***	0.027***	0.026***	0.035***
	0.001	0.004	0.004	0.003
Adivasi 5	0.032***	0.055***	0.053***	0.044***
	0.002	0.008	0.008	0.006
Muslim 6	-0.005***	0.009	0.007	0.007
	0.001	0.007	0.007	0.005
Christian, Sikh, Jain 7	-0.089***	-0.041***	-0.043***	-0.029***
	0.002	0.008	0.010	0.006
HH-Size (base:One-Member HH)				
Two member HH	-0.115***	-0.113***	-0.017	-0.117***
	0.007	0.010	0.014	0.007
Three member HH	-0.208***	-0.202***	-0.107***	-0.202***

	0.007	0.013	0.015	0.007
Four member HH	-0.221***	-0.214***	-0.117***	-0.212***
	0.007	0.013	0.015	0.007
Five member HH	-0.209***	-0.209***	-0.115***	-0.211***
	0.007	0.013	0.014	0.007
Six member HH	-0.200***	-0.207***	-0.111***	-0.209***
	0.007	0.014	0.016	0.007
Seven member HH	-0.198***	-0.209***	-0.114***	-0.215***
	0.007	0.013	0.016	0.007
Eight or More member HH	-0.197***	-0.214***	-0.118***	-0.222***
	0.007	0.014	0.015	0.007
Place of Residence (base:Metropolitan)				
other urban 1	0.047***	0.036***	0.033***	
	0.001	0.008	0.008	
more dev vill 2	0.109***	0.113***	0.108***	
	0.001	0.010	0.010	
less dev vill 3	0.178***	0.146***	0.139***	
	0.001	0.009	0.009	
Female # Age			0.0004	
			0.000	
Female # Age # Age			$-0.001*10^{-2}$	
			0.000	
Female # Age # Age # Age			$0.0009*10^{-4}$	
			0.000	
Female # Male Headed HH			0.005***	
			0.002	
Constant	0.590***	0.549***	0.463***	0.587***
	0.008	0.017	0.020	0.008
Education of HH-Head	Yes	Yes	Yes	Yes
Occupation Status	Yes	Yes	Yes	Yes
Sex # HH-Size	No	No	Yes	No
Sex # Caste & Religion Groups	No	No	Yes	No
Sex # Place of Residence	No	No	Yes	No
State # Sex	No	No	Yes	No
R2-Within	0.353	0.319	0.320	0.163
R2-Between		.423	.456	.484
R2-Overall		.341	.342	.254
N	198614	198614	198614	198614
Number of Groups		33	33	2462

Dependent variable is deprivation score for Comparative Household MPI. Robust Standard Errors are reported
* p<0.10, ** p<0.05, *** p<0.01

Table 11: Determinants of Individual MPI deprivation score.

	(1)	(2)	(3)	(4)	(5)
	OLS	State FE	State FE with Interactions	PSU FE	HH FE
	b/se	b/se	b/se	b/se	b/se
Female	0.014***	0.017***	-0.013	0.017***	0.014***
	0.001	0.003	0.018	0.001	0.001
Male Headed HH	0.035***	0.034***	0.039***	0.028***	
	0.002	0.005	0.006	0.003	
Age	-0.012***	-0.011***	-0.012***	-0.009***	-0.007***
	0.000	0.000	0.001	0.000	0.000
Age # Age	$0.025*10^{-2}$***	$0.025*10^{-2}$***	$0.024*10^{-2}$***	$0.024*10^{-2}$***	$0.022*10^{-2}$***
	0.000	0.000	0.000	0.000	0.000
Age # Age # Age	$-0.015*10^{-4}$***	$-0.015*10^{-4}$***	$-0.013*10^{-4}$***	$-0.016*10^{-4}$***	$-0.016*10^{-4}$***
	0.000	0.000	0.000	0.000	0.000
Marital Status (base:Married)					
Married, spouse absent	0.043***	0.028***	0.012**	0.024***	0.031***
	0.003	0.005	0.005	0.004	0.003
Unmarried	0.023***	0.027***	0.016**	0.030***	0.016***
	0.002	0.007	0.007	0.002	0.002
Widowed	0.064***	0.060***	0.036***	0.057***	0.056***
	0.002	0.003	0.003	0.003	0.002
Separated/Divorced	0.085***	0.085***	0.070***	0.082***	0.054***
	0.007	0.006	0.006	0.007	0.006
Married no gauna	0.063***	0.029***	0.017**	0.010	-0.010
	0.011	0.007	0.007	0.013	0.009
Relationship to Head (base:Self)					
Wife/Husband	0.066***	0.072***	0.035***	0.071***	0.074***
	0.002	0.006	0.006	0.002	0.001
Son/Daughter	-0.087***	-0.070***	-0.078***	-0.056***	-0.015***
	0.002	0.003	0.003	0.002	0.002
Child-in-Law	-0.074***	-0.051***	-0.076***	-0.034***	0.019***
	0.003	0.005	0.005	0.003	0.003
Grandchild	-0.171***	-0.139***	-0.146***	-0.104***	-0.011***
	0.003	0.005	0.005	0.004	0.004
Father/Mother	0.090***	0.094***	0.076***	0.086***	0.056***
	0.003	0.005	0.005	0.003	0.003
Other	-0.045***	-0.025***	-0.035***	-0.011***	0.025***
	0.003	0.007	0.006	0.003	0.002
Caste & Religion (base:OBC)					
Brahmin	-0.027***	-0.037***	-0.027***	-0.037***	
	0.002	0.005	0.005	0.004	
Forward caste	-0.045***	-0.033***	-0.027***	-0.029***	
	0.001	0.006	0.006	0.003	
Dalit	0.021***	0.029***	0.028***	0.034***	
	0.001	0.003	0.003	0.003	
Adivasi	0.033***	0.054***	0.049***	0.044***	
	0.002	0.007	0.007	0.005	
Muslim	0.006***	0.016**	0.019**	0.011***	
	0.001	0.008	0.008	0.004	
Christian, Sikh, Jain	-0.093***	-0.042***	-0.032***	-0.031***	
	0.002	0.005	0.006	0.005	
HH-Size (base:One-Member HH)					

Two member HH	-0.044***	-0.044***	-0.015	-0.047***	
	0.006	0.006	0.013	0.006	
Three mem. HH	-0.071***	-0.066***	-0.034***	-0.065***	
	0.006	0.007	0.012	0.006	
Four member HH	-0.077***	-0.070***	-0.038***	-0.068***	
	0.006	0.007	0.012	0.006	
Five member HH	-0.066***	-0.067***	-0.039***	-0.068***	
	0.006	0.006	0.012	0.006	
Six member HH	-0.056***	-0.065***	-0.038***	-0.067***	
	0.006	0.007	0.014	0.006	
Seven mem. HH	-0.053***	-0.067***	-0.040***	-0.072***	
	0.006	0.008	0.014	0.006	
Eight or More member HH	-0.055***	-0.075***	-0.049***	-0.083***	
	0.006	0.007	0.013	0.006	
Place of Residence (base:Metropolitan)					
other urban	0.033***	0.026***	0.020***		
	0.001	0.007	0.007		
more dev vill	0.088***	0.095***	0.075***		
	0.002	0.008	0.008		
less dev vill	0.158***	0.128***	0.104***		
	0.002	0.007	0.008		
Female # Age			0.002***		
			0.000		
Female # Age # Age			$-0.0001*10^{-2}$		
			0.000		
Female # Age # Age # Age			$-0.002*10^{-4}$*		
			0.000		
Female # Male Headed HH			0.001		
			0.003		
Constant	0.514***	0.473***	0.499***	0.495***	0.272***
	0.007	0.015	0.023	0.008	0.004
Ed. HH-Head	Yes	Yes	Yes	Yes	No
Occ. Status	Yes	Yes	Yes	Yes	Yes
Sex # HH-Size	No	No	Yes	No	No
Sex # Caste & Religion Groups	No	No	Yes	No	No
Sex # Residence	No	No	Yes	No	No
State # Sex	No	No	Yes	No	No
R2-Within	0.433	0.417	0.421	0.307	0.260
R2-Between		.548	.667	.573	.0617
R2-Overall		.423	.437	.36	.0941
N	197942	197942	197942	197942	198236
N Groups		33	33	2462	40726

Dependent variable is deprivation score for Individual MPI measure. Robust Standard Errors are reported
* p<0.10, ** p<0.05, *** p<0.01

Table 12:

	Men	Women	Total	Difference between women and men's measure	
				Absolute	Relative
Individual MPI					
Headcount	0.38	0.5	0.44	0.12	32%
Intensity	0.53	0.54	0.54	0.01	2%
MPI	0.2	0.27	0.24	0.07	35%
Individual Alternate MPI (Children under 7 years are assumed to be non deprived in education)					
Headcount	0.33	0.46	0.4	0.13	39%
Intensity	0.52	0.53	0.53	0.01	2%
MPI	0.17	0.24	0.21	0.07	41%
Individual Alternate Weights MPI (Education 0.5, Health 0.25 and Standard of Living 0.25)					
Headcount	0.32	0.45	0.38	0.13	41%
Intensity	0.65	0.66	0.65	0.01	2%
MPI	0.21	0.3	0.25	0.09	43%
Individual Alternate Weight MPI (Education 0.25, Health 0.5 and Standard of Living 0.25)					
Headcount	0.36	0.44	0.4	0.08	22%
Intensity	0.51	0.52	0.52	0.01	2%
MPI	0.18	0.23	0.21	0.05	28%
Individual Alternate Weights MPI (Education 0.25, Health 0.25 and Standard of Living 0.5)					
Headcount	0.4	0.49	0.45	0.09	23%
Intensity	0.51	0.53	0.52	0.02	4%
MPI	0.2	0.26	0.23	0.06	30%

Figures

Figure 1: Differential Impact of Sex of the Individual by Age

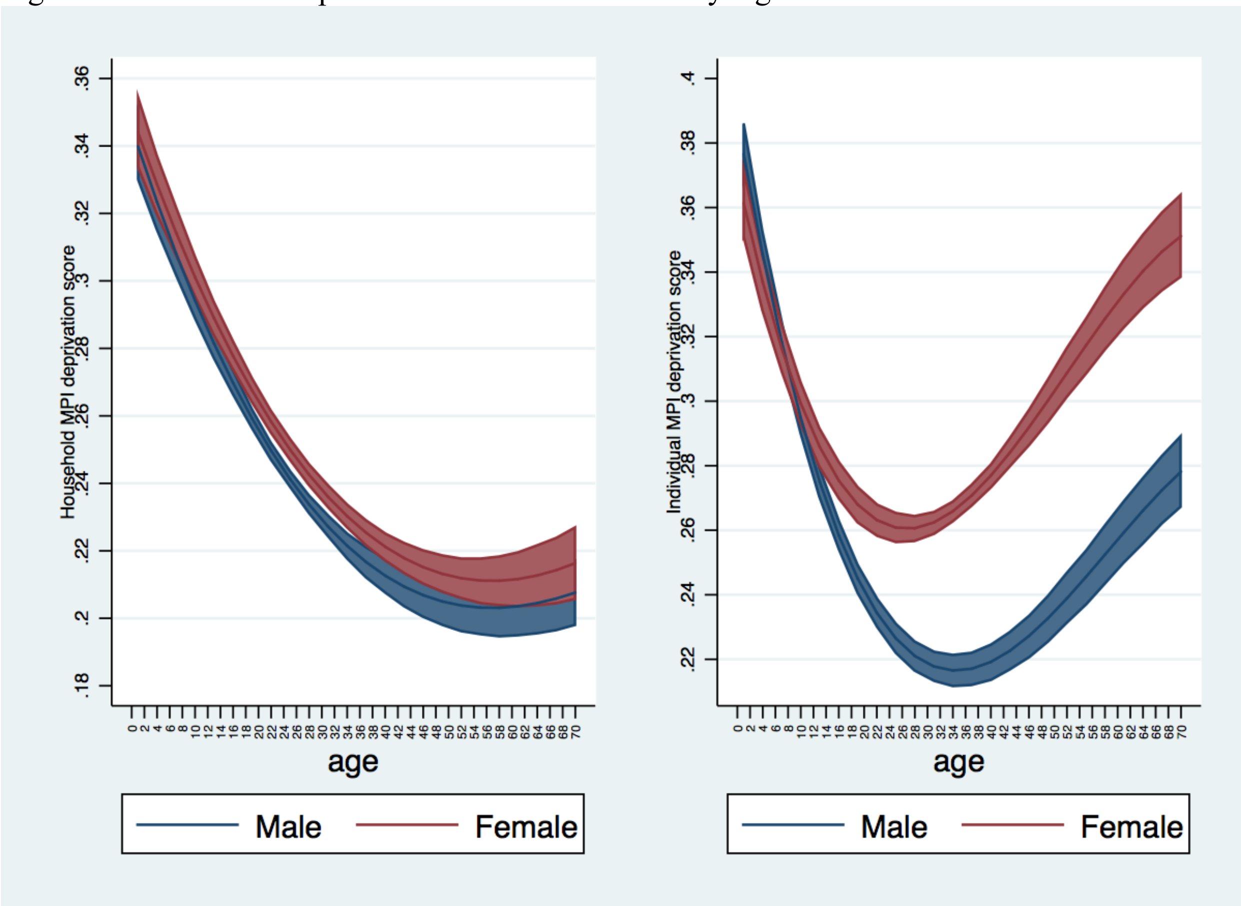

Figure 2: Regression results for state fixed effects for Household and Individual MPI

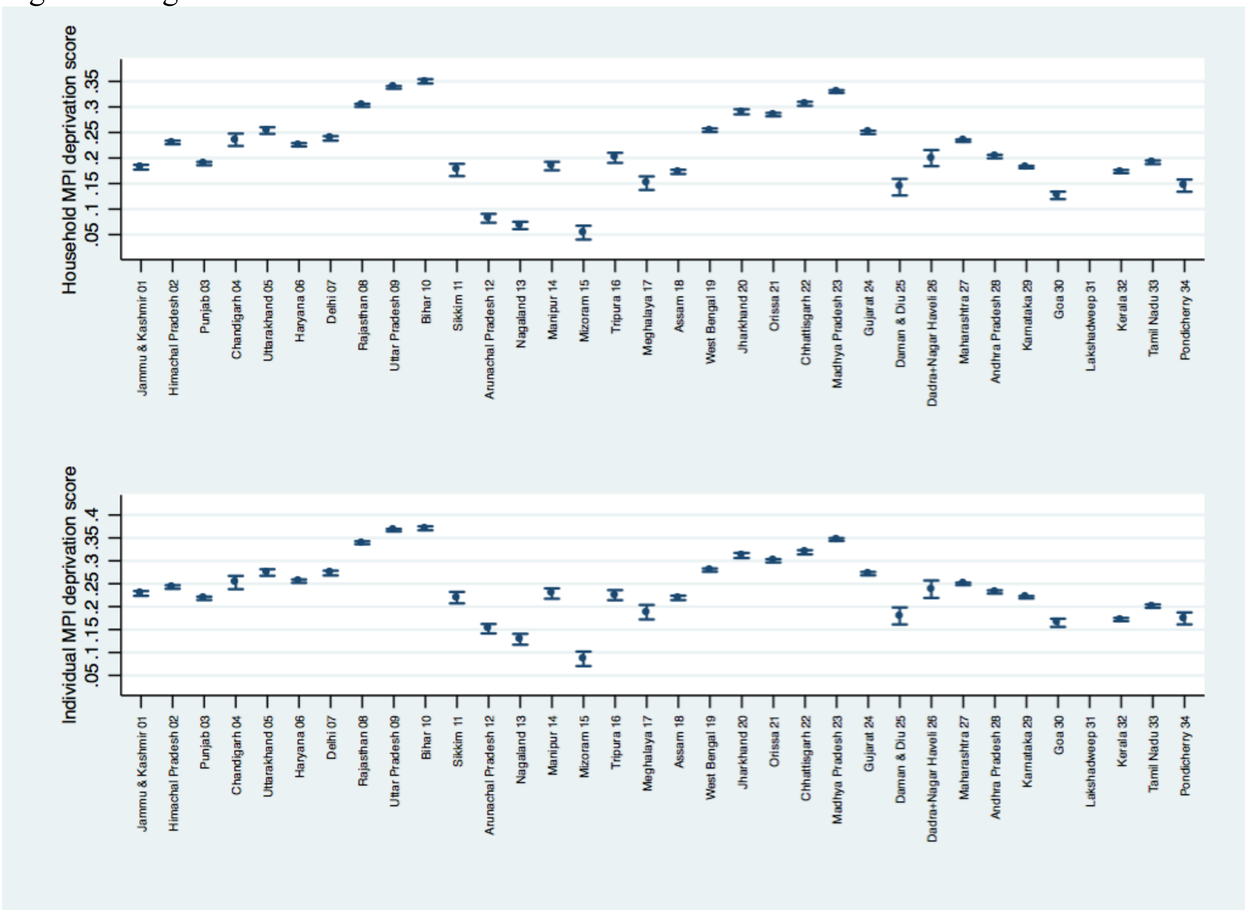

Figure 3: Multidimensional poverty headcount for various values of deprivation score cutoff by gender