

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/305352932>

# On Counting Multidimensional Well-being: An Indian Illustration

Article in *The Empirical Economics Letters* · October 2015

CITATIONS

0

READS

84

1 author:



Vachaspati Shukla

Sardar Patel Institute of Economic and Social Research

19 PUBLICATIONS 25 CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:



Examining Educational Progress in India [View project](#)

## **On Counting Multidimensional Well-being: An Indian Illustration**

**Udaya S Mishra<sup>\*</sup> and Vachaspati Shukla<sup>\*\*</sup>**

*Centre for Development Studies, Thiruvananthapuram-695011  
Kerala, India*

**Abstract:** Comprehending multidimensional well-being poses the challenge of counting them with all possible combinations and differentiating with appropriate weights. More often with these indicators being categorical in nature the challenge lies in counting 'how many' and 'which ones' at the same time. This paper attempts a welfare comparison of population with multi-dimensional discrete well-being indicators without any assumption either regarding strength of preference for each dimension or regarding the desirability of changes between levels within or across dimensions or the complementarities/substitutability between the dimensions. Such a comparison is made based on the principle of multidimensional first order dominance. The empirical illustration is made based on the data on Household basic amenities obtained in the NSSO rounds, and comparison is made across Indian states.

**Keywords:** Multidimensional Deprivation, Dominance, Welfare Comparison

**JEL Classification Number:** I3, I31, I32

### **1. Introduction**

The move from a uni-dimensional to a multidimensional approach of understanding deprivation is premised upon the disagreement of any single deprivation with others. The basic human need approach subscribes to having certain basic material needs that comprises of multiple dimensions (Hicks and Streeten 1979; Goldstein 1985; UNRISD 1970) which has given rise to assessment of multidimensional index of well being (Alkire and Santos 2010; Alkire and Foster 2011; Alkire and Seth 2013). In general such a comprehension signifies the number of indicators in which a particular household or individual is deprived/privileged overlooking the specificity of various dimensions of deprivation.

Given that every dimension of 'basic human needs' has its own characteristics and differential impact on the welfare of individuals, it may not be appropriate to make a welfare comparison on the basis of an aggregate index and draw policy inputs. To resolve this problem and provide a meaningful comparison, we adopt the concept of multidimensional first order dominance that enables us to make comparison across time

---

<sup>\*</sup> Professor. Email: mishra@cds.ac.in; <sup>\*\*</sup> PhD Scholar Email: vachaspatishukla@gmail.com, vachas10d@cds.ac.in

and between populations based on a series of binary or multi-leveled ordinal welfare indicators. This approach is applied to data from India with a focus on three ‘basic human needs’ essential for a better human life. These are access to latrine facility, safe drinking water and electricity. As a prelude, this note begins with the introduction of basic ‘Multidimensional Head Count Index’ and further proceeds towards a new approach of analyzing the Multidimensional Head Count Index.

## 2. Multidimensional Head Count Index of Achievement

The head count ratio in case of Multidimensional achievement is estimated by using the following formula:

$$H^* = \sum_{j=0}^K \left( \frac{j}{K} \right) H_j$$

Where  $H_j$  is the proportion of population that is privileged in exactly  $j$  dimension ( $j = 0, 1, 2, \dots, K$ ).  $K$  is the number of dimensions considered for the analysis. Following this formula MHI (Multidimensional Head Count Index) for achievement is estimated for rural India at two point of time 2002 and 2008-09 considering three dimensions of well being; access to Electricity, Water and Toilet. The estimated value of MHI is found to be 36.7 per cent during 2002 and 46.7 per cent during 2008-09, which clearly reveals an increase in the multi-dimensional head count of achievement (Table 1).

**Table 1: Multi-dimensional Headcount Achievement in Rural India**

Number of dimensions in which Achievement occurs	Head Count Ratio of Achievement	
	2002	2008-09
0	29.7	19.8
1	40.8	38.6
2	18.8	23.2
3	10.6	18.4
<b>MHI</b>	<b>36.7</b>	<b>46.7</b>

Source: Computed from NSSO unit record data of 58<sup>th</sup> (2002) and 65<sup>th</sup> (2008-09) round survey of Housing Condition and Amenities in India, National Sample Survey Office, Ministry of Statistics and Programme Implementation, Government of India.

This undoubtedly is a very simple and convincing method to assess the multi-dimensional achievement in any society and analyzing its progress thereof. However, this method captures number of dimensions well enough without differentiating across varied combinations of such dimensions within a given count of the same. Such a limitation not only equates ill-fare of each dimension but also combinations of dimensions within a given count of privilege/deprivation. The main drawback of this method is its silence

about the identity of the dimensions. As can be observed from Table 1, achievement in '0' dimension represents all deprived as against achievement in three dimensions represent all privileged. Achievement in one or two dimensions does not reveal which one or combination of which two dimensions. Hence, the MHI derived above is insensitive to dimension or combinations of dimensions of achievement. Given this limitation, Table 2 describes achievement in all possible combinations of dimensions which exhibits a differential rate of change in varied combinations of dimensions over time.

**Table 2: Multi-dimensional Headcount Achievement: All India**

Dimensions in which Achievement Occurs	Head Count Ratio of Achievement	
	2002	2008-09
0	29.7	19.8
E	26	27.4
W	12.9	8.5
T	1.9	2.7
WE	11.3	10.7
ET	5	9.5
WT	2.5	3
WET	10.6	18.4

Source: As in Table 1.

### **3. A New Approach to Compute the Multidimensional Head Count Index of Deprivation**

The prior discussion undoubtedly conveys the need for an appropriate method to make a robust comparison of achievement in welfare considering various counts and combinations of deprivations. Such an exercise is intended to not merely obtain an aggregate achievement index but also to compare the same across time and space using the principle of dominance. To accomplish this, we draw upon a concept known in the literature as multidimensional first order dominance (Arndt et al. 2012). This concept allows us to make welfare comparisons among various groups of populations on the basis of a series of ordinal welfare indicators. It is also known as the usual (stochastic) order in the stochastic dominance literature. In case of two population distribution, one distribution first order dominates another if one could hypothetically move from one population distribution to the other by iteratively shifting population mass in the direction from a better outcomes to a worse outcomes. Thus, whenever we are able to observe first order dominance between two population distributions, the dominating population is unambiguously 'better off'.

Continuing with the idea of ‘multidimensional first order dominance’ an attempt to compare the welfare across possible combinations of deprivation is made by plotting the cumulative share of privileged households against the privileged scores. The privileged scores represent the number/combination of dimensions in which households are privileged. Following this, households deprived in all dimensions will obtain a score of 0 as against the households privileged in the all the three dimension obtain a score of 3 as it is done while computing the MHI. However, unlike in the case of MHI, these scores cannot be treated as random variables as they do not associate with unique probabilities and in turn we cannot obtain an expected score of privilege. In an effort to resolve this issue, we make an attempt to differentiate privilege score within the same number of privilege but varying combinations as illustrated above. Such differentiation is made under a premise of conceptualizing deprivation/privilege conditioned by negative externality of prevalence of various combinations. For instance being deprived in one dimension should ideally be assigned a value of 1 which is differentiated with a  $Score = 1 - S_i$  where  $S_i$  is the prevalence share of a particular combination of single dimension deprivation. Similarly a  $Score = 2 - S_i$  is computed for all possible combinations with deprivation in two dimensions. For the purpose of illustration, privileged scores and cumulative share of privileged households is computed for the rural sector for the year 2008-09 (Table 3).

**Table 3: Computation of Privileged Score and Cumulative Share of Privileged Population for Rural Sector in 2008-09**

Indicators	Share( $S_i$ )	Privileged Score	Cumulative Share of Privileged Population( $S_i$ )
0	0.198	0.000	0.198
E	0.274	$0.726(1 - S_i)$	0.472
W	0.085	0.915 ``	0.557
T	0.027	0.973 ``	0.584
EW	0.107	$1.893 (2 - S_i)$	0.691
TE	0.095	1.905 ``	0.786
WT	0.030	1.970 ``	0.816
WET	0.184	3.000	1.000

Using the above count of deprivation and its associated prevalence, a multidimensional achievement index can be computed by following formula:

$$H^{**} = \sum_j \left( \frac{P_j}{K} \right) H_j$$

Here  $H_j$  is the proportion of population for  $j_{th}$  combination.  $P_j$  is the privilege score for  $j_{th}$  combination and  $K$  is the number of dimensions considered.  $J$  is the total number of possible combination of dimensions.  $H^{**}$  is the new Multi-dimensional Head Count Achievement Index.

This is computed for rural areas of Indian states for two periods of time as presented in Table 4. The wider differential in the levels of achievements made by various states is apparent from the Table 4; there is an extreme gap in such achievement among group of states which stand out in terms of deprivation in these basic amenities. Given the improvement observed across the board, the scale of improvement is quite different in keeping with the base levels. Undoubtedly, there are distinct states like Haryana, Himachal Pradesh and Maharashtra which have made remarkable progress as regard achievement in these three basic amenities.

**Table 4:Multidimensional Achievement Index in Rural India Across States**

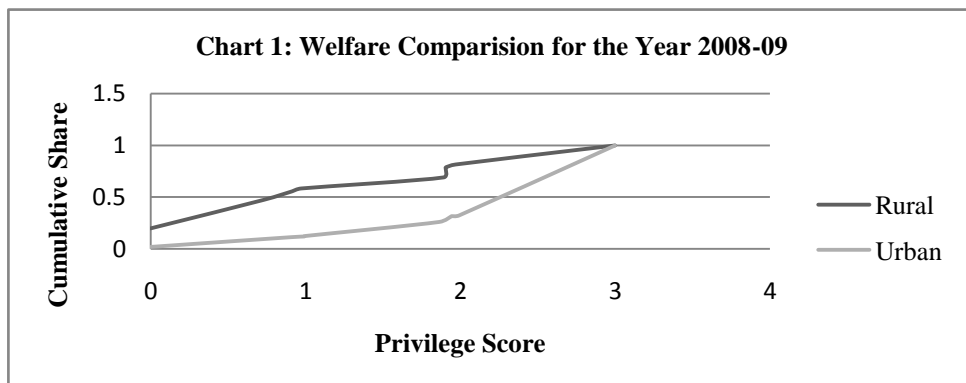
States	2008-09	2002	States	2008-09	2002
Andhra Pradesh	0.460	0.351	Madhya Pradesh	0.241	0.215
Assam	0.587	0.425	Maharashtra	0.468	0.313
Bihar	0.307	0.183	Orissa	0.202	0.165
Chhattisgarh	0.273	0.204	Punjab	0.776	0.704
Gujarat	0.503	0.428	Rajasthan	0.310	0.252
Haryana	0.663	0.397	Tamil Nadu	0.344	0.259
Himachal Pradesh	0.634	0.425	Uttarakhand	0.560	0.438
Jammu & Kashmir	0.667	0.552	Uttar Pradesh	0.345	0.254
Jharkhand	0.214	0.188	West Bengal	0.420	0.259
Karnataka	0.387	0.326	<b>India</b>	<b>0.433</b>	<b>0.334</b>
Kerala	0.859	0.752			

**Source:** As in Table 1.

Following this aggregate analysis, an attempt is made towards illustrating “Multidimensional First Order Dominance” to claim the differential achievement by characteristics, across regions and over time. While comparing such achievement between rural and urban areas, a distinct dominance can be visualized from chart-1. With privilege score ranging between 0 and 3 accounting for varying combination of such privilege, it is apparent that urban households have systematic advantage over rural households across all possible combinations of privilege.

A similar display of the welfare distribution among the richest states with the least share of households deprived in all of the indicators compares the states in order of dominance (Chart-2). It indicates that despite a similar level of deprivation in all, they vary in terms of

deprivations across combinations with the varying privilege scores. In this regard all the states namely Punjab, Jammu and Kashmir and Himachal Pradesh fair worse compared with Kerala when read in terms of cumulative distribution over the range of privilege scores. Such a comparison differentiates states in terms of gaps in privilege which is clearly the least between Jammu Kashmir and Himachal which is systematically worse compared with Punjab. This observation is meaningful while interpreting the aggregate distance between two index values.

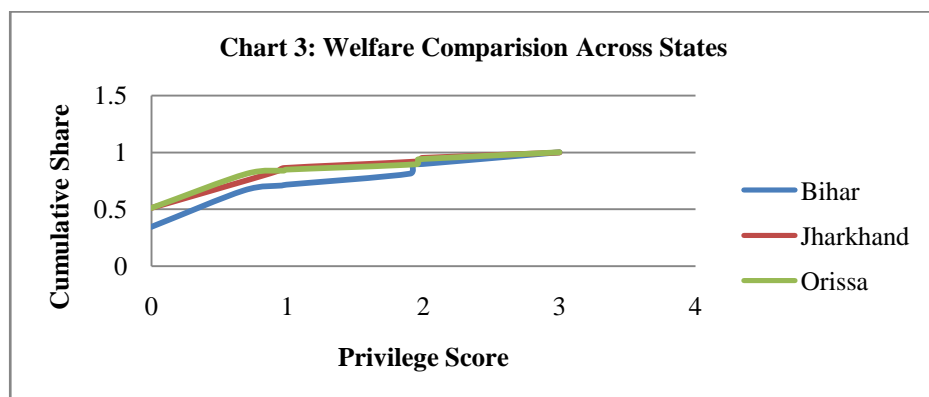


**Source:** As in Table 1.

Making similar comparison of dominance across poor states, we find Bihar being dominated by Jharkhand and Orissa. Bihar's advantage is not only in terms of the levels of deprivation in none but also across all combinations hence the gap between Bihar and these other two states could be considered genuine as against the marginal difference between Jharkhand and Orissa ( See Chart 3).

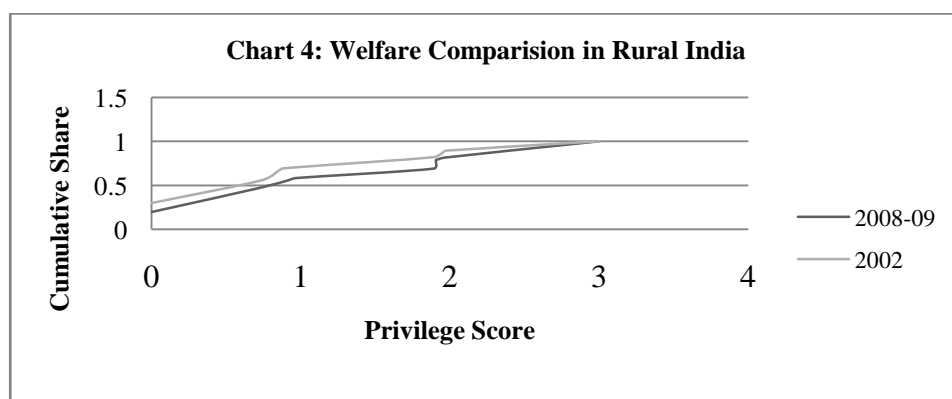


**Source:** As in Table 1.



Source: As in Table 1.

A time trend comparison of this deprivation for rural India might simply be an improvement from 0.334 to 0.433 but the distinct dominance of 2002 over 2008-09 confirms an improvement that is across all combinations of deprivation. The other significant feature that needs to be noted from this comparison is in terms of dominance in combinations with none, one and two deprivations (See Chart-4). Such time trend comparison made for rural Bihar, rural Jharkhand and Rural Orissa, depicts clear dominance in Rural Bihar as compared with other two states. This is despite marginal improvement in the index value for Jharkhand and Orissa. Undoubtedly, such marginal improvement cannot be reckoned without qualifying distinct dominance. In fact, these illustrations reiterate the degree of improvements on one hand and a clear dominance confirms improvement across all possible combinations of deprivation. (chart 5, 6 and 7).

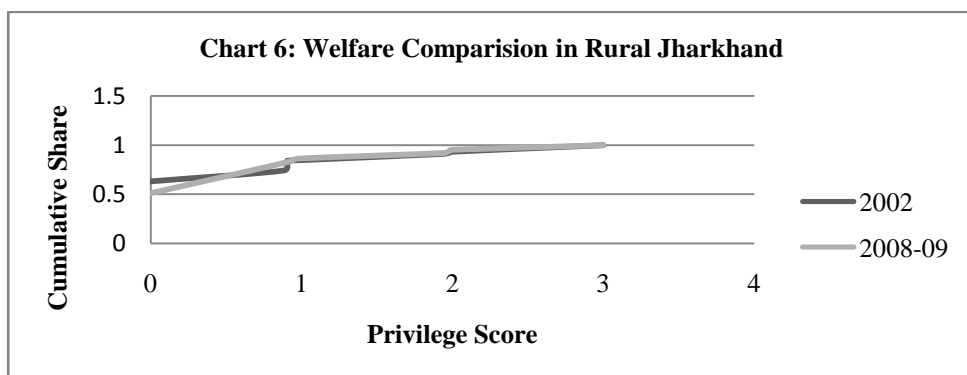


Source: As in Table-1

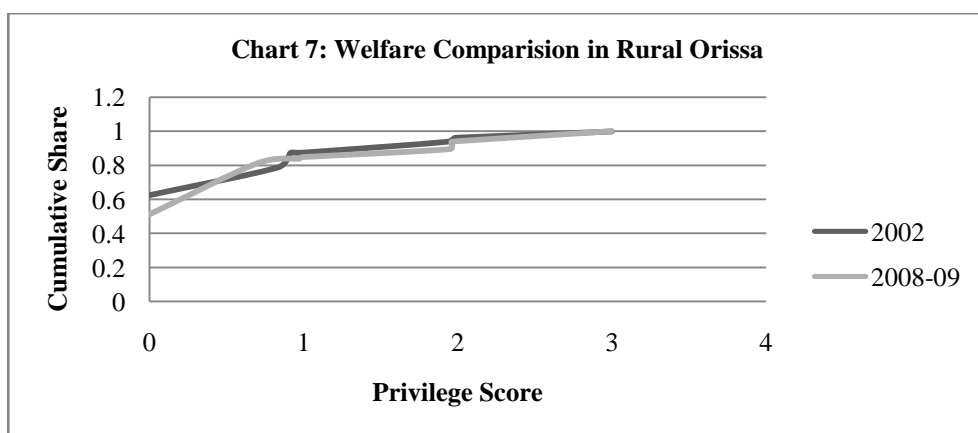




Source: As in Table 1.



Source: As in Table 1.



Source: As in Table 1.

#### 4. Conclusion

This paper suggests an alternative way to measure the multi-dimensional head count index for achievement accounting for not only the number of dimensions but also the possible combinations of them. A comparison of such achievement is illustrated based on a principle of dominance that differentiates equivalent aggregate scores in terms of systematic dominance over the range of privilege scores. Empirical illustration considering three indicators of welfare namely water sanitation and electricity for India and its states over time is made for this purpose. Interesting features observed in this exercise relate to differentiating equal or equivalent aggregates in case there is a violation of dominance and counting each combination of deprivation in terms of score/count that is conditioned by the level of prevalence. The empirical illustration using the information on the three basic indicators for India namely water, sanitation and electricity offers an assessment of progress in consideration of the dynamics of interdependence between these dimensions as well as demonstrates the clarity of this progress based on the qualification of dominance.

#### References

- Arndt, C., Distante, R., Hussain, M. A., Østerdal, L. P., Huong, P. L., and Ibraimo, M., 2012, Ordinal Welfare Comparisons with Multiple Discrete Indicators: A First Order Dominance Approach and Application to Child Poverty. *World Development*, 40(11), 2290-2301
- Alkire, S and Seth, S., 2013, Multidimensional Poverty Reduction in India Between 1999 and 2006: Where and How? Working Paper No. 60, Oxford Poverty & Human Development Initiative, Oxford University.
- Alkire, S and Foster, J.E., 2011, Counting and Multidimensional Poverty Measurement. *Journal of Public Economic*, 95(7), 476-487.
- Alkire, S and Santos, M.E., 2010, Acute Multidimensional Poverty: A new Index for Developing Countries. Working Paper No. 38, Oxford Poverty & Human Development Initiative, Oxford University.
- J.S. Goldstein, 1985, Basic Human Needs: The Plateau Curve. *World Development*, 13(5), 595-609.
- Norman L. Hicks and Paul P. Streeten, 1979, Indicators of Development: The Search for a Basic Needs Yardsticks. *World Development*, 7(6), 567-580.
- UNRISD, 1970, Contents and Measurement of Social Economic Development. United Nations Research Institute for Social Development.