Chapter 11
Is Poverty Comparable Across Varying Size of Population Among Indian States?

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Abstract The most popular measure of poverty, i.e. the head count ratio is undoubtedly a simple measure with inadequacies of comparison. It also suffers from the mismatched contradiction between the count of the poor and their share in the population. Such inadequacies point towards the limitation in comparing poverty head count ratio across varying population sizes. The comparison of this measure between not only varying population sizes but also varying shares of the poor and the non-poor is worth contemplating in case it derives upon the ill-fare of poverty. Given these concerns, the measure of poverty accounting for its absolute count, intensity as well as inequality is proposed here as a modified version of the Sen, Shorrocks and Thorn (SST) measure of poverty. Further, a decomposition exercise is carried out to comprehend the share of each of its components in the changing level of poverty which is illustrated using the Indian data set. The salient observation made here relates to declining poverty levels in Indian states being in disagreement with reduced ill-fare as the poverty gap is on a rise along with the count of the poor. This raises apprehensions as to whether poverty reduction has to less to the do with the changing state of the poor rather than the changing state of the non-poor.

Keywords Poverty · SST index · Head count · Poverty gap · Poverty intensity

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11.1 Introduction

The characterization and causes of poverty are vital for designing strategies for poverty alleviation in most of the developing countries in the world (Shan and Stifel 2000). Given that poverty alleviation remains a global priority, it is essential to know the dimensions of poverty and the mechanisms for its mitigation (Chakravarty et al. 2006). Its priority is reflected in being at the top of the MDGs list, which lays stress on halving the levels of poverty by 2015 (the poor identified as those with an income less than a dollar a day). This too is based on a simplistic measure of head count ratio of the poor in the population. Despite the development of a whole host of sensitive measures of poverty, head count ratio prevails as the most commonly acceptable measure of poverty, notwithstanding its limitation of temporal as well as cross-sectional comparability.

The various debates regarding poverty measurement hinge around how many poor are there in the world and what constitutes poverty. The first and foremost exercise in the case of poverty measurement is that of identification and aggregation of poverty. Some of the methods which have evolved over last few decades to measure the magnitude and severity of poverty are head count index, poverty gap index, Sen's index, the Sen–Shorrocks–Thon index (SST) and the FGT index. The identification exercise involves setting a poverty norm by considering a cut-off point to split the poor from the non-poor. A ratio of the count of poor to the total population gives rise to a head count measure of poverty.[1] Such a ratio has the virtue of simplicity, but sacrifices on adequacy as regard its robustness in comparison. Compromise on robustness is due to the measure not accounting for the amount by which the income of the poor falls below the poverty line (Osberg and Xu 1998). Moreover, such a measure cannot show the depth of poverty. The poverty gap index for the total population (I) takes the total aggregate shortfall from the poverty line divided by the number of people below the poverty line. But it ignores the number of poor people and the degree of inequality among them. As a result of such limitations, for a comprehensive measurement of poverty, a couple of measures were developed over last few decades such as the FGT index, SST index, Sen's index and Sen's square index. Sen's index seeks to combine the effect of the number of the poor, the depth of their poverty and the distribution of poverty within the group. Since Sen's index is not replication invariant, not continuous in individual incomes and fails to satisfy the transfer axioms, Shorrocks (1995) proposed a modified Sen's index, which was further modified by Thon (known as the SST index). The resultant SST index of poverty measures the depth, incidence and inequality in poverty.

Some recent developments in the measurement of poverty echo problems concerning the comparison of the extent of poverty with a varying population size. While calculating the head count ratio of poverty across the population, we have two figures at hand, i.e. the number of the poor and the number of non-poor, which can increase or decrease proportionately to render the level of poverty to

[1] One such likelihood measure.

be stagnant. Alternatively, if the number of poor is multiplied 10 times and the total population is also equally multiplied, then we have to conclude that poverty remains unchanged. Such anomalies bring to the fore the issue of poverty comparison across varying population sizes. Recent initiatives to consider poverty measure in varying population contexts has been made by a host of authors (Kundu and Smith 1983; Bossert 1990; Subramanian 2002, 2005a, b; Chakravarty et al. 2006; Kanbur and Mukherjee 2007; Hassoun and Subramanian 2010).

Most of the studies on measurement of poverty indices consider a set of axioms to be qualified by a poverty measure when computed for fixed and variable population. This is primarily due to change in poverty being reflective of the state of the poor rather than owing to varying population size. Not only the ratio-based measure such as the HCR but also most of the likelihood principle-based measures have the same folly when it comes to comparison over time or across the population. In this current exercise, we assess poverty on the basis of the SST index as an alternative to the simple measure of head count ratio. Choice of this alternative is motivated by the appreciation of the mere addition paradox framework, wherein change in poverty could very well be due to mere addition of rich or poor people in the total population. While such a change does not convey any change in the state of poverty, it can always be the case while comparing the level of poverty indices with variable population. Therefore, there is every need for a poverty measure that accommodates all possible aspects of poverty such as its count, base and intensity as well. In this regard, objection according to "mere addition paradox" relates to no change in the state of poverty with the addition of a rich individual to the total population (Hassoun 2010). Such a proposition becomes much more relevant in assessing the changing magnitude of poverty with a variable population base. When changing poverty levels could be in either direction with addition of the rich or the poor or proportionate addition of both, there is undoubtedly no implication for the state of poverty. As regards reduction in poverty, there needs to be either a reduced number of the poor or a reduced average gap of their income/expenditure against a given norm. In sum, there is every need for a poverty measure that reflects the state of poverty more than the share or ratio of the poor which is due to change without any change in the state of poverty.

The analysis of poverty indices through mere addition can be shown through an example given by (Hassoun and Subramanian 2010) where we have two sets of conditions—in the first case, there are only a few rich people, while in the second case, there is some addition to the rich people in the total population. So the second population has a larger number of rich people as compared to the first population, as a result of which the addition of the extra rich person may not lead to a decrease in the level of poverty. It means that a change that does not affect the poor may not lead to a reduction in the level of poverty. This follows Sen's principle which shows that "poverty is a characteristics of the poor, and the reduction of the income of the poor must increase the measure of poverty, no matter how much the income of the non-poor go up at the same time" (Sen 1981: 190). So it is important to know how much poverty there is in a population and what is the best way to deal with that. In our study, we will use the SST index to measure the

incidence and depth of poverty. The SST index has been used by (Xu and Osberg 1999) to compare poverty in the USA and Canada over time. One of the benefits of the SST index is that it gives a good sense of sources of chance of poverty over time. The SST index also shows the poverty declines with the mere addition of a rich person to a population that contains some poverty (Hassoun 2010). In our present analysis, we will first analyse the likelihood principles of poverty through the SST index and subsequently, we will discuss the lacunas of this principle by taking the Indian data sets on consumer expenditure.

11.2 Data and Methodology

The present study is based on secondary data. To analyse the level of poverty, this study uses two major thick NSSO quinquennial rounds of the consumption expenditure survey (Unit-level data on dietary patterns and consumer expenditure, NSSO-CES). The present analysis is based on the two rounds of NSSO-CES (61st and 66th rounds). Due to the unavailability of income data, the per capita expenditure of sample households was used as a proxy for per capita income. We took the official poverty norm for measuring the poor and the non-poor. We included 15 major states in our analysis. These states are Andhra Pradesh (AP), Assam (AS), Bihar (BR), Gujarat (GR), Haryana (HR), Karnataka (KR), Kerala (KE), Madhya Pradesh (MP), Maharashtra (MR), Odisha (OR), Punjab (PN), Rajasthan (RJ), Tamil Nadu (TN), Uttar Pradesh (UR) and West Bengal (WB). As per the Tendulkar estimates, we took the MRP instead of URP to calculate the official poverty line from the NSSO unit-level data. In this study, we used the SST index to calculate the incidence, depth and inequality of poverty.

11.2.1 SST Index for Poverty Measurement

The SST index is an index of poverty intensity. It measures the depth, incidence and inequality of poverty. So it is a comprehensive measure of poverty index. The SST index can be regarded as a weighted "average" of individual poverty gap ratios of the poor.

This is an improvement over Sen's index because Sen's index does not satisfy the strong upward transfer and continuity axiom, but the SST index does this. It is also desirable because as examined by Xu (1998, p. 5), "it is symmetric, replication invariant, monotonic, homogeneous of degree zero in individual incomes and the corresponding poverty line and normalized to take values in the range [0, 1]". According to Xu and Osberg (2002), the SST index of poverty intensity can be calculated as the product of three poverty measures during a certain period of time: (1) poverty rate, (2) average poverty gap and (3) 1 + Gini coefficient of poverty gaps for the population. This can be shown as

SST index = (poverty rate) × (average poverty gap) × (1 + Gini coefficient of poverty gaps for the population),

where the poverty head count can be shown as $H = n^p/\mathrm{p}$, n is the total number of population and n^p is the number of poor individuals in the population.[2]

The second-term average poverty gap can be shown as

$$I^P = 1/n^P \sum_{i=1}^{n^p} x_i^P$$

where x_i^P is the individuals i's poverty gap $(z - y_i)/z$ and all i's in this case are below the poverty line (indicated by the superscript p). The last term can be shown as the Gini coefficient for the whole population as

$$G = \frac{\sum_{I=1}^{n} \sum_{j=1}^{n} \left| x_i - x_j \right|}{2n^2 I}$$

where G is the Gini of the poverty ratios for the whole population. Here, all individual gaps are taken into account including the gaps of the rich.[3]

The three measures show the number of people in poverty, size of the gap per poor person and the distribution of poverty among the poor (Xu 2011).

ΔSST index = Δ (poverty rate) + Δ (average poverty gap) + Δ (1 + gini coefficient of poverty gaps for the population).

The above equation is also useful for decomposing the percentage differences in poverty intensity between two populations into percentage differences in poverty rate, poverty gap and inequality of poverty. The overall percentage change in poverty intensity overtime can be expressed as sum of the percentage change in poverty rate, average poverty gap ratio and Gini inequality in the poverty gap ratios (among all poor).

11.2.2 Rural and Urban Poverty Comparison Through SST Index

India's level of poverty has always remained contentious owing to its simplistic measurement, on the one hand, and disagreements with alternative dimensions of ill-fare, on the other. As a result, there have been attempts at revising the methodology of poverty measurement from time to time. Regardless, the magnitude of decline in poverty still remains questionable primarily because the reported levels

[2] Number of people who have an amount of good y_i less than the amount necessary to reach the poverty line z (Hassoun 2010).

[3] For details, look at the Hasssoun (2010), Kundu and Smith (1983), Osberg and Xu (1998).

of poverty do not match the real state of deprivation. Further, when poverty levels are compared over time and across populations, one wonders whether these changes owe to the realistic change in the state of the poor of a mere statistical artefact. In this context, the mere addition paradox comes into play as a change in simplistic measure of poverty could very well be due to the addition of the population in the denominator or also due to a change in the count of the rich in the population. Hence, the present analysis situates an alternative in the SST index to accommodate the headcount, depth and intensity of poverty.

It is very clear from Table 11.1 that there is a stark difference between rural and urban poverty intensity among Indian states. The three components of the SST index (poverty rate, average poverty gap ratio and inequality in poverty gaps shown by Gini) represent an interesting pattern across the states and over time. At the all India level, both in rural and urban areas, the intensity of poverty measured in terms of the SST index seems to decline during 61st and 66th NSSO rounds. In rural areas, all the states exhibit a decline in poverty intensity measured in terms of the SST index. The result indicates that the SST index of poverty intensity in Odisha was 0.277 (three times higher than Punjab (0.070)) in 2004–2005 in rural areas. In urban India (2004–2005), the poverty intensity was highest in Bihar (0.194) and lowest in Punjab (0.060). Though as compared to 2004–2005, the intensity of poverty is declining in 2009–2010, but it is still higher in Odisha (0.082), followed by Bihar (0.062) and Madhya Pradesh (0.065) in rural areas, and in Bihar (0.064), Madhya Pradesh (0.046) and Odisha (0.044) in urban areas. But the components of the SST index are not showing the same pattern across the states, both in rural and urban areas.

First, the poverty rate is showing a declining trend in all states except Assam, both in rural and urban area. The decline is highest in Tamil Nadu (from 0.375 to 0.212), followed by Maharashtra and Kerala and lowest in Bihar (from 0.557 to 0.553) in rural areas, whereas for urban areas, it is highest in Tamil Nadu, Kerala and Rajasthan and lowest in Punjab followed by Uttar Pradesh. In 2009–2010, almost one-third of the population in rural India was in poverty.

Second, the poverty gap index measured in terms of total aggregate shortfall from the poverty line divided by the number of people below the poverty line showing most of the Indian states indicates a decline in the poverty gap except in a few states. In rural India, all states except Bihar, Haryana and Karnataka show a declining trend in poverty gap rates, whereas for urban areas, it is Andhra Pradesh, Assam, Bihar, Karnataka, Punjab and Uttar Pradesh. At the all India level, the poverty gap has declined from 0.230 to 0.205 in rural areas and from 0.236 to 0.217 in urban areas between 2004 and 2005 and 2009 and 2010. But the third component of the SST index, i.e. Gini portrays some different pictures as compared to the other two measures of poverty rate and poverty gap. It clearly shows that there is an increasing trend in the Gini coefficient—both at the all India level and across the states in rural (except Assam) and urban (except Assam and Haryana) areas. The poverty gap index applied to the poor stood at only 0.205, and the Gini coefficient of the poverty gap ratio was 0.795 % which generates an SST index value of 0.122 in rural areas in the 66th round.

Table 11.1 Decomposition of SST index for rural and urban households

State	Rural								Urban							
	61st round				66th round				61st round				66th round			
	Decomposition of level			SST index	Decomposition of level			SST index	Decomposition of level			SST index	Decomposition of level			SST index
	Rate	Gap	Gini		Rate	Gap	Gini		Rate	Gap	Gini		Rate	Gap	Gini	
AP	0.323	0.216	0.803	0.126	0.227	0.207	0.865	0.032	0.234	0.206	0.855	0.089	0.177	0.216	0.891	0.023
AS	0.364	0.193	0.777	0.125	0.399	0.183	0.751	0.027	0.218	0.195	0.857	0.079	0.259	0.229	0.840	0.022
BR	0.557	0.228	0.633	0.207	0.553	0.243	0.642	0.062	0.437	0.261	0.697	0.194	0.394	0.263	0.743	0.064
GR	0.391	0.239	0.751	0.164	0.266	0.174	0.836	0.035	0.201	0.196	0.878	0.074	0.177	0.205	0.888	0.018
HR	0.248	0.191	0.847	0.087	0.186	0.201	0.886	0.021	0.224	0.220	0.864	0.092	0.230	0.199	0.848	0.022
KR	0.375	0.174	0.771	0.115	0.261	0.183	0.837	0.025	0.259	0.239	0.838	0.114	0.195	0.223	0.879	0.031
KE	0.202	0.216	0.881	0.082	0.120	0.188	0.931	0.019	0.184	0.220	0.888	0.076	0.121	0.178	0.929	0.017
MP	0.536	0.235	0.659	0.209	0.420	0.253	0.728	0.065	0.351	0.245	0.774	0.152	0.229	0.243	0.851	0.046
MH	0.479	0.249	0.700	0.203	0.295	0.193	0.811	0.049	0.256	0.253	0.836	0.119	0.183	0.217	0.889	0.032
OR	0.608	0.286	0.594	0.277	0.392	0.230	0.757	0.082	0.376	0.255	0.763	0.169	0.259	0.205	0.850	0.044
PN	0.221	0.170	0.867	0.070	0.146	0.132	0.916	0.011	0.187	0.170	0.881	0.060	0.180	0.208	0.884	0.015
RJ	0.358	0.196	0.778	0.125	0.264	0.164	0.838	0.025	0.297	0.194	0.821	0.105	0.199	0.190	0.883	0.024
TN	0.375	0.198	0.766	0.131	0.212	0.175	0.872	0.028	0.197	0.207	0.879	0.077	0.128	0.168	0.928	0.016
UP	0.427	0.215	0.727	0.158	0.394	0.193	0.757	0.037	0.341	0.229	0.784	0.139	0.317	0.231	0.799	0.039
WB	0.382	0.207	0.759	0.139	0.288	0.183	0.824	0.031	0.244	0.216	0.847	0.098	0.219	0.207	0.870	0.025
India	0.418	0.230	0.735	0.167	0.333	0.205	0.795	0.042	0.257	0.236	0.838	0.112	0.209	0.217	0.872	0.030

Source Authors' own calculation using unit-level NSSO 61st and 66th rounds

Table 11.2 Change in SST index in rural and urban areas

State	Rural				Urban			
	Rate	Gap	Gini	SST index	Rate	Gap	Gini	SST index
AP	−0.297	−0.041	0.076	−0.748	−0.244	0.051	0.043	−0.739
AS	0.096	−0.053	−0.034	−0.782	0.188	0.173	−0.019	−0.727
BR	−0.007	0.068	0.014	−0.702	−0.100	0.005	0.067	−0.669
GR	−0.319	−0.274	0.113	−0.785	−0.119	0.046	0.012	−0.755
HR	−0.253	0.055	0.046	−0.761	0.027	−0.097	−0.018	−0.757
KR	−0.303	0.056	0.086	−0.785	−0.245	−0.066	0.049	−0.723
KE	−0.407	−0.131	0.058	−0.771	−0.344	−0.189	0.046	−0.783
MP	−0.217	0.079	0.106	−0.687	−0.347	−0.008	0.099	−0.697
MH	−0.384	−0.227	0.159	−0.759	−0.287	−0.141	0.063	−0.728
OR	−0.355	−0.197	0.274	−0.705	−0.311	−0.197	0.113	−0.742
PN	−0.340	−0.222	0.056	−0.846	−0.036	0.229	0.003	−0.756
RJ	−0.264	−0.159	0.076	−0.803	−0.329	−0.020	0.075	−0.774
TN	−0.436	−0.115	0.139	−0.790	−0.354	−0.190	0.056	−0.797
UP	−0.079	−0.100	0.041	−0.766	−0.070	0.007	0.019	−0.716
WB	−0.247	−0.117	0.085	−0.779	−0.102	−0.045	0.027	−0.749
India	−0.205	−0.110	0.081	−0.748	−0.190	−0.079	0.041	−0.731

Source Authors' own calculation using unit-level NSSO 61st and 66th rounds

It is discernible from Table 11.2 that between the two time periods, the change in poverty level is mostly due to the count of the poor and the size of the poverty gap when compared with the variation in the distribution of the poor. It is quite evident that the states across India are showing an increase in distribution of the poor in both rural and urban areas. States such as Bihar, Haryana, Karnataka and Madhya Pradesh show an increase in the poverty gap in rural areas, despite the decline in head count poverty.

This evidence undoubtedly informs the disagreement between head count poverty and poverty gaps in most of the states of rural and urban India. The alternative proposed here in the form of the SST index undoubtedly overcomes the limitation of poverty head count which is based on the likelihood principle. This index accommodates the absolute change in the count of the poor and the non-poor which adds strength to its representing state of poverty. A clear pattern emerges in the computation that there is a decrease in poverty due to mere addition of the non-poor instead of decrease of the poor in rural Gujarat, Haryana, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and India. On the other hand, Andhra Pradesh, Karnataka, Kerala, Odisha and West Bengal poverty have witnessed a decrease in poverty along with a decrease in the number of the poor (see Table 11.3). However, this is not completely true for urban India.

The percentage changes in poor population depict that the decline in the percentage of the poor is highest in Kerala, followed by Tamil Nadu, Maharashtra and Odisha in rural India, whereas the decline is highest in Odisha and Madhya

Table 11.3 Changes in poor and non-poor population in rural and urban India

State	Rural			Urban			Rural			Urban		
	Absolute difference between 2009–2010 and 2004–2005						Percentage change in poor and non-poor					
	Poor	Non-poor	Total	Poor	Non-poor	Total	Poor	Non-poor	Total	Poor	Non-poor	Total
AP	−53,031	48,741	−4,290	−5,549	34,281	28,732	−30.3	13.3	−0.8	−12.7	24.0	15.4
AS	14,555	1,895	16,450	2,226	2,685	4,911	17.5	1.3	7.2	43.8	14.7	21.0
BR	36,273	33,869	70,142	4,960	15,225	20,185	9.8	11.5	10.5	16.7	39.7	29.6
GR	−34,880	48,646	13,766	4,469	42,877	47,346	−28.8	25.8	4.4	13.7	32.9	29.1
HR	−9,065	13,672	4,607	2,395	6,497	8,892	−23.1	11.5	2.9	18.6	14.6	15.5
KR	−40,536	33,577	−6,959	−2,947	37,172	34,225	−31.7	15.7	−2.0	−7.5	33.1	22.6
KE	−20,234	12,848	−7,386	−3,569	11,923	8,354	−42.5	6.8	−3.1	−26.8	20.2	11.6
MP	−47,106	62,278	15,172	−15,479	22,663	7,184	−19.1	29.2	3.3	−31.4	24.8	5.1
MH	−100,323	103,493	3,170	−21,165	55,047	33,882	−38.0	36.0	0.6	−22.2	19.9	9.1
OR	−71,762	65,454	−6,308	−6,154	5,315	−839	−36.8	52.0	−2.0	−32.2	16.8	−1.7
PN	−11,579	13,172	1,593	610	5,538	6,148	−33.3	10.8	1.0	4.4	9.1	8.3
RJ	−32,795	62,769	29,974	−6,587	33,865	27,278	−21.3	22.8	7.0	−18.0	39.1	22.1
TN	−53,081	69,186	16,105	−6,346	74,794	68,448	−41.0	32.1	4.7	−14.9	43.2	31.7
UP	−17,667	86,275	68,608	−548	23,280	22,732	−3.1	11.4	5.2	−0.5	10.9	7.0
WB	−61,549	43,242	−18,307	−6,092	251	−5,841	−27.0	11.7	−3.1	−12.9	0.2	−3.0
India	−549,947	783,164	233,217	−51,785	386,242	334,457	−17.9	18.4	3.2	−8.1	20.9	13.5

Source Authors' own calculation using unit-level NSSO 61st and 66th rounds

Pradesh in urban India. Nevertheless, it is worth noting that there is a rising change in the percentage of the poor in both rural and urban areas in Assam. The above analysis shows the poverty intensity measurement through the SST index. The three indicators of the SST index depict that although the first two components are declining, the third component is showing an increasing trend among the states. The result affirms that the decrease in poverty is due to mere addition of the non-poor instead of a decrease in the poor.

11.3 Conclusion

This study made an attempt to investigate one of the most contested debates in poverty measurement. The Sen–Shorrocks–Thon index of poverty intensity effectively summarized the extent of poverty, partly because it can be decomposed into the poverty rate, the average poverty gap ratio and the degree of inequality in poverty gaps in the population. The result affirms that although the headcount poverty is declining, inequality has been increasing as indicated by rising values of Gini. This paper has put forward the argument that mere addition of the non-poor need not be considered as poverty reducing unless these people provide financial assistance to the non-poor. But in the conventional measurement of head count of poverty, mere addition of the non-poor results in reduced levels of poverty. Hence, this illustration is a definite improvement over the simplistic head count of poverty which is inadequate to describe the state of poverty.

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