

# Handbook of Research on Global Indicators of Economic and Political Convergence

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# Chapter 15

## Economic Convergence and Real Dimensions: The Case of Shelter Deprivation

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### ABSTRACT

*Economic convergence exists when two or more economies tend to reach a similar level of development and wealth. The idea of convergence in economics is the hypothesis that poorer economies' per capita incomes will tend to grow at faster rates than richer economies. Though income is considered to be an important indicator, it is now widely recognized that 'real' dimensions like nutrition, health, shelter, education etc. assess the overall wellbeing of an individual/household. The objective of this chapter is to discuss and formulate a methodology by which one can measure shelter deprivation and its convergence in a region as a step forward to add on to overall well-being of an individual or household. This chapter not only shows a methodology to calculate such divergence and analyses the reasons for such divergence, but also prepares a list of possible combinations of policy prescriptions by which a policy maker, such as the government, can find the extent of rectification of shelter deprivation of a group given its allotment of budget.*

### INTRODUCTION

Economic convergence exists when two or more economies tend to reach a similar level of development and wealth. The idea of convergence in economics is the hypothesis that poorer economies' per capita incomes will tend to grow at faster rates than richer economies. As a result, all economies should eventually converge in terms of per capita income. Developing countries have the potential to grow at a faster rate than developed countries. Furthermore, poorer countries can replicate the production methods, technologies, and institutions of developed countries.

We know that in economic literature, the term “convergence” might have two meanings. The first kind (sometimes called “sigma-convergence”) refers to a reduction in the dispersion of levels of income across economies. “Beta-convergence” on the other hand, occurs when poor economies tend to grow

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faster than richer ones. Economists say that there is “conditional beta-convergence” when economies experience “beta-convergence” but it is conditional on other variables being held constant.

Though income is considered to be an important indicator in the study of economic divergence, it is now widely recognized that ‘real’ dimensions<sup>1</sup> like nutrition, health, shelter, education etc. assess the overall wellbeing of an individual/household. Even if income is considered to be an accurate, sufficient or exhaustive indicator, information about the achievement or deprivations of an individual with respect to real factors may be of interest on policy grounds. Sen (1987) stated that ‘income’ is necessarily a useful indicator but is not adequate in judging the overall well-being or the degree of actual deprivation. For more accurate assessment of an individual’s well-being or deprivation, one may need to identify the various ‘real’ dimensions of well-being and assess the individual’s overall well-being or deprivation on the basis of the individual’s achievements in terms of these dimensions. Also, even if one considered income to be an accurate indicator of overall well-being or deprivation, for policy purposes one may still need information about achievements or deprivations of an individual or a community in terms of specific real indicators of well-being.

### **OBJECTIVES**

The objective of this chapter is to discuss and formulate a methodology, similar to that of Chakraborty (2010) by which one can measure shelter deprivation and its convergence in a region as a step forward to add on to overall well-being of an individual or household. Though it requires a broader study ‘real aspects’ of the standard of living, over time, in this region, this chapter believes that this may also be of independent interest as a case study insofar as:

1. It seeks to grapple with the problem of multidimensional deprivation in the context where much information is likely to be qualitative rather than quantitative; and
2. To the best of my knowledge, there are not much detailed case studies of shelter deprivation in regions like India.

The objective of this chapter is thereby to formulate how to test the convergence of regions, preferably two states of the country India, in the sense that whether one state, that is more deprived, converges to the other, which is less deprived, over time.

Though the objective of this chapter is similar to that of Sundaram and Tendulkar (1995) and Gundersen (1996), there are a few differences too. First, Sundaram and Tendulkar (1995) studied the problem on a large scale mainly on inter-country basis while this paper would like to confine itself to only a two regions (viz. villages<sup>2</sup>) taken from two different districts of the state of West Bengal of India so that the study is more focused. Second, this chapter has a different conceptual structure regarding aggregation of individual indices. Finally, this chapter attempts to find a rule, a formula, which will be of immense help for the policy makers to distribute funds and aid relating to shelter deprivation at the grass-root level so that one region may converge to the other. But rectification and development funds are very limited in developing countries and hence such limited funds have to be judiciously economized so that the deprivation levels can be reduced the maximum. That is, the attributes for which the deprivation levels are high are to be identified and given priority in allocation of funds. This chapter proposes a comparative static analysis which is of great help in determining up to how much the shelter deprivation can be regulated with limited funds and finding out the best combination of policies to do so.

## METHODOLOGY

### Basic Structure and Methodology

Various groups  $N = \{1, 2, \dots, n\}$  comprising either of reserved category of people namely SC, ST, OBC, General or Total population of each group for which convergence is measured are to be considered whose deprivation are to form the principal interest of our study. Let  $\mathbf{d}$  denote the degree of housing deprivation for the group  $N$  such that  $\mathbf{d}$  is an increasing function of  $\mathbf{d}_i$  ( $i = 1, 2, \dots, n$ ) where  $\mathbf{d}_i$  denotes the degree of individual  $i$ 's housing deprivation. Hence we may write  $\mathbf{d} = F(\mathbf{d}_1, \mathbf{d}_2, \mathbf{d}_3, \dots, \mathbf{d}_n)$ . We assume that  $\mathbf{d}_i$  lies in the interval  $[0, 1]$  and an individual is said to be deprived if and only if  $\mathbf{d}_i > 0$ . However, it is to be admitted that this paper does not distinguish between individuals who do not suffer from housing deprivation but who have different levels of achievement in terms of housing. The intuitive conclusion about this formulation is that the degrees of 'overachievements' in terms of housing, of individuals, who are not deprived in terms of housing, are irrelevant for the purpose of measuring the housing deprivation of the group. This is, of course, exactly analogous to the literature on poverty measurement where no distinction is made between the different non-poor individuals.

In the process we assume that all the individuals living in the same housing unit enjoy the same standard of housing by ignoring any intra-household differences that may exist in this respect. It is obvious that in judging the standard of housing available to the individuals in a household, one has to take into account many different attributes like condition of roof, the amount of available floor space, type of toilet facilities, etc. Indeed, this multiplicity of the relevant attributes, together with the quantitative nature of some of these attributes, constitutes a major source of complexity in evaluating the standard of housing. To judge the standard of housing available to the individuals in a household, this paper takes into consideration a set of various different relevant attributes  $\mathbf{Z}$  (relating to adequacy, environment, sanitation, comfort, etc.). For every individual  $i \in N$  and for every attribute  $x$ , let  $\mathbf{y}_i(\mathbf{x})$  denote  $i$ 's actual consumption of attribute  $x$ . since many of the attributes are qualitative rather than quantitative in nature, we are to assume and assign a relevant real number<sup>3</sup> to denote its level. Let for every attribute  $x$ , let  $\mathbf{r}(\mathbf{x})$  denote the benchmark level of the consumption of attribute  $x$ , i.e.  $\mathbf{r}(\mathbf{x})$  is the level of consumption which is considered satisfactory. For example, if  $x_i$  is 'drinking water facilities', then  $\mathbf{r}(\mathbf{x})$  is 'piped drinking water' which this paper considers the best possible alternative. But then, as these are qualitative in nature, they are denoted by  $\mathbf{b}(\mathbf{x})$ , which then is converted, to a real number  $\mathbf{r}(\mathbf{x})$  by a rule to be discussed later. It follows that individual  $i$ 's consumption of attribute  $x$  is satisfactory if and only if  $\mathbf{y}_i(\mathbf{x}) \geq \mathbf{r}(\mathbf{x})$ . We assume that, for every  $i \in N$ , the degree of housing deprivation,  $\mathbf{d}_i$ , is a function of  $\mathbf{y}_i(\mathbf{x})_{x \in \mathbf{Z}}$  and  $\mathbf{r}(\mathbf{x})_{x \in \mathbf{Z}}$ . Thus, the function can be written as:

$$d_i = f\left(\mathbf{y}_i(\mathbf{x})_{x \in \mathbf{Z}}, \mathbf{r}(\mathbf{x})_{x \in \mathbf{Z}}\right)$$

### The Criteria and the Attributes

Though there are numerous attributes which are relevant in judging the standard of housing enjoyed by the members of the household, this chapter focuses and considers a set of only 20 such attributes. These attributes are partitioned into four groups each of which is called as criterion. The partitioning of the attributes is not entirely arbitrary; it has an intuitive basis in so far as the attributes in each criterion relate to

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a specific intuitive aspect of housing. The four criteria henceforth will be called adequacy (A), sanitation (S), environment (E) and comfort (C). Following are the explanations of each criterion and its elements.

1. **Structural Adequacy (A):** The basic purpose of a house is to provide protection against the elements and this is the aspect that is captured by this particular criterion. This paper considers a set  $\{a_1, a_2, a_3\}$  of following three attributes for this criterion to explain structural adequacy of a house.

- a. Condition of the roof ( $a_1$ )
- b. Condition of the walls ( $a_2$ )
- c. Condition of the floor ( $a_3$ )

However, it is to be admitted that many other attributes could have been included into this criterion for its exhaustiveness, but as field data is generally collected by surveyors, who actually are not dwellers of those houses, one has to totally depend on their value judgments which generally is also a fact that it is difficult for them to judge exactly in cases when such attributes<sup>4</sup> cannot be understood just by seeing it externally.

2. **Sanitation (S):** Habitat without sanitary facilities may offer protection from the elements but may cause serious health problems and hence sanitary facilities constitute a basic necessity. This paper considers the criterion of sanitation to be a set,  $\{s_1, s_2, s_3\}$  of following three attributes:

- a. Quality of drinking water ( $s_1$ )
- b. Quality of water for bathing and washing ( $s_2$ )
- c. Toilet facilities ( $s_3$ )

It is tempting to assume that in view of the reality of rural India, one can afford to ignore the toilet facilities. However given that toilet facilities are important for hygienic living, this paper seeks to capture that concept of 'absolute deprivation' rather than 'relative deprivation. Given this, the fact that most of the rural population of India does not have proper toilet facilities either in the house itself or in the compound of the house, it is not a compelling reason for not including toilet facilities as a relevant attribute.

3. **Environment (E):** Health and hygiene outside the floor area is as important as that inside. Taking this into consideration the criterion of environment is considered a set  $\{e_1, e_2, e_3\}$  of following three attributes:

- a. Presence or absence of stagnant water near the house ( $e_1$ )
- b. Presence of garbage in around the house ( $e_2$ )
- c. Presence of cattle/other animals in proximity ( $e_3$ )

It is to be admitted that many other<sup>5</sup> attributes could have been included into this criterion for its exhaustiveness, but as only such attributes are common to villages in India, this paper considers the aforementioned. However, one can add many other attributes that may be suitable for a particular place or village where the actual survey and the study are to be done.

4. **Comfort (C):** Here we gather together several attributes which, individually, may not be essential as any of those included in structural adequacy, sanitary facilities and environment, but which are important for comfortable living. This criterion of comfort encompasses:

- a. Floor space per adult equivalent ( $c_1$ )
- b. Room per adult equivalent ( $c_2$ )
- c. Presence of electricity ( $c_3$ )
- d. Presence of separate kitchen ( $c_4$ )

- e. Distance from the source of drinking water ( $c_5$ )
- f. Distance from the source of water for washing and bathing ( $c_6$ )

For the purpose of calculating the amount of floor space per person and the number of rooms per person, a child<sup>6</sup> should not have the same status as an adult<sup>7</sup>, since children need less space at home than adults. It can be assumed, though arbitrarily, that a child of no more than 5 years should count as  $\frac{1}{4}$ <sup>th</sup> of an adult and a child of more than 5 years should count as  $\frac{1}{2}$  an adult. The number of adult equivalent has to be calculated for each household using these conversion factors. Note that the floor space per adult equivalent is intended to be an indicator of the amount of space that members of the household have while the number of rooms per adult equivalent is intended to capture the amount of privacy that they enjoy.

## NUMERICAL REPRESENTATION OF CONSUMPTION LEVELS

Some of the attributes, like floor area per adult equivalent, come with obvious numerical measures for corresponding consumption levels. In contrast, the condition of walls does not have any such obvious measure and in real life is judged qualitatively by saying whether it is broken or not. But for numerical analysis the issue is how to transform such qualitative data into some numerical value. Note that numerical measures that seek to capture qualitative judgments cannot have a compelling obviousness of the ‘natural’ numerical measures available in the case of an attribute such as the floor space enjoyed by a person. They must involve judgments, and, to that extent, they must involve an element of arbitrariness. However, so long as the underlying judgments are made clear, they do serve a useful purpose.

1. **Specification of Achievement Levels:** For an attribute  $x$ , the different possible qualitative levels have to be specified. As for example, for the criterion **A** (Structural Adequacy) and  $a_1$  (condition of the roof), one can consider four levels of achievements listed in ascending order:
  - a. Very poor and will leak if it rains ( $a_{1,1}$ )
  - b. Roof will partly leak in some parts of the house ( $a_{1,2}$ )
  - c. Roof will not leak but still needs repair ( $a_{1,3}$ )
  - d. Good ( $a_{1,4}$ )

In general, for any given attribute  $x$ , one has to distinguish in quantitative terms,  $t[x]$  levels of possible achievements  $(x.1), (x.2) \dots (x.t[x])$ . In Appendix I, we identify the different qualitative levels of achievements for the other attributes.
2. **Benchmarks for the Different Attributes:** For every attribute  $x$ , a qualitative ‘benchmark’ level,  $b[x]$  has to be specified, such that any household that falls short of that benchmark is deprived in terms of  $x$ . As for the condition of the roof  $a_1$ , we consider the achievement level  $a_{1,4}$  to be the benchmark so that any household achieving only  $a_{1,1}, a_{1,2}$  and  $a_{1,3}$  will be considered to be deprived in terms of condition of the roof. Thus  $b[a_1]$  is  $a_{1,4}$ .
3. **Specification of Numerical Scores:** Let  $i$  be a given individual and  $x$  be a given attribute. Suppose the level of  $i$ ’s achievement in terms of  $x$  is  $x.k$  and  $b[x]$  is  $x.k$ . The achievement score  $y_i(x)$  for  $x$  is to be specified as  $(k-1)$  and the numerical benchmark score  $r(x)$  for  $x$  to be  $(k-1)$ . Consider the following example. Suppose, in terms of the condition of the roof  $a_1$ , household  $i$ ’s achievement level is ‘roof will partly leak in some parts of the house’ ( $a_{1,2}$ ). Then  $i$ ’s achievement score  $y_i(a_1)$

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is given by  $(2-1)=1$  and noting  $b[a_1] = a_1 \cdot 4$ , the benchmark score of  $a_1$  is  $(4-1) = 3$ . At the risk of emphasizing the obvious, it may worth be explaining the intuitive procedure underlying this method for specifying  $y_i(x)$  and  $r(x)$ . The procedure is actually the procedure for assigning rank numbers under the well-known **Borda**<sup>8</sup> rule, supplemented by the rule of normalization. Since there are four possible achievement levels for the roof  $a_1$ , the rank numbers for them range from 1 to 4, a higher number being assigned to a higher achievement level; like rank number assigned to the benchmark level  $b[a_1] = a_1 \cdot 4$  is 4. These numbers are then normalized by deducting 1 from each of them, so that the lowest possible achievement level ( $a_1 \cdot 1$ ) is assigned the number 1 and the benchmark level  $b[a_1]$  is represented by the benchmark score 3.

**The Function f:** Given the scores  $y_i(x)$  and  $r(x)$  for each attribute  $x$ , the overall deprivation  $d_i$  of individual  $i$  can be obtained by a three-stage technique. First, for every individual  $i$  and every attribute  $x$ , his or her deprivation in terms of that attribute can be represented as:

$$d_i(x) = \begin{cases} 0 & \text{if } y_i(x) \geq r(x) \\ \frac{r(x) - y_i(x)}{r(x)} & \text{if } y_i(x) < r(x) \end{cases}$$

Where individual  $i$  is said to be deprived of the attribute  $x$  if  $y_i(x) < r(x)$  and thus  $d_i(x) > 0$ . Intuitively, an individual is deprived in terms of attribute  $x$  if and only if  $i$ 's achievement score falls short of the benchmark score for  $x$ . further, the degree of deprivation, if any, is the shortfall from the benchmark score expressed as a percentage of the benchmark score.

Once the level of deprivation of an individual is obtained for each attribute  $d_i(x)$ , the deprivation of individual  $i$  for each criterion  $d_i(X)$  can be obtained by the following two alternative measures.

$$d'_i(X) = \frac{\sum d_i(x)}{|X|}$$

$$d''_i(X) = \begin{cases} 0 & \text{if } \sum \frac{r(x) - y_i(x)}{r(x)} \leq 0 \\ \frac{\sum \frac{r(x) - y_i(x)}{r(x)}}{|X|} & \text{if } \sum \frac{r(x) - y_i(x)}{r(x)} > 0 \end{cases}$$

The two alternative ways of computing the degree of deprivation in terms of  $X$  differ insofar as  $d''_i(X)$  allows deprivation in terms of one attribute in  $X$  to be compensated by over-achievement in terms of another attribute in  $X$ , where  $d'_i(X)$  does not allow for such compensation or trade-off. Therefore if one uses  $d'_i(X)$  as a measure of  $i$ 's deprivation in terms of  $X$  and  $i$  happens to be deprived in terms of any attribute in  $X$ , then  $i$  will turn out to be deprived in terms of criterion  $X$ , no matter how high  $i$ 's achievements in terms of the other attributes in  $X$  may be. However, for all  $X$  in  $\{A,S,E\}$  and all  $x$  in  $X$ , the benchmark score in terms of  $x$  is also the highest of all the possible achievement scores for  $x$ , and therefore,



for all  $x \in \{A, S, E\}$  and for all  $x \in X$ , we must have  $\frac{r(x) - y_i(x)}{r(x)} > 0$

for all  $x \in \{A, S, E\}$  we must have  $d'_i(X) > d''_i(X)$

It is only for  $X=C$  that  $d'_i(X)$  and  $d''_i(X)$  may diverge as the benchmark level is not the top-most level. The judgment is that none of the attributes in  $C$  is as 'essential' as those in  $A, S$  or  $E$ . therefore, in thinking of a household's deprivation in terms of comfort, it does not seem unreasonable to allow for the possibility of the shortfall in terms of one attribute in  $C$  being partly or fully cancelled out by the over-achievement in terms of another attribute in  $C$ . For example, it is not implausible to argue that the shortfall in terms of 'kitchen' arriving from the absence of kitchen could be compensated, at least partially, by an over-achievement in terms of 'floor space per adult equivalent'.

The overall deprivation of an individual  $i$  is assumed to a weighted average of the deprivations of  $i$  in terms of each of the four criteria. However, since for every criterion  $X$ , there may be two conceptually different measures of deprivation  $d'_i(X)$  and  $d''_i(X)$ , and since  $d'_i(C)$  is actually different from  $d''_i(C)$ , there must be two different distinct versions of the overall deprivation  $d_i$  for individual  $i$ .

$$d'_i = w(A) \cdot d'_i(A) + w(S) \cdot d'_i(S) + w(E) \cdot d'_i(E) + w(C) \cdot d'_i(C)$$

$$d''_i = w(A) \cdot d''_i(A) + w(S) \cdot d''_i(S) + w(E) \cdot d''_i(E) + w(C) \cdot d''_i(C)$$

where  $w(A)$ ,  $w(S)$ ,  $w(E)$  and  $w(C)$  are non-negative weights adding up to 1. These weights can be considered equal and taken to be each equal to  $1/4$  or in any other fashion as the investigator perceives about the importance of the criterion. Suppose the investigator opines that 'comfort' is not that much essential, he may consider  $w(A) = w(S) = w(E) = 2/7$  and  $w(C) = 1/7$ .

## AGGREGATION OF INDIVIDUAL DEPRIVATION LEVELS

Once derived a measure of housing deprivation of every individual in  $N$ , the process to measure the housing deprivation of the group  $N$  is similar to measuring income poverty of a group, given the percentage shortfall of each individual from the poverty threshold. For this, the three measures can be used, the Sen Measure, the Quadratic Measure and the Simple Average each of which can be based either on  $(d'_1, d'_2, \dots, d'_n)$  or on  $(d''_1, d''_2, \dots, d''_n)$ . Thus there are actually six different measures of housing deprivation on  $N$ . Measures based on  $(d'_1, d'_2, \dots, d'_n)$  are termed as **Type - I** and those based on  $(d''_1, d''_2, \dots, d''_n)$  are termed as **Type - II**.

Let  $\mathbf{J}$  be the set of all  $I$  in  $N$  such that  $d'_i > 0$ . Let  $\mathbf{p}$  be the cardinality of  $\mathbf{J}$ . Index the individuals in  $\mathbf{J}$  as  $j(1), j(2), \dots, j(\mathbf{p})$  in such a way that  $d'_{j(1)} \leq d'_{j(2)} \leq \dots \leq d'_{j(\mathbf{p})}$ . For all  $I$  in  $\mathbf{J}$ , the rank of  $i$ , denoted by  $\mathbf{q}(i)$ , is defined to be  $\mathbf{v}$  where  $\mathbf{I} = \mathbf{j}(\mathbf{v})$ . Then,

$$\text{Sen Measure (Type-I)} = \frac{2 \sum_{i \in \mathbf{J}} q(i) \cdot d'_i}{n(\mathbf{p} + 1)}$$

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$$\text{Quadratic Measure (Type-I)} = \frac{\sum_{i \in j} (d'_i)^2}{n}$$

$$\text{Simple Average (Type-I)} = \frac{\sum_{i \in j} (d'_i)}{n}$$

Type – II measures can be defined similarly in terms of  $d''_i$ . The Sen's Measure was first introduced in his classic paper Sen (1976)<sup>9</sup>. The Quadratic measure is a distinguished element of the class of poverty measures considered by Foster, Green and Thorbecke (1984). The Simple Average is just the aggregate of all deprivations divided by the total number of individuals in the group under consideration but this measure has serious limitations insofar the intuitively compelling 'transfer axiom'.

## **HOW TO RECTIFY THE DEPRIVATION?**

The policy makers need a readymade formula so that they can formulate rectification measures easily and accurately. But rectification and development funds are very limited in developing countries and hence such limited funds have to be judiciously economized so that the deprivation levels can be reduced the maximum. That is, the attributes for which the deprivation levels are high are to be identified and given priority in allocation of funds. A comparative static analysis is of great help in this respect. This analysis can be done in the following manner. Force the ill-performed attributes one-by-one to their benchmark levels and note the change in the overall deprivation levels. Now, try this for every permutation and combination of such attributes. Each such combination will have a corresponding net ability to reduce overall deprivation and will also have a particular cost. These abilities and costs are to be ranked and tabulated. Now, if the policy maker wants to reduce the level of deprivation to a particular level, he can allocate the corresponding fund. On the other hand, if the policy maker wants to minimize deprivation by spending a particular level of money, he can easily find the combination of change in attributes for that amount of money. Hence, such combination of attributes has to be ranked both in terms of net deprivation levels and in terms of total costs. It is however to be noted that some of the attributes have to be rectified individually for which some of the households are deprived but others are not. There are some other attributes (*like tap water facility*) which is of public good nature for which simultaneous deprivation applies.

This study does not take into consideration about the cost of rectification of the attributes and therefore does not survey for such costs. It therefore follows that this study can only rank combinations of rectification measures according as the amount of overall deprivation they can rectify. Taking into consideration the amount of data and attributes and considering the fact that each attribute has numerous surveyed, the number of combinations to be considered is magnum opus which cannot be done in this chapter that emphasizes more on measurement of housing deprivations than on rectifying them accurately. However, this chapter identifies potential criteria and attributes where the dwellers perform badly and combines policies to test the change in the deprivation levels following an improvement in the score of such attributes. This process of comparative static analysis is performed by taking the lowest scoring attributes first. However, we will consider individual attributes and not individual dweller.

## **DATA AND OBSERVATIONS**

The data about housing deprivation in the surveyed regions<sup>10</sup> have been collected by a questionnaire to study the various aspects of housing deprivation of people in backward areas. The questionnaire has been formulated keeping in view the various attributes considered in this study to formulate the required indicators taken to measure the deprivation of people with respect to shelter.

There are several observations that must be stated about this data at the outset.

First, the data collected on each house is based on direct observation and assessment of an investigator who visited the house and not on the assessment of the house by the people living in it. For example, it was the investigator's observation and judgment that decided whether the roof of the house is under 'very poor and will leak if it rains' or under 'will not leak if it rains, but still in need of some repair'. This of course, involves the subjective judgment of the investigator, but it is not clear how one can avoid subjective judgments in such matters.

Secondly, every house of the village was observed by one investigator at only one point of time rather than over a period of time, and the different questions in the questionnaire were answered by the investigator on the basis of his observation on the house at that particular point of time. This clearly has its limitations. If the roof of the house is usually badly damaged in every monsoon, but is regularly repaired after the monsoon, and if the investigator happens to observe it only after the monsoon, then the fact that the roof is regularly in a damaged state during the monsoons will not be reflected in the observations of the investigator. One way of avoiding such difficulties would have been for the investigator to make repeated visits to the same household over a year or so, but this was not practicable. Another way of handling such difficulties can be to ask the members of the household questions involving the state of the house over a period of time, even though the investigator visits the house at only one point of time. However, this paper does not include data with such modified questions and thus is one such limitations of this study.

Lastly, there are a few cases of non-response to some questions and some cases where the response sounded vague. In such cases, in such cases, investigators relied on neighbors. But, these instances are very less in number and are expected not to influence the results largely.

This chapter organizes its findings in various charts and tables which deal with two distinct aspects of the analysis of housing deprivation. First, the histograms show, for different groups of individuals, the distribution of deprivation in terms of specific criteria, and also the distribution of overall housing deprivation. Second, the tables give indices of housing deprivation for different groups of individuals, calculated on the basis of alternative measures of housing deprivation.

Most of the data that was surveyed in this project was qualitative in nature and thereby highly dependent on value judgment of the surveyors. This makes the consideration and classification of data very difficult. Moreover, there are two more problems. First, that the different surveyors may classify same data differently. Second, the same surveyor may classify a particular type of data differently when he visits a different set in different place. For example, different surveyors may differently rank 'Roof', 'Floor' or 'Walls' differently as 'very good', 'good', 'poor' or 'very poor'. This is the first type of problem. The second problem is that the same surveyor may consider a similar type of 'Roof' in two different villages differently into 'very good', 'good', 'poor' or 'very poor'.

As for example, for the criterion A (Structural Adequacy) and a1 (condition of the roof), how can one consider the four levels of achievements without knowing the true standard for each level:

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1. Very poor and will leak if it rains (a1.1)
2. Roof will partly leak in some parts of the house (a1.2)
3. Roof will not leak but still needs repair (a1.3)
4. Good (a1.4)

## **ANALYSIS OF POOLED DATA**

### **Pooled Data**

Instead of taking data of two countries or two of its states, this study considers only two regions, specifically villages, each taken from two different districts viz. Purulia and Burdwan of the state of West Bengal in India. The pooled data for these two villages consists of 52 households with a total population of 239. Out of these 231 belong to Scheduled Tribes (ST) and 8 to Other Backward Classes (OBC). There are no Scheduled Caste (SC) and General (G) class people in this village. We therefore term Scheduled Caste as SC and non-SC as NSC henceforth. The distribution of the total population among different groups that this paper considers is shown in Table 1.

### **Classification of Population into Groups**

In addition to the total population of the village, we consider groups of individuals, defined in terms of:

1. Caste [the scheduled tribes (ST) and the non-scheduled tribes (NSC) population]
2. Age [adults and children]
3. Age & sex [adult males and adult females]
4. Regions [region I & region II]

The partition of the total population into the ST population and NST population has an obvious interest since, in rural India; the caste is believed to have a close relation with economic status. The significance of the partition in terms of age and sex may not be so transparent. Since, this paper ignores intra-household differences; it may be asked why one should introduce the principles of sex and age in identifying the groups that may be of interest in this context. The reason for considering age and sex

*Table 1. List of surveyed households in two districts of West Bengal*

	<b>Entire Village</b>	<b>Region-I (Purulia)</b>	<b>Region-II (Burdwan)</b>	<b>SC</b>	<b>ST</b>	<b>OBC</b>	<b>GENERAL</b>
No. of Households	52	24	28	0	51	1	0
Total Population	239	109	130	0	231	8	0
Children	85	41	44	0	83	2	0
Adults	154	68	86	0	148	6	0
Adult males	82	36	46	0	79	3	0
Adult Females	72	32	40	0	69	3	0

is that, in India, there is a general presumption that the number of children tends to be higher in more deprived households. If this is true, then one would expect to see a greater degree of deprivation among children than among adults. Similarly, in West Bengal, the opportunity for employment is likely to be higher for men than among women. Also, traditionally, men handle the job of repairing their house to a greater extent than women. Therefore, one would expect that individuals in households with a relatively larger number of adult women are more likely to suffer from housing deprivation than individuals in households with a relatively larger number of adult men. However, since neither the consideration of employment nor the consideration of differential ability to do the physical work of repairing the house is relevant in the context of children, this paper considers the distinction on the basis of sex for adult population only.

### The Distribution of Deprivation

#### All Households of the Village

When the total population of the pooled regions is considered, it is found that the Sen's measure of housing deprivation is 0.62 (see Table 2). It means that the dwellers are 62% shelter deprived. In other words, the pooled regions are 62% away from the minimum benchmark level they should enjoy in terms of housing facilities. However, the level of deprivation decreases (*from 0.62 to 0.61 and then to 0.51*) as the importance of comfort falls (*from 1/4 to 1/7, and then to 0*). This shows that the people are worse-off in terms of comfort of their houses (see Table 2, 3 &4).

Table 2. Total population when  $w(A) = 1/4$   $w(S) = 1/4$   $w(E) = 1/4$   $w(C) = 1/4$

Group	First Measure considering d'i			Second Measure considering d''i		
	Sen's Measure	Quadratic Measure	Simple Average	Sen's Measure	Quadratic Measure	Simple Average
Children	0.58	0.35	0.59	0.56	0.30	0.54
Adult	0.59	0.36	0.60	0.60	0.33	0.57
Female	0.56	0.35	0.59	0.56	0.30	0.54
Male	0.57	0.35	0.59	0.55	0.29	0.53
Total	0.62	0.37	0.60	0.61	0.35	0.59

Table 3. Total population when  $w(A) = 2/7$   $w(S) = 2/7$   $w(E) = 2/7$   $w(C) = 1/7$

Group	First Measure considering d'i			Second Measure considering d''i		
	Sen's Measure	Quadratic Measure	Simple Average	Sen's Measure	Quadratic Measure	Simple Average
Children	0.57	0.34	0.58	0.58	0.31	0.55
Adult	0.58	0.34	0.58	0.59	0.33	0.57
Region – I	0.55	0.35	0.59	0.53	0.28	0.53
Region – II	0.55	0.35	0.58	0.53	0.28	0.52
Total	0.61	0.35	0.59	0.53	0.34	0.58

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Table 4. Total population when  $w(A)=1/3$   $w(S)=1/3$   $w(E)=1/3$   $w(C)=0$

Group	First Measure considering $d''_i$			Second Measure considering $d'''_i$		
	Sen's Measure	Quadratic Measure	Simple Average	Sen's Measure	Quadratic Measure	Simple Average
Children	0.51	0.32	0.56	0.51	0.32	0.56
Adult	0.51	0.33	0.57	0.51	0.33	0.57
Region – I	0.51	0.33	0.57	0.51	0.33	0.57
Region – II	0.51	0.33	0.57	0.51	0.33	0.57
Total	0.52	0.33	0.56	0.52	0.33	0.56

The tabulated results also infer that the various groups of the village, namely, adult, children, male, female, region – I, region – II, etc. are more or less similarly deprived in this village. However, children are better-off than adults when comfort plays a dominant role in determining the overall deprivation. This can be seen from the fact that Sen's second measure for adults and children are 0.60 and 0.56 respectively when  $w(c)=1/4$  but becomes 0.51 each when  $w(c)=0$ .

The performance of these villagers with respect to comfort improves when trade-offs are permitted between the attributes in the criterion of comfort as compared to the situation where no such trade-offs are permitted. This is in accordance with our hypothesis that when under-achievement in terms of one attribute in comfort is allowed to be compensated for by over-achievement in terms of some other attribute in comfort, one can only expect the extent of comfort-deprivation to fall.

## ST and NST Households

As has been the case in India, the reserved castes and tribes are more deprived than the non-reserved ones and hence the positive discrimination in their favor. However, this is not true at least for this pooled data. It therefore implies that the target group for positive discrimination cannot be blindly chosen on the basis of caste, as far as the above analogy is considered. It should be however kept in mind that on one hand this particular regions consists of very few NST population in comparison to the STs, and hence, it is difficult to rely on indices and statistics for such small data sample; and on the other, that even a single household should not be deprived of government aid or correctional positive discrimination only because it is a mere minority in the group. So, policy prescriptions must take such cases into consideration so that it is robust of any peculiarities of the target group and just not rely simply on the rule of thumb.

This can also be known from the indices of housing deprivation. The Sen's measure shows that the ST population is about 60% deprived whereas the NST population is about 70% housing deprived (see Tables 5, 6, 7, 8, 9, and 10). The adults are more deprived than any other people in this village, be it ST or NST population. But this is true only when the criterion 'comfort' carries some weight in the measure of housing deprivation (*see Tables 7 & 10 that all the groups have equal measures*). This proves that unequal achievements in comfort make people unevenly deprived. It follows that if comfort is not taken into consideration; all people are similarly deprived in this village. All the second measures considering  $d'''_{is}$  are less than that of the first measures indicating the fact that there are overachievements in some of the attributes of comfort (*only for this criterion, the benchmark levels are not the maximum achievement levels*) by some people.

Table 5. ST population when  $w(a)= 1/4$   $w(s)= 1/4$   $w(e)=1/4$   $w(c)=1/4$

Group	First Measure considering d'i			Second Measure considering d''i		
	Sen's Measure	Quadratic Measure	Simple Average	Sen's Measure	Quadratic Measure	Simple Average
Children	0.57	0.34	0.60	0.56	0.30	0.54
Adult	0.59	0.35	0.58	0.60	0.33	0.57
Female	0.56	0.35	0.59	0.56	0.30	0.54
Male	0.57	0.35	0.59	0.55	0.29	0.53
Total	0.61	0.37	0.60	0.61	0.35	0.59

Table 6. ST population when  $w(a)= 2/7$   $w(s)= 2/7$   $w(e)=2/7$   $w(c)=2/7$

Group	First Measure considering d'i			Second Measure considering d''i		
	Sen's Measure	Quadratic Measure	Simple Average	Sen's Measure	Quadratic Measure	Simple Average
Children	0.57	0.33	0.57	0.58	0.30	0.55
Adult	0.58	0.34	0.58	0.59	0.33	0.57
Region – I	0.55	0.34	0.58	0.56	0.30	0.54
Region – II	0.54	0.33	0.57	0.57	0.30	0.54
Total	0.60	0.35	0.58	0.60	0.30	0.55

Table 7. ST population when  $w(a)= 1/3$   $w(s)= 1/3$   $w(e)=1/3$   $w(c)=0$

Group	First Measure considering d'i			Second Measure considering d''i		
	Sen's Measure	Quadratic Measure	Simple Average	Sen's Measure	Quadratic Measure	Simple Average
Children	0.50	0.32	0.56	0.50	0.32	0.56
Adult	0.51	0.32	0.56	0.51	0.32	0.56
Region – I	0.51	0.32	0.56	0.51	0.32	0.56
Region – II	0.51	0.32	0.56	0.51	0.32	0.56
Total	0.51	0.32	0.56	0.51	0.32	0.56

Table 8. NST population when  $w(a)= 1/4$   $w(s)= 1/4$   $w(e)=1/4$   $w(c)=1/4$

Group	First Measure considering d'i			Second Measure considering d''i		
	Sen's Measure	Quadratic Measure	Simple Average	Sen's Measure	Quadratic Measure	Simple Average
Children	0.67	0.46	0.67	0.64	0.41	0.64
Adult	0.73	0.53	0.73	0.73	0.53	0.73
Female	0.69	0.48	0.69	0.69	0.48	0.69
Male	0.71	0.50	0.70	0.71	0.50	0.71
Total	0.71	0.50	0.71	0.71	0.50	0.71

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Table 9. NST population when  $w(a)=2/7$   $w(s)=2/7$   $w(e)=2/7$   $w(c)=2/7$

Group	First Measure considering d'i			Second Measure considering d''i		
	Sen's Measure	Quadratic Measure	Simple Average	Sen's Measure	Quadratic Measure	Simple Average
Children	0.68	0.46	0.68	0.69	0.43	0.66
Adult	0.71	0.50	0.71	0.69	0.50	0.71
Region – I	0.69	0.48	0.69	0.69	0.48	0.69
Region – II	0.69	0.48	0.69	0.69	0.48	0.69
Total	0.70	0.49	0.70	0.69	0.49	0.70

Table 10. NST population when  $w(A)=1/3$   $w(S)=1/3$   $w(E)=1/3$   $w(C)=0$

Group	First Measure considering d'i			Second Measure considering d''i		
	Sen's Measure	Quadratic Measure	Simple Average	Sen's Measure	Quadratic Measure	Simple Average
Children	0.69	0.47	0.69	0.69	0.47	0.69
Adult	0.69	0.47	0.69	0.69	0.47	0.69
Region – I	0.69	0.47	0.69	0.69	0.47	0.69
Region – II	0.69	0.47	0.69	0.69	0.47	0.69
Total	0.69	0.47	0.69	0.69	0.47	0.69

## Indices of Relative Deprivation for Different Groups

The indices of overall deprivation for different groups of individuals in the region may be of great use so far as the nature of policy prescriptions are concerned. This may help policy makers to choose the right target group or the right policy for the group. To compare the deprivations of the various groups, this paper considers the following index for the relative gap between the concerned groups. For every measure of deprivation, H, and every ordered pair of groups (N', N''), the index of deprivation gap (DGI) is the proportion by which the deprivation of N' exceeds the deprivation of N''. Thus, we have:

$$DGI = \frac{DI_{N'} - DI_{N''}}{DI_{N'}}$$

where  $DI_{N''}$  is the deprivation index of N'' under the measure of H (SenQuadratic or Simple Average) and  $DI_{N'}$  is the deprivation index of N' under the measure of H. The following are the groups considered and their gaps in deprivations.

## ST and NST Population

After what has been found from the distributions of deprivation over the ST and NST population, it should not come as a surprise that, in terms of different measures of overall deprivation, the NST population



Table 11. Relative gap between ST and NST population when  $w(C) = 0$

First Measure considering $d^i$			Second Measure considering $d^{*i}$		
Sen's Measure	Quadratic Measure	Simple Average	Sen's Measure	Quadratic Measure	Simple Average
0.26	0.32	0.19	0.26	0.32	0.19

turns out to be much worse off than the ST population. First, consider Tables 4 & 7, where comfort does not count for deprivation (*when  $w(C)=0$* ). On the basis of the last two rows of these two tables, we have the following information:

It is found that even when the relative gap between the ST and NST population happen to be the smallest, the NST population is 19% more deprived than the ST population. The distinction between Type-I and Type-II disappears because trade-off is not allowed for other criteria other than ‘comfort’ which itself is assigned no weight in this particular case. But then, when the importance of comfort is increased by assigning the weights  $1/7$  and  $1/4$ , the following results are obtained:

The above results show that when comfort gains importance from 0 to  $1/7$  and then to  $1/4$ , the relative gap decreases between NST and ST population. This is because of the following reason. With the increase in the importance of comfort, the deprivation of NST population increases (*see Tables 2, 3 and 4*) but is less than the increase in the deprivation of ST population (*see Tables 5, 6 and 7*). Thus the relative gap between the ST and NST population gets decreased. Again when trade-off is permitted within comfort, the gap reduces further due to over-compensation of some of the attributes.

## REGION – I and REGION – II

People in rural India, even today, are discriminated with respect to sex, as far as housing facilities are concerned. Whether such happens in this case and whether sex specific correctional measures are to be adopted, demands relative gap analyses concerning Men and Women of the pooled data, the results of

Table 12. Relative gap between ST and NST population when  $w(C) = 1/7$

First Measure considering $d^i$			Second Measure considering $d^{*i}$		
Sen's Measure	Quadratic Measure	Simple Average	Sen's Measure	Quadratic Measure	Simple Average
0.14	0.29	0.17	0.13	0.31	0.17

Table 13. Relative gap between ST and NST population when  $w(C) = 1/4$

First Measure considering $d^i$			Second Measure considering $d^{*i}$		
Sen's Measure	Quadratic Measure	Simple Average	Sen's Measure	Quadratic Measure	Simple Average
0.14	0.26	0.15	0.13	0.29	0.17

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which are shown in Table 15 – 22. First of all, the relative gap between the two regions is found out and has been shown in Table 14.

The above results show that when no trade-off is allowed, region – I is 7% less deprived than region – II. However, when trade-off is permitted in comfort, the picture reverts and it is obtained that those region – II is now at least 9% more deprived than region – I. It follows that, either region – I has over achievement in some of the attributes of comfort and such over-achievement compensates other attributes when trade-off is allowed; or region – II do not have over achievement in any of the attributes of comfort.

Now let us see some of the components of this group. As stated earlier, there are *a priori* reasons to expect that, other things remaining the same, households with relatively more adult women and fewer adult men are likely to have a greater degree of deprivation. It is thus of some importance to examine the relative deprivation of adult male and adult female population, the results of which are tabulated in Tables 15 and 16.

Tables 15 and 16 reveal that there is a huge gap between adult male and adult female of both the regions. In fact, females are about 27% more deprived than men, which is in accordance to our hypothesis. However, if the two regions are concerned, there is hardly any gap between the two. It now demands as to why there is then a 7% difference between the two regions. We now tabulate the values of pooled adult males and adult females.

Table 14. Relative gap between REGION – I & REGION – II population when  $w(C) = 1/4$

First Measure considering d'i			Second Measure considering d''i		
Sen's Measure	Quadratic Measure	Simple Average	Sen's Measure	Quadratic Measure	Simple Average
-0.07	0.00	0.00	0.09	0.04	0.03

Table 15. Relative gap between adult male and adult female of REGION – I

When $W(c) =$	First Measure considering d'i			Second Measure considering d''i		
	Sen's Measure	Quadratic Measure	Simple Average	Sen's Measure	Quadratic Measure	Simple Average
0	0.27	0.22	0.02	0.24	0.21	0.02
1/7	0.23	0.20	0.00	0.19	0.16	0.00
1/4	0.11	0.13	0.02	0.07	0.10	0.06

Table 16. Relative gap between adult male and adult female of REGION – II

When $W(c) =$	First Measure considering d'i			Second Measure considering d''i		
	Sen's Measure	Quadratic Measure	Simple Average	Sen's Measure	Quadratic Measure	Simple Average
0	0.26	0.25	0.24	0.25	0.21	0.24
1/7	0.20	0.18	0.19	0.20	0.12	0.21
1/4	0.02	0.03	0.02	0.00	0.00	0.00

From Tables 17 and 18 it is clear that, adult men and adult women are equally deprived of housing when comfort does not matter. But when comfort matters and there is no trade-off, adult women are 1% more deprived than adult men. Again when there is trade-off, adult women are 2% less deprived than adult men. This indicates that deprivation gap between adult men and adult women is mainly due to comfort and that adult women have over achievement in some of the attributes of comfort than adult men.

So till now we have obtained that there is a divergence between the two regions but such regional divergence is not due to the divergence in achievements of adult female and adult males. To see whether there is discrimination of sex amongst ST and NST population, the relative gap between ST female and ST male and the relative gap between NST female and NST male are to be analyzed. Tables 19 and 20 portray the following results.

From Tables 19 and 20 it is clear that, adult men and adult women are almost equally deprived of housing as far as differences in caste within sex is concerned. But then it would be interesting to analyze the differences, if any, between ST and NST adult females and males, the results of which are tabulated in Table 21 and 22.

*Table 17. Relative gap between adult female and adult male when  $w(C) = 0$*

First Measure considering d'i			Second Measure considering d''i		
Sen's Measure	Quadratic Measure	Simple Average	Sen's Measure	Quadratic Measure	Simple Average
0.00	0.00	0.00	0.00	0.00	0.00

*Table 18. Relative gap between adult female and adult male when  $w(C) = 1/7$*

First Measure considering d'i			Second Measure considering d''i		
Sen's Measure	Quadratic Measure	Simple Average	Sen's Measure	Quadratic Measure	Simple Average
0.01	0.00	0.00	-0.02	0.01	0.01

*Table 19. Relative gap between adult ST female and adult ST male when  $w(C) = 1/7$*

First Measure considering d'i			Second Measure considering d''i		
Sen's Measure	Quadratic Measure	Simple Average	Sen's Measure	Quadratic Measure	Simple Average
0.01	0.02	0.01	-0.02	-0.01	0.00

*Table 20. Relative gap between adult NST female and adult NST male when  $w(C) = 1/7$*

First Measure considering d'i			Second Measure considering d''i		
Sen's Measure	Quadratic Measure	Simple Average	Sen's Measure	Quadratic Measure	Simple Average
0.00	0.00	0.00	0.00	0.00	0.00

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Table 21. Relative gap between adult ST female and adult NST female when  $w(C) = 1/7$

First Measure considering d'i			Second Measure considering d''i		
Sen's Measure	Quadratic Measure	Simple Average	Sen's Measure	Quadratic Measure	Simple Average
-0.26	-0.43	-0.20	-0.23	-0.61	-0.28

Table 22. Relative gap between adult ST male and adult NST male when  $w(C) = 1/7$

First Measure considering d'i			Second Measure considering d''i		
Sen's Measure	Quadratic Measure	Simple Average	Sen's Measure	Quadratic Measure	Simple Average
-0.28	-0.45	-0.21	-0.21	-0.60	-0.28

It follows that adult females and adult male are hugely discriminated whether they are ST or NST but not much within their caste community.

### How to Rectify the Deprivation?

Having found that this village is severely deprived in terms of housing with deprivation levels not less than 60% from the benchmark scores, it is of utmost importance that the policy makers start their action right away. But rectification and development funds are very limited in developing countries and hence such limited funds have to be judiciously economized so that the deprivation levels can be reduced the maximum. That is, the attributes for which the deprivation levels are high are to be identified and given priority in allocation of funds. A comparative static analysis is of great help in this respect. This analysis can be done in the following manner. Force the ill-performed attributes one-by-one to their benchmark levels and note the change in the overall deprivation levels. Now, try this for every permutation and combination of such attributes. Each such combination will have a corresponding net ability to reduce overall deprivation and will also have a particular cost. These abilities and costs are to be ranked and tabulated. Now, if the policy maker wants to reduce the level of deprivation to a particular level, he can allocate the corresponding fund. On the other hand, if the policy maker wants to minimize deprivation by spending a particular level of money, he can easily find the combination of change in attributes for that amount of money. Hence, such combination of attributes has to be ranked both in terms of net deprivation levels and in terms of total costs. It is however to be noted that some of the attributes have to be rectified individually for which some of the persons scoreless. There are some other attributes (*like tap water facility*) which is of public good nature for which simultaneous consumption applies.

This study does not take into consideration about the cost of rectification of the attributes and therefore does not survey for such costs. It therefore follows that this project can only rank combinations of rectification measures according as the amount of overall deprivation they can rectify. Taking into consideration the amount of data and attributes and considering the fact that each attribute has at least 50 villagers, the number of combinations to be considered is magnum opus which cannot be done in this project that emphasizes more on measurement of housing deprivations than on rectifying them accurately. However, this project identifies potential criteria and attributes where the dwellers perform badly and

combines policies to test the change in the deprivation levels following an improvement in the score of such attributes. This process of comparative static analysis is performed by taking the lowest scoring attributes first. However, we will consider individual attributes and not individual dweller.

### Comparative Static Analysis in Ranking Deprivation Rectifying Policies

The criteria for which the dwellers are worse-off can be easily seen from the charts but the charts do not portray the position of the individual criteria. To know the relative position of the criteria we have to rank these criteria in terms of the average deprivation levels as shown Table 23.

We now tabulate the change in the deprivation level when an attribute or a combination of attributes is upgraded to the benchmark levels. The choice of the attribute combinations is done by taking those attributes first which have the highest level of deprivation and then adding on the next deprived attribute. For instance, we consider s2, s3 and c7 first (*as they have highest level of deprivation 1.0*) and then we take the combination s2+s3+c7+c4 (*because c4 is the next worst attribute*). This has been shown in Table 24. Note that we consider only *Sen's Measure* of deprivation with trade-off and  $w(c) = 1/7$ . It is admitted that there are other ways of combining policies which at most can be done in  ${}^{17}C_1 + {}^{17}C_2 + \dots + {}^{17}C_{17}$  ways taking different combinations of the 17 attributes. However, we consider the idea that each badly performing attribute has to be treated first in order to rectify the better performed one. Another aspect that needs to be mentioned is that the rectifying policies are taken only to reach the benchmark levels and not beyond the benchmark level. For example, out of the 5 achievement levels (c2.1 to c2.5) for the attribute c2 of which the achievement level c2.3 is the benchmark, improvement is sought only up to the level c2.3 and not up to c2.5.

Table 23. Average deprivation levels of each attribute

Criterion	Attribute Codes	Attribute Names	Average Deprivation Levels
Structural Adequacy	a1	condition of ROOF	0.67
	a2	condition of WALL	0.44
	a3	condition of FLOOR	0.37
Sanitation	s1	Quality of drinking water	0.50
	s2	Quality of water for bathing and washing	1.00
	s3	Toilet Facilities	1.00
Environment	e1	Stagnant Water	0.63
	e2	Garbage	0.33
	e3	Cattle/Other animals	0.15
Comfort	c1	type of House – Kaccha/Pucka	0.98
	c2	Floor Space per Adult Equivalent	0.25
	c3	Room per Adult Equivalent	0.35
	c4	Presence of Electricity	0.99
	c5	Kitchen	0.98
	c6	Drinking Water Source	0.52
	c7	Bath Water Source	1.00

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Table 24. Deprivation levels for rectification measures

Combination Sl. No.	Attribute Combinations	Sen's Measure considering $d''$ and $w(c)=1/7$	% improvement in the deprivation level
-	Actual Situation	0.61	-
co1	s3	0.51	16.39%
co2	s3+s2	0.42	31.15%
co3	s3+s2+c7	0.40	34.43%
co4	s3+s2+c7+c4	0.38	37.70%
co5	s3+s2+c7+c4+c1	0.36	40.98%
co6	s3+s2+c7+c4+c1+c5	0.34	44.26%
co7	s3+s2+c7+c4+c1+c5+a1	0.28	54.10%
co8	s3+s2+c7+c4+c1+c5+a1+e1	0.21	65.57%
co9	s3+s2+c7+c4+c1+c5+a1+e1+c6	0.20	67.21%
co10	s3+s2+c7+c4+c1+c5+a1+e1+c6+s1	0.15	75.41%
co11	s3+s2+c7+c4+c1+c5+a1+e1+c6+s1+a2	0.11	79.97%
co12	s3+s2+c7+c4+c1+c5+a1+e1+c6+s1+a2+a3	0.08	86.89%
co13	s3+s2+c7+c4+c1+c5+a1+e1+c6+s1+a2+a3+c3	0.05	91.80%
co14	s3+s2+c7+c4+c1+c5+a1+e1+c6+s1+a2+a3+c3+e2	0.03	95.08%
co15	s3+s2+c7+c4+c1+c5+a1+e1+c6+s1+a2+a3+c3+e2+c2	0.02	96.72%
co16	s3+s2+c7+c4+c1+c5+a1+e1+c6+s1+a2+a3+c3+e2+c2+e3	0.00	100.00%

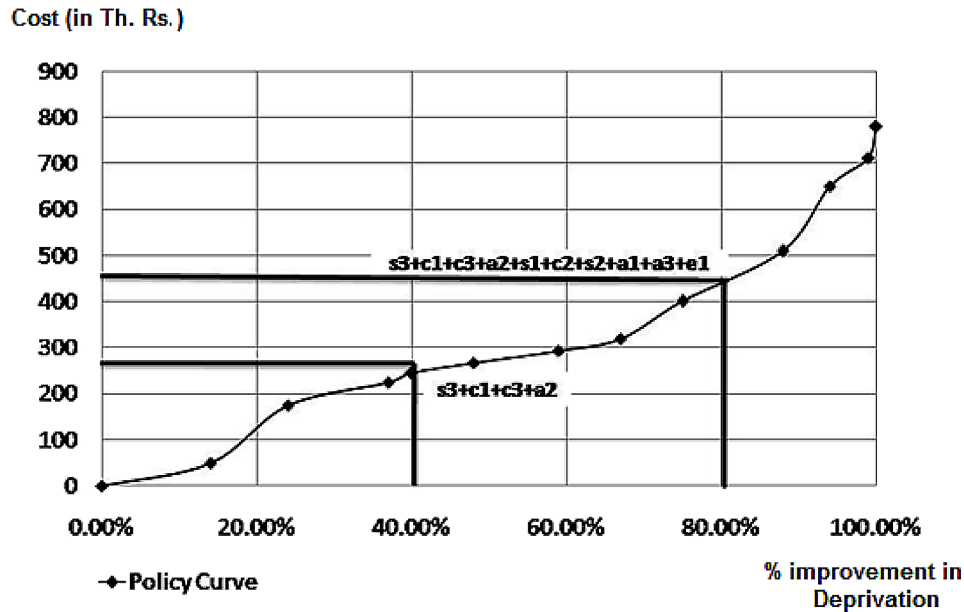
Though s2, s3 and c7 have equal average levels of deprivations, we consider the order as s3, s2 and c7 because it has been obtained that they reduce the Sen's measure to 0.51, 0.52 and 0.58 respectively when considered individually. Table 24 shows how various combinations of rectification of attributes can reduce the overall deprivation of the group. The last column also shows the cumulative percentage improvement in the deprivation levels for each such combination.

On knowing the cost of each policy combination of the rectification measures, a policy curve can be plotted with % of improvement on one axis and cost of such combination on the other. This policy curve can determine the cost of the desired policy combination on one hand and also on the other hand it can determine the best policy combination for a desired level of budget. For instance<sup>11</sup>, to rectify divergence up to 40%, one has to implement the policy combination s2+s3+c7+c4+c1 costing Rs.2, 80,000. Conversely, Rs.4, 70,000 can rectify up to 80% shelter deprivation requiring a policy combination of s3+s2+c7+c4+c1+c5+a1+e1+c6+s1+a2. This has been shown in the following Figure 1.

## CONCLUSION

Housing deprivation is one of the real indicators which must be taken into consideration in measuring poverty. Income, the most popular of the indicators, does not only lack in completeness of measurement, but also undergo a limitation that it is the most difficult variable to estimate. Whereas, conversion

Figure 1. Policy curve



of qualitative data to numerical ranks is difficult in case of housing deprivation, income deprivation is easy to calculate, but what does such calculation infer when income is never estimated correctly? Governments tend to avoid incorporating housing deprivation in poverty estimates probably to bury the infrastructural inadequacy. This study claims that study of housing deprivation is necessary and can be easily estimated by simple procedures.

For more accurate assessment of an individual’s well-being or deprivation, one may need to identify the various ‘real’ dimensions of well-being and assess the individual’s overall well-being or deprivation on the basis of the individual’s achievements in terms of these dimensions. Also, even if one considered income to be an accurate indicator of overall well-being or deprivation, for policy purposes one may still need information about achievements or deprivations of an individual or a community in terms of specific real indicators of well-being like environment, sanitation, education facilities, political stability, etc.

This analysis can help the policy makers to frame specific policies not only to reduce the overall deprivation levels but also to correct the intra-group differences. This analysis has been extended by performing a comparative static analysis of policy prescriptions based on micro and macro basis as the policy makers need a readymade formula so that they can formulate rectification measures easily and accurately. But rectification and development funds are very limited in developing countries and hence such limited funds have to be judiciously economized so that the deprivation levels can be reduced the maximum. That is, the attributes for which the deprivation levels are high are to be identified and given priority in allocation of funds.

Now, if the policy maker wants to reduce the level of deprivation to a particular level, he can allocate the corresponding fund. On the other hand, if the policy maker wants to minimize deprivation by spending a particular level of money, he can easily find the combination of change in attributes for that amount of money. Hence, such combination of attributes has to be ranked both in terms of net deprivation levels and in terms of total costs. It is however to be noted that some of the attributes have to be

## ***Economic Convergence and Real Dimensions***

rectified individually for which some of the persons score less. There are some other attributes (*like tap water facility*) which is of public good nature for which simultaneous consumption applies.

A ready reference table has also been formulated so that the policy makers can quickly know the amount of shelter deprivation they can reduce within their budget. This table can also state the policy combination for remedial measures.

This study does not take into consideration about the cost of rectification of the attributes and therefore does not survey for such costs. It therefore follows that this study can only rank combinations of rectification measures according as the amount of overall deprivation they can rectify. Taking into consideration the amount of data and attributes and considering the fact that each attribute has at least 50 villagers, the number of combinations to be considered is magnum opus which cannot be done in this project that emphasizes more on measurement of housing deprivations than on rectifying them accurately. However, this study identifies potential criteria and attributes where the dwellers perform badly and combines policies to test the change in the deprivation levels following an improvement in the score of such attributes. This process of comparative static analysis is performed by taking the lowest scoring attributes first. However, we will consider individual attributes and not individual dweller.

This chapter actually emphasizes that estimation of real dimensions like shelter are extremely important in assaying regional divergence. This chapter not only shows a methodology to calculate such divergence and analyses the reasons for such divergence, but also prepares a list of possible combinations of policy prescriptions by which a policy maker, such as the government, can find the extent of rectification of shelter deprivation of a group given its allotment of budget. The policy maker can however also calculate the cost of a rectification package for a desired level of decrease in the shelter deprivation. In a way, this chapter proposes the way how convergence can be attained.

## **FUTURE RESEARCH DIRECTIONS**

Taking real dimensions into consideration, one needs to assay the movement of these real dimensions with convergence of traditional economic variables like income, savings, investment and consumption. It must be the lookout whether the real variables can really catch-up even if the traditional variables converges. It is also of much concern whether the real variables of deprived regions grow faster than the less-deprived regions.

This study can be extended by replacing two village regions with two countries or two states of a country. This chapter was just a model, and the actual empirical study has to be done taking into consideration the total population of the census data.

Deeper study taking into consideration the caste & age [ST adults, ST children, NST adults, NST children], age, caste & sex [adult ST males, adult ST females, adult NST males, adult NST females], etc. can be considered for a better result.



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## KEY TERMS AND DEFINITIONS

**Convergence:** It refers to gradual reduction in the disparity and thereby merging of certain economic criteria between two groups.

**Deprivation:** It means underachievement of any economic variable/attribute from its benchmark level.

**Divergence Rectification:** It is a process of correction of economic divergence through policy measures.

**Fund Allocation:** It refers to economic and judicious disbursement of funds.

**Policy Curve:** It is a curve showing various policy options for the policy maker.

**Real Dimensions:** It includes non-monetary economic aspects like nutrition, health, shelter, education etc.

**Regional Disparity:** It refers to difference in economic development and uneven economic achievement in different geographical regions.

**Shelter:** It refers to standard of dwelling units basically with respect to certain criteria like adequacy, sanitation, environment and comfort.

## **ENDNOTES**

- <sup>1</sup> See Sen (1987) for some of these reasons in detail.
- <sup>2</sup> Gourbazaar in Purulia District & Bindudihi in Burdwan District, both in the state of West Bengal, India.
- <sup>3</sup> The rule for deciding what real number is to be assigned, a rule is to be used that has been discussed later in this paper.
- <sup>4</sup> For example, soundness of the foundation of the house or strength and life of the pillars of the house.
- <sup>5</sup> Features of neighborhood such as the presence of parking lots, presence of high rises, graffiti, the number of housing units in the neighborhood with bars on their windows, the number of boarded up, vandalized or abandoned buildings in the neighborhood, litter and trash, etc. are attributes taken for the western society as has been included by American Housing Survey (AHS) conducted by the U.S. Department of Commerce for the Department of Housing and Urban Development (HUD).
- <sup>6</sup> Defined to be a person aged less than 15 years.
- <sup>7</sup> Defined to be a person aged more than or equal to 15 years.
- <sup>8</sup> famous rule for assigning numerical ranks to qualitative data.
- <sup>9</sup> See also Tsui, K. (1995)
- <sup>10</sup> See note ii
- <sup>11</sup> The cost of rectification of each attribute was just considered by verbal interview of the concerned local authority.

**APPENDIX: ACHIEVEMENTS AND BENCHMARKS**

Table 25.

Criterion	Attribute Codes	Attribute Names	Achievement Levels		Benchmark Levels
Structural adequacy	a1	condition of ROOF	a1.1	will leak EVERYWHERE if it rains	a1.4
			a1.2	will leak SOMEWHERE if it rains	
			a1.3	will NOT leak but needs REPAIR	
			a1.4	does not need repair	
	a2	condition of ROOF	a2.1	will leak EVERYWHERE if it rains	a2.4
			a2.2	will leak SOMEWHERE if it rains	
			a2.3	will NOT leak but needs REPAIR	
			a2.4	does not need repair	
	a3	condition of ROOF	a3.1	with holes EVERYWHERE	a3.4
			a3.2	will leak SOMEWHERE if it rains	
			a3.3	with NO holes but needs REPAIR	
			a3.4	does not need repair	
Sanitation	s1	Quality of drinking water	s1.1	from POND/RIVER	s1.3
			s1.2	from WELL/HAND PUMP	
			s1.3	from PIPE	
	s2	Quality of water for bathing and washing	s2.1	from POND/RIVER	s2.4
			s2.2	partially from POND/RIVER and partially from WELL/HAND PUMP	
			s2.3	from WELL/HAND PUMP	
			s2.4	from PIPE	
	s3	Toilet Facilities	s3.1	not within house premises	s3.2
			s3.2	within house premises	
	Environment	e1	Stagnant Water	e1.1	near the house
e1.2				not near the house	
e2		Garbage	e2.1	around the house	e2.2
			e2.2	not around the house	
e3		Cattle/Other animals	e3.1	in proximity	e3.2
			e3.2	not in proximity	

*continued on following page*

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*Table 25. Continued*

C Criterion	Attribute Codes	Attribute Names	Achievement Levels		Benchmark Levels
<b>Comfort</b>	<b>c1</b>	type of House	c1.1	Kutccha	c1.2
			c1.2	Puccka	
	<b>c2</b>	Floor Space per Adult Equivalent	c2.1	< 50 sq.ft.	c2.3
			c2.2	> 50 sq.ft. but < 90 sq.ft.	
			c2.3	> 90 sq.ft. but < 120 sq.ft.	
			c2.4	> 120 sq.ft. but < 150 sq.ft.	
			c2.5	> 150 sq.ft.	
	<b>c3</b>	Room per Adult Equivalent	c3.1	< 0.25	c3.3
			c3.2	> 0.25 but < 0.50	
			c3.3	> 0.50 but < 0.75	
			c3.4	> 0.75 but < 1.00	
			c3.5	> 1.00	
	<b>c4</b>	presence of Electricity	c4.1	NO Electricity	c4.3
			c4.2	PARTIAL Electricity	
			c4.3	FULL Electricity	
	<b>c5</b>	Kitchen	c5.1	NOT Separately Present	c5.2
			c5.2	Separately Present	
	<b>c6</b>	Drinking Water Source	c6.1	more than 1 km.	c6.3
			c6.2	1/2 km. to 1 km.	
			c6.3	Less than 1/2 Km.	
<b>c7</b>	Bath Water Source	c7.1	more than 1 km.	c7.3	
		c7.2	1/2 km. to 1 km.		
		c7.3	Less than 1/2 Km.		