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Assessment of Facility Deprivation in the Households of the North Eastern States of India

Introduction

THE NORTH-EASTERN REGION (NER) of India comprises eight states, *Assam, Arunachal Pradesh, Manipur, Meghlaya, Mizoram, Nagaland, Sikkim* and *Tripura*, and has been described as the most diverse, complex and resourceful region of the country (Agarwal, 1997). While the vast region accounts for nearly 7.8 per cent of India's total land area, the population density is indexed by approximately 151 persons per sq. km. (Census, 2001). The hilly terrains have naturally divided the population into different cultures, religions, languages and traditions. The geographical isolation also hinges on lack of infrastructural development, leaving a narrow corridor to connect the NER states with the rest of the country (Agnihotri, 2004; Kumar, 2004). Consequently, there is a strong need in the entire region to work towards an integrated approach in transport, phone, irrigation and flood control, management of forest resources and supply of food and essential commodities (Agnihotri, 2004).

Despite its immense resource potential, the NER is confined by geographic isolation that has led to deprivation of economic development, which, in turn, minimised the resource access to support a primitive style of living (Cappellari and Jenkins, 2006). Thus, assessing the deprivation is not only crucial for the regional concern, but also important for establishment of equity toward balanced development across the nation. Accordingly, this research is designed to investigate the availability of some basic facilities in the different districts of the NER. Indicators of deprivation are obtained using the percentage of households in each district covered by availability of safe drinking water, sanitary facilities and electricity supply. These indices are calibrated by a weighted deprivation index to incorporate considerations

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among those aspects. The distribution pattern is disentangled to link the index variability with disparity of the deprivation in this region.

Literature Review

Often the words ‘poverty’ and ‘deprivation’ are used interchangeably, but in recent years, European literature has designated the word ‘deprivation’ to explain the concept of relative poverty. For instance, Peter Townsend (2009), an authority on poverty and related studies, had stated, “Deprivation may be defined as a state of observable and demonstrable disadvantage, relative to the local community or the wider society or nation to which an individual, family or groups belong.” (p. 214)

Once the concept of relative poverty was accepted, there had been many attempts to define both deprivation and its measure (Osmani; 2007). The National Assembly for Wales, in partnership with the Welsh Local Government Association, developed the first deprivation index called the Welsh Index of Multiple Deprivation (WIMD), that was published in August 2000 and replaced the then existing Welsh Index of Socio-Economic conditions. The index combined six domains of deprivation, namely Income, Employment, Health and Disability, Education, Skills and Training, and Housing and Geographical Access to Services. The next edition of the WIMD was released in 2005 which had seven domains instead of six in the earlier index. The added domain was that of physical environment. The index is a measure of multiple deprivation at small area super output area level. Multidimensional indices of deprivation based on absolute thresholds have been developed in several other studies. Eurostat (2002) and Layte *et al.* (2001) provide a composite index based on 24 items for European countries. Jensen *et al.* (2002) propose a different approach for the construction of a synthetic measure of deprivation for New Zealand. Extending the approach of Fergusson *et al.* (2001), Jensen *et al.* (2002) build a full-spectrum index of living standards (the Economic Living Standard Scale) by selecting items according to the respondents’ view about their importance, and their capacity to discriminate between high and low living standards. Some other literature concerned about similar issues and their measurement involves Cowell (1995) and Fedorov (2002).

To a great extent, the construction of empirical indices is inseparable from statistical modeling. Cappellari and Jenkins (2006) employed a two parameter item response model to measure deprivation for household level data. Martínez and Ruiz-Huerta (2006) used direct standard of living indicators to construct deprivation indices for Spanish Data. To measure the unequal distribution of wealth in different geographical regions, an index of deprivation was created by the Office of the Deputy Prime Minister of England in 2004.

India is a land of diversities in terms of several demographic respects. Thus, deprivation in the distribution of national wealth is something that seems very obvious to happen. Several authors have taken up the issue of deprivation and have presented different dimensions of the issue in their works. Sen contributed significantly towards the issue of deprivation with considerable emphasis on the Indian context, and stressed that deprivation is the main hindrance towards economic development through a series of works, some of which are Sen (1980, 1981, 1983, 1985, 1987, 1990, 1992, 1997, 1999a, 1999b). Bhatty (1998) discusses deprivation in primary education, especially amongst children, who prefer to join the labour force because of poverty, though there are several government initiatives in this regard. Chakravarty and Mukharjee (1999) articulated different measures of relative and absolute deprivation using functions of social satisfaction. Srinivasan and Mohanty (2004), based on National Family Health Survey (NFHS) data, measured the deprivation of basic amenities in India, classifying the population by caste and religion. Gaiha and others (2007) expressed the different issues of deprivation in rural areas compared to urban India.

While the wealth characteristics seemed more pertinent to developed regions, the NER of India has been struggling with obtaining basic household necessities. The development process of a region must include fulfilling the basic necessities of people—clean drinking water for sustaining life, modernised sanitation and clean environment for healthy life, and electricity connection for a productive and comfortable life. In the words of Sen (1999a), "Development requires the removal of major sources of unfreedom: poverty as well as tyranny, poor economic opportunities as well as systematic social deprivation, neglect of public facilities as well as intolerance or overactivity of repressive states." Of the different parameters related to social deprivation, Sen's main stress was on deprivation to public facilities namely, schooling, safe water, sanitation, basic health facilities, etc. (Sen, 1999b). Dimensions of deprivation can be due to lack of access to basic health services, primary education, drinking water, sanitation, electricity etc. (Kumar *et al.*, 2008). Of the different types of basic facilities described above, a few of them are household specific and others are made available only at the community level. Therefore, empirical investigations are needed to develop primitive indicators involving household specific basic facilities, to understand the disparity of their allocation in NER. Yoskowitz and Umphres (2006) theorized a linkage between utility and sanitation, where the utility part typically covers the availability of running water and electricity drawn from the natural environment. Snyder and Keary (2007) concurred inseparability of those two aspects in any asset management. Those household necessities are indispensable for a sustainable development in the 21st century (Daigger, 2009). Guided by the current literature, the availability of safe drinking water, sanitary facilities and electricity supply has been chosen to facilitate examination of regional disparity across the NER districts.

The term 'deprivation' seems to be more comprehensive in comparison to the deprivation of basic facilities at household level that the current study is out to measure. Thus, the term 'facility deprivation' is introduced to specify the particular dimension of deprivation that is under consideration. Accordingly, the composite index is termed 'Facility Deprivation Index' (FDI).

Objective of the Study

The paper is planned to attain the following objectives:

(i) To quantify the level of facility deprivation in the different districts of NER, in terms of three basic facilities namely, supply of safe drinking water, electricity and sanitary facility.

(ii) Develop a weighted index of deprivation (to be called as the facility deprivation index) for all the three basic facilities taken together and to categorize the districts as per their level of deprivation.

(iii) To identify some of the possible reasons for the highly deprived districts of NER.

Data and Methodology

Data Source

The source of data for the study is from "Ranking and Mapping of Districts based on Socio-economic and Demographic Indicators" a report by Ram and Sekhar (2006), published by the International Institute of Population Studies, Mumbai. The report, along with several other district level information, also provides data on the percentage of households in each district of the entire country covered under the supply of safe drinking water, sanitary facility and supply of electricity. The study is delimited to those districts that have the availability information documented in the NER. As a result, this study excludes the following districts, Tinsukia of Assam, Saiha of Mizoram, Bishnupur of Manipur and West Garo Hills of Meghlaya.

The Facility Deprivation Index (FDI)

Notation of the facility deprivation index construction depends on clarification of variables and subscript below. Let x_{ijk} represent the percentage of households enjoying the *k*th facility in the *j*th district of the *i*th state, where

$i = 1, 2, ..., 8$ for those aforementioned eight states in NER,

$j = 1, 2, \ldots, n_i$ for the numer of districts in the *i*th state is represented by n_i,

and $k = 1, 2, 3$ for the three basic necessities: safe drinking water (k =1), sanitary facility (k =2) and electricity supply (k =3).

Let max($x_{..k}$) denote the percentage of households in a given district which has the best coverage of the k^{th} facility (k = 1, 2, 3) in entire nation and min($x_{..k}$) represent the percentage of households in the district that has the worst coverage of the *k*th facility (k = 1, 2, 3) in the entire nation.

The deprivation indicator (DI) for the *k*th facility in the *j*th district of the *i*th state is given by,

$$DI_{ijk} = \frac{\max(x_{..k}) - x_{ijk}}{\max\left(x_{..k}\right) - \min(x_{..k})} \qquad \ldots(1)$$

The value of DI_{ijk} varies from zero to one, where the value of 1 implies that the given district is most deprived in comparison to the best district in the country in the *k*th facility. The reverse is true for a value of 0.

To construct the facility deprivation index for the district comparison, one must recognize the fact that all the indicators are not equally important. Thus, a simple average of the three indicator values should be avoided in the index construction. On the contrary, Morris and Liser (1977) advocated the use of weighted average when developing the Physical Quality of Life Index (PQLI). Another important contributer to this issue is Iyengar and Sudarshan

(1982) who assumed that the weights vary inversely as the variation in the respective variable. Das and Nath (2007) also developed a weighted composite index for human deprivation in different river islands of Assam. Based on the current literature, the weighted index of deprivation (facility deprivation index) for the *j*th district of the *i*th state is given by,

$$FDI_{ij} = W_1 \times DI_{ij1} + W_2 \times DI_{ij2} + W_3 \times DI_{ij3}, \text{ with } \sum_{k=1}^{3} W_k = 1 \qquad \ldots(2)$$

where W_k represents the weight associated with the *k*th basic facility (k = 1, 2, 3).

Iyengar and Sudarshan (1982) further linked the weight to variance of deprivation across the regions. More precisely, they postulated that

$$W_k = \frac{C}{\sqrt{Var(DI_{ijk})}} \qquad \ldots(3)$$

where C is a normalizing constant that follows

$$C = \left[\sum_{k=1}^{3} \frac{1}{\sqrt{Var(DI_{ijk})}} \right]^{-1} \qquad \ldots(4)$$

The choice of the weights in this manner would ensure that large variation in any one of the indicators would not unduly dominate the contribution of the rest of the indicators and distort the inter-district comparisons (Iyengar and Sudarshan, 1982).

The value of the facility deprivation index can indicate the status of deprivation in a district for all the three facilities taken together. Again, based on Iyengar and Sudarshan's (1982) calibration, a score near 0 is an indicator of availability of basic facilities i.e. very low level of deprivation and a value of 1 is an indication of poor availability of basic facilities i.e. a high level of deprivation.

Such an index supports comparison amongst the districts of a state, and the result can be aggregated across the districts for inter-state comparison. The variance of the weighted index scores of the different districts can be used as a measure of dispersion in basic facilities within that state.

Distribution of the Weighted Index of Deprivation

To support the probabilistic inference, distribution of the FDI should be examined to facilitate classification of the districts on the basis of the extent of deprivation (Navaneetham and Saxena; 1999). Iyengar and Sudarshan (1982) assumed that the development index followed the Beta distribution. Vidwan (1983) empirically showed a better classification under a normal distribution. Hence, the assumed distribution played a crucial role in obtaining the empirical outcomes (Navaneetham and Saxena; 1999).

For testing the hypothetical distribution of the weighted index of deprivation (FDI_{ij}), one may use the chi-square test of goodness of fit. As $FDI_{ij} \in [0, 1]$, the values of the indices are essentially continuous in nature. To model the empirical frequency, the range [0, 1] can be divided into non-overlapping class intervals, and the chi-square test of goodness of fit can be conducted after obtaining the frequency within each class interval. The observed frequency can be compared with the theoretical frequencies expected under the hypothetical distribution. Although the interval setting could be arbitrary and converting the scale from continuous to discrete might have reduced the precision, the approach outlined above has been commonly used in practice (Kotz and Johnson, 1983).

The Kolmogorov Smirnov (K-S) test statistic could also be applied in this case as the indices are continuous in nature. Different authors have proved that the K-S statistic is more appropriate for continuous data compared to the chi-square test of goodness of fit (Keeping, 1962; Pal, 1998). The test statistic is given by,

$$D_n = \max | S_n(x) - F(x) | \qquad \ldots(5)$$

where $S_n(x)$ and $F(x)$ are empirical and theoretical distribution functions respectively. However, for performing the K-S statistic, the theoretical distribution needs to be completely specified i.e. the valued of the parameters needs to be known. In this exercise the parameters are estimated from the data. The critical value of D_n for α level of significance depends on the number of observations and may be denoted by $D_{a,n}$. If the number of observations are over 35, as the case here, the critical value at 5 per cent level of significance ($D_{0.05,n}$) is $1.36/\sqrt{n}$. Thus, D_n value greater than $1.36/\sqrt{n}$, will indicate that the fitted distribution is significantly different from the theoretical distribution.

Thus, both the tests, viz. the K-S test and chi-square test, can be used to verify the appropriate distribution to which the FDI values fit. The interval $[F(x) - D_{a,n}, F(x) + D_{a,n}]$ provides the $100(1 - \alpha)\%$ confidence band for $F(x)$ which can be used as a visual tool for goodness of fit.

After deciding about the probability distribution of FDI_{ij} it is important to find two real numbers $c, d \in [0, 1]$ to divide three linear intervals namely $[0, c]$, $[c, d]$ and $[d, 1]$ with the same probability weight of 33.33%, i.e.,

$$P[0 \le FDI_{ij} \le c] = 0.3333 \qquad \ldots(6)$$

and, $$P[0 \le FDI_{ij} \le d] = 0.6666 \qquad \ldots(7)$$

Thus, $P[c \le FDI_{ij} \le d] = 0.3333$ using (6) and (7)

These intervals have been used in this study to characterize the various stages of deprivation as follows:

(i) Low Deprivation if $0 \le FDI_{ij} \le c$
(ii) Moderate Deprivation if $c \le FDI_{ij} \le d$
(iii) High Deprivation if $d \le FDI_{ij} \le 1$

Calculation and Results

The weight can be computed using formulas (3) and (4). Based on the data available from the source mentioned above, formula (1) is used to calculate the deprivation indicator (See Table 1 for the weights corrosponding to the different indicators).

TABLE 1: WEIGHTS ASSOCIATED WITH THE INDICATORS OF THE DIFFERENT BASIC FACILITIES

Basic facility	Safe drinking water	Sanitary facilities	Electricity
Weights	0.3056	0.3865	0.3079

After obtaining the weights, the facility deprivation index (FDI) for all the districts are obtained using (2). The facility deprivation index for the most deprived and the least deprived districts for each of the states can be seen in Table 2. The table also shows the averages and standard deviations of the FDI of the districts for each of the states.

TABLE 2: THE MOST AND LEAST DEPRIVED DISTRICTS OF THE DIFFERENT STATES OF NORTH EAST INDIA ALONG WITH THEIR AVERAGE FDI VALUES

State	*Number of Districts*	*District*		*AverageFDI of the State*	*SD of FDI of the State*
		Least Deprived	*Most Deprived*		
Arunachal Pradesh	13	Papum Pare 0.197	East Kameng 0.565	0.3876	0.1013
Assam	23	Dibrugarh 0.3246	Kokrajhar 0.7935	0.5387	0.1074
Manipur	9	Imphal West 0.2024	Tamenglong 0.6626	0.4533	0.136
Meghalaya	7	East Khasi Hills 0.3547	Jaintia Hills 0.7222	0.6009	0.1258
Mizoram	8	Aizawl 0.1998	Mamit 0.5542	0.3874	0.1317
Nagaland	8	Mokokchung 0.2279	Wokha 0.5196	0.3971	0.1015
Sikkim	4	East 0.2299	North 0.4965	0.353	0.0954
Tripura	4	West Tripura 0.3456	Dhalai 0.5181	0.4375	0.0686
North East India	76	Papum Pare 0.1970	Kokrajhar 0.7935	0.4609	0.1358

Source: Calculated from "Ranking and Mapping of Districts based on Socio-economic and Demographic Indicators" by Ram and Shekhar (2006).

It should be noted in Table 2 that among the states of NER, the maximum average deprivation in the basic facilities is located in Meghalaya (0.6009) followed by Assam (0.5387). The average value of the facility deprivation index in the districts of Arunachal Pradesh is the least, which implies that the state has minimum deprivation in basic facilities. The deprivation index varies most in Manipur as evident from its standard deviation, followed by Mizoram. This implies more irregularity in the distribution of basic facilities in these two states. In the entire NER, the least deprived district is Papum Pare of Arunachal Pradesh and the most deprived district is Kokrajhar of Assam. The FDI of the different districts along with their statewise mean and standard deviation is shown in the jittered plot (Fig. 1).

Since the values of FDI lie between 0 and 1, one may select the two parameter beta distribution of type I as a probable distribution. The beta distribution is generally a skewed distribution and its probability density function is given by,

$$f(x) = \frac{1}{\beta(a,b)} x^{a-1} (1-x)^{b-1}, \ 0 < x < 1 \text{ and } a, b > 0 \qquad \ldots(8)$$

= 0, otherwise

Here, $$\beta(a,b) = \int_0^1 x^{a-1}(1-x)^{b-1}\,dx \qquad \ldots(9)$$

Based on the values of FDI for all districts, the estimated values of *a* and *b* are obtained using the method of maximum likelihood (Johnson and Kotz, 1970). The estimated values are given by,

$$\hat{a} = m_1\left[\frac{m_1(1-m_1)}{m_2} - 1\right] \qquad \ldots(10)$$

and

$$\hat{b} = (1-m_1)\left[\frac{m_1(1-m_1)}{m_2} - 1\right] \qquad \ldots(11)$$

Here,
m_1 = mean of all FDIs and
m_2 = variance of all FDIs

Based on the empirical data for this investigation, the estimated model parameters are $\hat{a} = 5.7465$ and $\hat{b} = 6.7224$. The goodness of fit test has generated a result of $\chi^2(2\ df)$ = 4.54, p = 0.1028 for this model, which supports the use of $\beta_I(5.7465, 6.7224)$ to describe the values of FDI in this investigation. The K-S test is also used to test if the FDI values fit to the beta distribution specified by the parameters already estimated from the data. The value of the statistic,

$$D_n = \max|S_n(x) - F(x)| = 0.053182$$

which is insignificant at 5 per cent level, confirms the findings of the chi-square test.

To reduce potential subjectivity in the model selection, the empirical distribution function (EDF) plot is employed to triangulate the findings from the chi-square test and to visualize the results of the K-S test. The closeness of the step function (EDF) to the CDF curve, and the step function lying within the bounds, reconfirmed the model fitness to the empirical database.

Based on (6),

$P[0 \le FDI_{ij} \le c] = 0.3333$

$$\Rightarrow \int_0^c \frac{1}{\beta(5.7465, 6.7224)} x^{4.7465}(1-x)^{5.7224}\,dx = 0.3333$$

$\Rightarrow c = 0.3974$ (Using regularized incomplete beta function calculator)[1]

Similarly, (7) leads to $P[0 \le FDI_{ij} \le d] = 0.6666$

$$\Rightarrow \int_0^d \frac{1}{\beta(5.7465, 6.7224)} x^{4.7465}(1-x)^{5.7224}\,dx = 0.6666$$

$\Rightarrow d = 0.5209$ (Using regularized incomplete beta function calculator)[1]

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[1]http://functions.wolfram.com/webMathematica/FunctionEvaluation.jsp?name=BetaRegularized

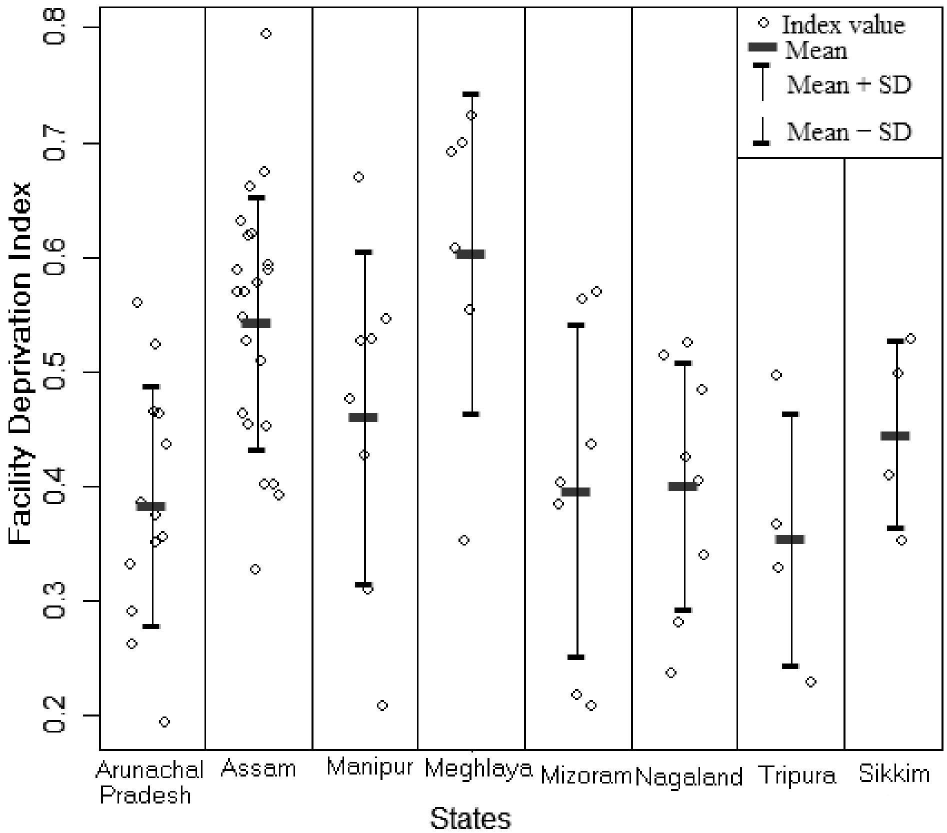

Fig. 1: The jittered plot for the weighted deprivation index of all the districts classified by states

Source: Data in table 2.

Footnote: The graph is created with R, an open source environment and language for statistical computing and graphics <http://cran.r-project.org/> (For code see Appendix II)

The values of *c* and *d* thus obtained are needed to classify the FDI values into the following three stages of deprivation.

TABLE 3: STAGES OF DEPRIVATION CLASSIFIED BY THE FDI

Stage of deprivation	*Values of FDI*
Low Deprivation	Less than 0.3974
Moderate Deprivation	Between 0.3974 but less than 0.5209
High Deprivation	0.5209 or higher

Through a comparison between the values of FDI and the classification criteria in Table 3, the different districts of the region can be categorized into the different levels of deprivation.

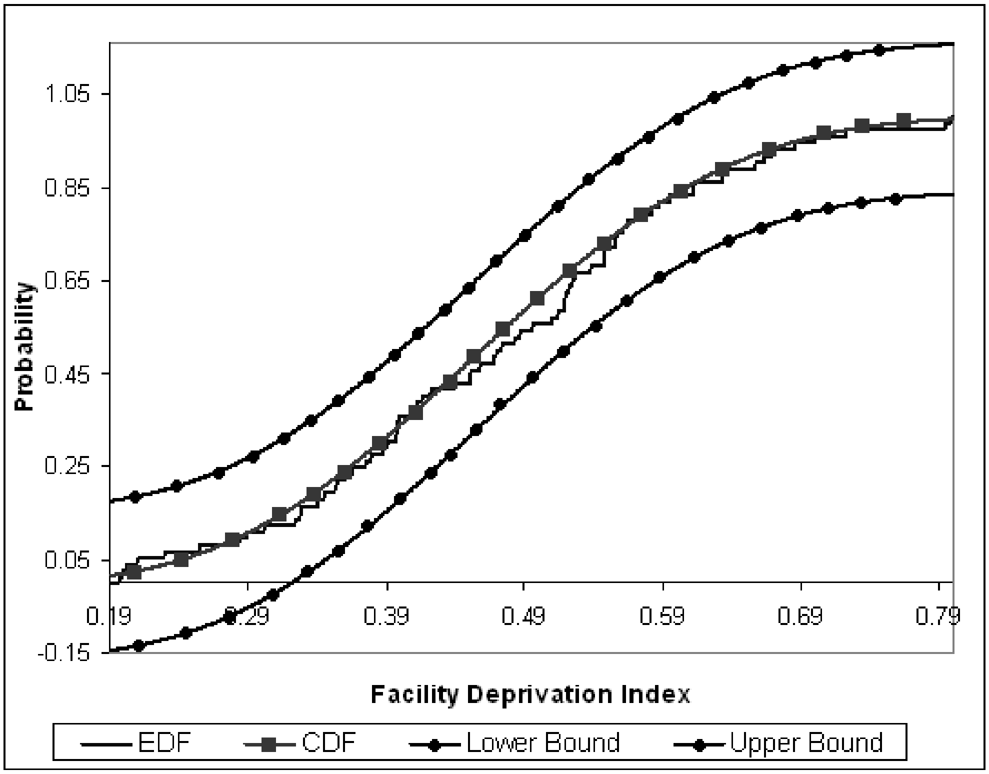

Fig. 2: Visualizing the goodness of FIT of FDI values to beta distribution using empirical distribution function plot

Source: Based on values of the FDI for different districts (See Appendix I)
Footnote: The graph is created with *R*, an open source environment and language for statistical computing and graphics http://cran.r-project.org/ (For code see Appendix III)

It is interesting to note that though Assam is the most well located state in NER, majority of its districts get classified into the "High Deprivation" category. The condition is almost same in Meghlaya. Out of 26 highly deprived districts in the region, 14 of them are from Assam. In Nagaland and Sikkim, none of the districts are classified in the "High Deprivation" category, and in Arunachal Pradesh and Sikkim, most of the districts fall in the "Low Deprivation" category. For all the states under consideration, as expected, the district in which the capital city of the state belongs, remain classified as the less deprived district, with Nagaland being the only exception.

Probable Reasons for High Deprivation

Deprivation in basic facilities might be either due to topographical hurdles in the district or due to unequal distribution of facilities within the state. The reasons of unequal distribution of basic facilities arise due to lack of poor implementation of government policies and are mostly political. North-East India has a highly complex and colourful social mosaic. Several

TABLE 4: DISTRICTS OF THE NORTH EASTERN STATES CLASSIFIED BY THE LEVEL OF DEPRIVATION

State	*Type of Deprivation*	*Districts*
Arunachal Pradesh	Low Deprivation	Dibang valley, East Siang, Lower Subansiri, Papum Pare, Tawang, Upper Subansiri, West Kameng, West Siang
	Moderate Deprivation	Lohit, Tirap, Upper Siang
	High Deprivation	East Kameng, Changlang
Assam	Low Deprivation	Dibrugarh, Kamrup, Nagaon
	Moderate Deprivation	Barpeta, Golaghat, Jorhat, Marigaon, Sibsagar
	High Deprivation	Bongaigaon, Cachar, Darrang, Dhemaji, Dhubri, Goalpara, Hailakandi, Karbi Anglong, Karimganj, Kokrajhar, Lakhimpur, Nalbari, North Cachar Hills, Sonitpur
Manipur	Low Deprivation	Imphal East, Imphal West
	Moderate Deprivation	Thoubal, Ukhrul, Churachandpur
	High Deprivation	Chandel, Tamenglong, Senapati
Meghlaya	Low Deprivation	East Khasi Hills
	Moderate Deprivation	
	High Deprivation	East Garo Hills, Jaintia Hills, Ri Bhoi, South Garo Hills, West Khasi Hills
Mizoram	Low Deprivation	Aizawl, Erchipp, Kolasib
	Moderate Deprivation	Champhai, Lunglei
	High Deprivation	Lawngtlai, Mamit
Nagaland	Low Deprivation	Dimapur, Mokokchung, Phek
	Moderate Deprivation	Kohima, Mon, Tuensang, Wokha, Zunheboto
	High Deprivation	
Sikkim	Low Deprivation	West, South, East
	Moderate Deprivation	North
	High Deprivation	
Tripura	Low Deprivation	West Tripura
	Moderate Deprivation	South Tripura, North Tripura
	High Deprivation	Dhalai

cultural markers - language, race, tribe, caste, religion and region serve as identity axes for the different ethnic groups residing in this part of the country. This has given rise to a history of long-running and violent autonomy movements on behalf of a number of ethnic groups. Even keeping the insurgency problems apart, inter-communal and ethnic differences, allegations and counter-allegation of deprivation against dominating ethnic groups remain common. Popular demands for local autonomy, boundary changes, and new states continue to proliferate. Thus, it is important to investigate if the dispersion in facility deprivation arises from ethnic dominance of one group over the other or otherwise.

In the previous section it was found, that from the 72 districts considered in the study, 26 of them are highly deprived, out of which Assam and Meghlaya are the worst sufferers. Meghalaya and Assam together have 19 highly deprived districts out of 26. Meghlaya has some ethnic bitterness amongst three dominant ethnic groups—the Garos, the Khasis and the Pnars (Jaiantias). But, so far as facility deprivation in the state is concerned, the issue might not be ethnic. The East Khasi Hills district of Meghalaya enjoys lowest level of deprivation. The district hosts the capital city of Meghalaya, i.e. Shillong, which was also the capital of undivided Assam, right from the British period. The district is pre-dominantly urban, and for these obvious reasons, the district attains such a low status of deprivation. But the conditions of all the other districts of the state are an indication of negligence in equitable distribution of resources related to basic facilities and share of development compared to the capital city Shillong and its neighboring areas.

In many respects, Assam is like mini-India with different national, ethnic, religious, linguistic and tribal groups living together in the region for centuries (Srikanth; 2000). The population of Assam is a broad racial intermix of Mongolian, Indo-Burmese, Indo-Iranian and Aryan races (Das; 1987). A considerable number of Bengali speaking people live in Assam (approximately 20 per cent as per the 2001 census). The Bengali speaking population is spread throughout Assam, but the majority of the Bengali population of Assam is concentrated in three southern districts of Assam viz. Cachar, Karimganj and Hailakandi. The Assamese population in south Assam is even less than 1 per cent as per the last census report. History has seen mass agitation by the Assamese speaking people against 'foreigners'. The blanket term 'foreigner' includes *inter alia*, mostly the non-Muslim displaced person from erstwhile East Pakistan, who came over to Assam in thousands, during 1951-1971. This resulted in the harassment of even pre-1951 old settlers of Bengali origin, both Hindus and Muslims (Das Gupta and Guha, 1985). While both upper and lower Assam has seen several movements, mainly against Bengalis, the story of south Assam, which is mostly populated with Bengalis, is that of gross neglect. A strong sense of deprivation, in the share of resources, has always engrossed the people of this region. The high values of FDI in these districts support the popular belief. Since India's independence, Assam has seen several movements by the hill tribes for a separate identity, through the establishment of their own state. Several such movements were successful, leading to the reduction of size of the territory of Assam. Such movements led to the establishment of autonomous Bodoland areas district, and autonomous districts of the two major hill tribes: the Karbis of Karbi Anglong district and the Dimasa of North Cachar Hills district. The Bodoland comprises of the district Kokrajhar and portion of the districts Dhubri, Bongaigaon, Barpeta, Nalbari, Darrang and Kamrup. The high deprivation in basic facilities prevails in the districts of Karbi Anglong, North Cachar Hills and most of the districts that fall within Bodoland. One of the reasons for such movements is deprivation in the allocation of resources which cannot be overlooked considering the high values of FDI in those districts. The districts of upper Assam are well-off as compared to the lower and south Assam districts.

In Arunachal Pradesh, only two districts, East Kameng and Changlang, are suffering from high deprivation. The East Kameng district is an extended part of the east-north-eastward Bhutan Himalaya range, rhe altitude of which raises to about 11,000 meters above sea level. The entire northern boundary of the district is international and shared with China (Bhatt, 2004). The population density of the district is as low as 14 per square kilometer. The topographical reasons and scarce population may be responsible for the high level of deprivation in the district. The Changlang district, on the other hand, is the eastern most district of the state. It has a lengthy international boundary with Myanmar in the east. Along with local tribes, sizeable communities of refugees, comprising the Tibetans, Bodo, Hajong and Chakma, stay here. The Chakma refugees, who follow Buddhism, were uprooted from erstwhile East Pakistan and were allowed to settle in NEFA, the present Arunachal Pradesh. Naga Militants (NSCN) infiltrate to Changlang and Tirap districts of Arunachal Pradesh and often carry out campaigns (some of which are violent) to encourage the locals to make Changlang and Tirap a part of Nagaland. The reasons of insurgency and refugees may have resulted in the improper distribution of basic facilities in Changlang district.

In Manipur there are nine districts which can be classified as hill districts and valley districts. The valley districts comprise East and West Imphal, Thoubal and Bishnupur, while Ukhrul, Senapati, Tamenglong, Chandel and Churachandpur are the hill districts. The hill population is mainly the tribes: Naga groups and Kuki-Chin (Zomi) groups. Among the plains inhabitants, the Meithai or Manipuri (non-tribal) community is the majority group (Shimray, 2000). The hill districts covers 88.15 per cent of total land area of Manipur, but is scarcely populated with only 33 per cent of its population. In Manipur, Senapati, Tamenglong and Chandel are the highly deprived districts, and interestingly all of them are hill districts. The headquarters of these districts are connected to the capital city of Imphal by roadways only, most of which are prone to heavy landslide, especially during the rainy season. Insurgency is always an issue in the development process of Manipur. Different militant groups have come into existence in both the hill districts and the valley districts. The revolutionary outfits operating in the valley region dream to make a sovereign republic of Kangleipak (Manipur) free from the Indian union and its colonial system of government once and for all. The militant groups in the hill districts are busy in ethnic clashes between the Naga outfits and their Kuki countarpart - though the Naga militant groups had a different objective initially. Today, Manipur is one of the worst insurgency-hit states in northeast India where at least 20 militant outfits are active (Das, 2008). In addition to this, there are issues of mutual dislike between the tribes and non-tribes, because of difference in religion, language, culture and customs. As the non-tribes comprise the majority of the population, it is obvious that they have higher representation in decision making bodies. All these factors, probably in different ways, contributed to the high values of FDI in the said districts.

Tripura is a small state with four districts, out of which only one of them, viz. Dhalai, is highly deprived. Seventy per cent of the total land area of the district is covered by hills and dense forest. The tribal people of this region do not live in villages but in remote '*paras*'– habitations of just one or two huts. Many of them practice *jhoom* (shifting) cultivation. They are being encouraged to give up this kind of farming, practice settled agriculture and take up other forms of livelihood. But, as they say, old habits die hard. Some parts of this district are still threatened with insurgency. These factors naturally hamper the government's developmental work and projects (Sehgal, 2006).

Mizoram has two highly deprived districts, Lawngtlai and Mamit. The Lawngtlai district is populated with the Chakmas. While the Mizo population is mostly Christian, Chakmas who follow Buddhism are the largest minority group in the state. About 8.02 per cent of the population, as per the 2001 census of the state, are Chakmas. A major portion of this minority group resides in the Lawngtlai district. About 53.33 per cent of the total population of the district is the Chakmas. The ethnic issues between the Mizos and Chakmas, that make news often, may have reflected through the high level of deprivation in the district. The Mamit district also has some Chakma population (14.15 per cent of total population of the district) and a large number of Reang people, another tribal group, who are mostly Hindus. A large section of the Reang population from the Mamit district had taken shelter as refugees in the north district of Tripura, following atrocities committed against them allegedly by Mizos, in October 1997. The process of taking back the refugees by the Mizo government from Tripura has got momentum only in May, 2010 after proper intercession by the Home Ministry of the central government. This ended a long speculation on this issue by the two state governments. Thus, the highly deprived districts in Mizoram are a result of ethnic clashes of the majorities with different minority groups.

Conclusion and Future Directions of Research

In a vast country like India, the resource distribution could vary across geographical regions. To justify accountability of the government policy, quantitative indicators are needed to identify deprivation of household necessities, which hinder a balanced national development. The deprivation of basic facilities create a sense of neglect in the mind of the citizens of the deprived areas towards the government. This may sometimes prove to be very hazardous in a democratic setup like India. To quantify the neglect in the basic human rights, the indicator constructed from this research is grounded on fundamental amenities that are essential to life quality like *safe drinking water*, *sanitary facility* and *electricity supply*. In NER, some of the districts are predominantly rural, while a few of them are enjoying an urban or mostly urban set up. The urban districts are less deprived for obvious reasons. With higher deviation in basic facilities, the pre-dominantly urban districts will pull the population towards itself, which at a later stage may enhance the deprivation indices of the urban districs. On investigating the probable reasons of high deprivation in some of the districts, it was found that remoteness is one of the reasons while insurgency and ethnic issues are also playing vital roles. Most of the highly deprived districts of north-east are dominated by minority groups of the state. Thus, a tendency of depriving the weaker section of the population is prominent in NER, which itself is considered to be deprived in comparison to the main land of India.

For future researchers, the facility deprivation index can be extended for region-wise analysis of all the other states of the country. The classification of the FDI can be done to five groups instead of three and the most deprived districts can be identified. An indepth analysis of the physical and political conditions of those highly deprived districts may provide further insight into the reasons of such a pathetic level of deprivation. Another area of research can be to compute the extent of urbanization in the districts and then to search for the existence of any relation with the deprivation index. Some other basic facilities that are household specific may also be included in the study and the weighted deprivation index be calculated afresh.

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APPENDICES

APPENDIX I: VALUES OF THE INDICATORS AND THE WEIGHTED DEPRIVATION INDICES (FDI) OF ALL DISTRICTS

State	*District*	*Drinking*	*Electricity*	*Sanitation*	*Weighted Deprivation Index*
Arunachal Pradesh	Changlang	0.4076	0.6294	0.5346	0.5240
Arunachal Pradesh	Dibang Valley	0.1523	0.5083	0.4860	0.3864
Arunachal Pradesh	East Kameng	0.2794	0.7226	0.6652	0.5600
Arunachal Pradesh	East Siang	0.1586	0.5507	0.3488	0.3519
Arunachal Pradesh	Lohit	0.2143	0.6553	0.5184	0.4645
Arunachal Pradesh	Lower Subansiri	0.2258	0.3685	0.4611	0.3566
Arunachal Pradesh	Papum Pare	0.2027	0.1201	0.2538	0.1951
Arunachal Pradesh	Tawang	0.3256	0.3178	0.1609	0.2632
Arunachal Pradesh	Tirap	0.3624	0.4306	0.5086	0.4372
Arunachal Pradesh	Upper Siang	0.1765	0.4327	0.7419	0.4632
Arunachal Pradesh	Upper Subansiri	0.1597	0.5725	0.3909	0.3745
Arunachal Pradesh	West Kameng	0.1565	0.2402	0.5670	0.3323
Arunachal Pradesh	West Siang	0.1397	0.4990	0.2408	0.2902
Assam	Barpeta	0.2752	0.8799	0.2657	0.4632
Assam	Bongaigaon	0.6723	0.8427	0.4957	0.6620
Assam	Cachar	0.8246	0.7660	0.1760	0.5702
Assam	Darrang	0.3750	0.8799	0.5205	0.5878
Assam	Dhemaji	0.3529	0.9286	0.6166	0.6311
Assam	Dhubri	0.2227	0.9130	0.5140	0.5472
Assam	Dibrugarh	0.1366	0.6584	0.2073	0.3275
Assam	Goalpara	0.5735	0.8675	0.3596	0.5888
Assam	Golaghat	0.2458	0.7733	0.3542	0.4522
Assam	Hailakandi	0.8351	0.8447	0.1609	0.5929
Assam	Jorhat	0.4223	0.6149	0.3434	0.4546
Assam	Kamrup	0.3729	0.5445	0.2765	0.3922
Assam	Karbi Anglong	0.6828	0.8416	0.5194	0.6737
Assam	Karimganj	0.8676	0.8126	0.1188	0.5779
Assam	Kokrajhar	0.7101	0.8965	0.7775	0.7936
Assam	Lakhimpur	0.6229	0.8354	0.4276	0.6192
Assam	Marigaon	0.2080	0.8737	0.4568	0.5092
Assam	Nagaon	0.2374	0.7795	0.2192	0.4024
Assam	Nalbari	0.2721	0.8375	0.4795	0.5265
Assam	North Cachar Hills	0.6639	0.6874	0.3855	0.5701
Assam	Sibsagar	0.3162	0.6346	0.2732	0.4014
Assam	Sonitpur	0.7101	0.7774	0.4050	0.6204
Manipur	Chandel	0.8057	0.5528	0.3132	0.5465
Manipur	Churachandpur	0.7300	0.6004	0.2883	0.5284
Manipur	Imphal East	0.6134	0.2609	0.0864	0.3101
Manipur	Imphal West	0.4055	0.2143	0.0324	0.2093
Manipur	Senapati	0.6607	0.5487	0.3909	0.5271

Appendix Table 1 *contd.* (on p. 52)

Appendix Table 1 *contd.* (from p. 51)

Manipur	Tamenglong	0.8372	0.6812	0.5097	0.6687
Manipur	Thoubal	0.8235	0.4762	0.0346	0.4266
Manipur	Ukhrul	0.7069	0.4110	0.3283	0.4755
Meghalaya	East Garo Hills	0.8130	0.8219	0.2408	0.6077
Meghalaya	East khasi Hills	0.3761	0.2692	0.4060	0.3531
Meghalaya	Jaintia Hills	0.8508	0.6201	0.7019	0.7236
Meghalaya	Ri Bhoi	0.6334	0.6201	0.4255	0.5536
Meghalaya	South Garo Hills	0.7479	0.8395	0.5130	0.6915
Meghalaya	West Khasi Hills	0.7069	0.6594	0.7257	0.6987
Mizoram	Aizawl	0.5546	0.0983	0.0000	0.2084
Mizoram	Champhai	0.7836	0.4907	0.0842	0.4365
Mizoram	Erchipp	0.5672	0.0735	0.0367	0.2180
Mizoram	Kolasib	0.6418	0.2453	0.2786	0.3842
Mizoram	Lawngtlai	0.8824	0.7153	0.1490	0.5628
Mizoram	Lunglei	0.6544	0.2930	0.2786	0.4033
Mizoram	Mamit	0.9895	0.6253	0.1533	0.5701
Nagaland	Dimapur	0.7311	0.2484	0.0745	0.3395
Nagaland	Kohima	0.5788	0.2422	0.3942	0.4051
Nagaland	Mokokchung	0.5137	0.2277	0.0022	0.2371
Nagaland	Mon	0.4758	0.6791	0.1587	0.4249
Nagaland	Phek	0.2363	0.2702	0.3326	0.2821
Nagaland	Tuensang	0.4685	0.5963	0.4838	0.5145
Nagaland	Wokha	0.7983	0.3706	0.4179	0.5246
Nagaland	Zunheboto	0.6450	0.3354	0.4719	0.4840
Sikkim	West	0.2532	0.2588	0.5410	0.3662
Sikkim	South	0.27	0.2961	0.4039	0.3288
Sikkim	East	0.3025	0.1522	0.2343	0.2299
Sikkim	North	0.6008	0.3613	0.5216	0.4965
Tripura	West Tripura	0.3992	0.5176	0.1663	0.3520
Tripura	South Tripura	0.4905	0.6646	0.1156	0.4093
Tripura	North Tripura	0.6702	0.6708	0.1955	0.4977
Tripura	Dhalai	0.6838	0.7070	0.2365	0.5285

Appendix II

R code for drawing the jittered plot

```
s1<-seq(1,1,length=13)+runif(13,min=-.2,max=.2)
aruna<-c(0.52398, 0.38636,
0.56004,0.35193,0.46450,0.35659,0.19513,0.26324,0.43719,0.46324,0.37447,0.33227,0.29022)
s2<-seq(2,2,length=22)+runif(22,min=-.2,max=.2)
assam<-c(0.463186531, 0.661986334, 0.570169, 0.587781808, 0.63109, 0.547219202,
0.327512032, 0.588796819, 0.452233, 0.592937, 0.454578, 0.392157, 0.673658, 0.577869,
0.79363, 0.619164, 0.509247, 0.402417, 0.526509, 0.570076, 0.401358, 0.620436)
s3<-seq(3,3,length=8)+runif(8,min=-.2,max=.2)
mani<-c(0.546490059, 0.528353673, 0.310131, 0.209252055, 0.527115, 0.668687958,
0.426612724, 0.475520918)
s4<-seq(4,4,length=6)+runif(6,min=-.2,max=.2)
megh<-c(0.607738818, 0.353116051, 0.723629, 0.553566518, 0.691466, 0.698716668)
s5<-seq(5,5, length=7)+runif(7,min=-.2,max=.2)
mizo<-c(0.208448216, 0.436507166, 0.217966, 0.384194026, 0.56276, 0.403300048,
0.570071313)
s6<-seq(6,6,length=8)+runif(8,min=-.2,max=.2)
naga<-c(0.339489393, 0.405087446, 0.237105, 0.424862134, 0.282072, 0.514514076,
0.524554672, 0.484020008)
s7<-seq(7,7,length=4)+runif(4,min=-.2,max=.2)
sik<-c(0.3662, 0.3288,      0.2299, 0.4965)
s8<-seq(8,8,length=4)+runif(4,min=-.2,max=.2)
tri<-c(0.35196872, 0.409264616,          0.49772076, 0.528482479)
x<-c(s1,s2,s3,s4,s5,s6,s7,s8)
y<-c(aruna,assam,mani,megh,mizo,naga,sik,tri)
plot(x,y,main=”Jittred Plot for Deprivation Index”,xlab=”States”,ylab=”Weighted
Deprivation Index”)
s<-seq(1.5,7.5,length=7)
abline(v=s)
avg<-
c(mean(aruna),mean(assam),mean(mani),mean(megh),mean(mizo),mean(naga),mean(sik),mean(tri))
points(seq(1,8,length=8),avg,pch=”—”,col=2,cex=3.5)
sd<-c(sd(aruna),sd(assam),sd(mani),sd(megh),sd(mizo),sd(naga),sd(sik),sd(tri))
up<-avg+sd
lo<-avg-sd
points(seq(1,8,length=8),up,pch=”—”,col=1,cex=2)
points(seq(1,8,length=8),lo,pch=”—”,col=1,cex=2)
segments(seq(1,8,length=8),up,seq(1,8,length=8),lo)
```

Appendix III

R code for drawing the CDF, its bounds and the empirical distribution function

```
x1<-c(0.524949764, 0.390870089, 0.564977, 0.35285626, 0.4675918, 0.360711282,
0.197013974, 0.259555, 0.439931609, 0.473906, 0.376148824, 0.34090522, 0.289402594,
0.457708, 0.656478, 0.555891, 0.586707, 0.632094, 0.547856, 0.324586, 0.581362,
0.450115, 0.577482, 0.451104, 0.388465, 0.668552, 0.561274, 0.793546, 0.612864,
0.509128, 0.397286, 0.526319, 0.563526, 0.397608, 0.612893, 0.537461, 0.519411,
0.301182, 0.202409, 0.521939, 0.662579, 0.411646, 0.469463, 0.594615, 0.35473,
0.722242, 0.548942, 0.685312, 0.699558, 0.199772, 0.42311, 0.210166, 0.379363,
0.547494, 0.397877, 0.554176, 0.328718, 0.403806, 0.22793, 0.415864, 0.283972,
0.513751, 0.519603,0.482768,0.345629, 0.3992, 0.486892, 0.518082, 0.366158, 0.328798,
0.229878, 0.496454) #include indices of all the districts
x<-sort(x1)
n<-length(x)
y<-pbeta( x, 5.7465, 6.7224, TRUE)
z<-ecdf(x)
plot(z, do.points = FALSE, verticals = TRUE, xlab = “Facility Deprivation Index”, ylab =
“Probability” )
up<-y + 1.36/sqrt(n)
lo<-y – 1.36/sqrt(n)
lines(x,y,lty=1)
lines (x, up, lty =3)
lines (x, lo, lty =3)
```