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Indirect Estimation of Net Reproduction Rates for the Districts of Selected States of India

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The growth of a population being a function of both fertility and mortality, Net Reproduction Rate (NRR) is a more appropriate index of the extent to which population stabilization is attained. In India, due to incomplete registration of births and deaths direct estimation of fertility and mortality measures are not possible. The Sample Registration System (SRS) is the main source of fertility estimates at the state level, but does not provide district level estimates. However, a few researchers have used different techniques to estimate fertility rates at the district level using census data, but possibly due to the absence of reliable mortality information, none attempted to estimate the NRR. The present study attempts to estimate the NRR for the districts of some selected states of India, by using generated one parameter model female life tables of these states (based on SRS data) from estimated female life expectancy at birth. It is found that Barmer district of Rajasthan has the highest NRR while Kolkata of West Bengal has the lowest NRR among the districts of the selected states.

Keywords: *NRR, indirect estimation, district, India*

Introduction

The size of the population and its growth in India has been a major hurdle in achieving the goal of population stabilization. The National Population policy launched in 2000 had the medium term objective to achieve replacement level fertility by 2010. This also envisages states to bring their policies, giving priority to local issues in coherence with the goals and objectives prescribed in the national policy. To measure the achievement of such an objective one needs to understand

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the fertility and reproductive variations within the states. Therefore, district level fertility and reproduction estimates are not only appropriate, but also necessary to execute any policy effectively (http://www.iipsindia.org/pdf/05_b_09cchep3.pdf).

The growth of a population being a function of both fertility and mortality, the Net Reproduction Rate (NRR) is an appropriate index of the extent to which population stabilization is attained. The NRR is a synthetic demographic rate that measures the average number of daughters per woman who survive to average reproductive age. Essentially, The NRR measures, to what extent one generation is replaced by the next generation - taking into account the levels of both (period) fertility and mortality. The NRR is probably the most accurate (period) measure of the actual demographic situation in a particular population. It eliminates age structure effects, which can seriously distort the rates of population growth or decline, as well as the birth and death rates. The NRR shows how a population would change with the *current* vital rates. It is often an "early warning sign". The NRR illustrates what is actually going on in a population by analytically removing momentum effects and migration flows (http://www.china - profile.com/data/fig_WPP2010_NRR_1.htm).

NRR is a suitable measure and preferable to TFR for some reasons. In populations with low levels of mortality, as in most developed countries, the replacement level of Total Fertility Rate (TFR) is about 2.1 whereas in populations with higher mortality, particularly high childhood mortality, the replacement level of TFR can be as high as 3.5 or 4.0. Thus, fertility rates that correspond to an NRR of 1.00 are often referred to as replacement level fertility (Preston, Heuveline, & Guillot, 2003).

In India, due to insufficient vital registration, the Sample Registration System (SRS) has emerged as the main source of fertility and reproduction estimates (Crude Birth Rate, Total Fertility Rate and Gross Reproduction Rate) at the state level, but it does not provide district level estimates. Nor does it provide state level estimates of the NRR. Moreover, although the National Family Health Surveys (NFHS) provide comparable estimates of fertility for the states and the union territories, they do not give district level estimates.

Traditionally, computation of the NRR requires female age specific survival probabilities within the child bearing period (generally obtained from a female life table) and female age specific fertility rates both of which are not available at the district level of India from the readily available sources like the SRS and NFHS, nor can they be computed directly due to poor registration of births and deaths.

One of the indirect methods, called 'The variable r method' (Preston, Heuveline, & Guillot, 2003) suggests that the NRR can be recaptured without any reference to the underlying mortality and fertility schedule if good quality age data are available from two censuses taken 5 or 10 years apart along with inter-censal female births. However, the absence of the intercensal births due to poor birth registration or difficulty in estimating them indirectly due to the effect of changing fertility situations between the censuses prevents use of this method at the state and the district levels of India.

Demographers have developed several mechanisms to estimate fertility by different direct and indirect methods [The Concept of Dual Record System by Chandra Sekar and Deming (1949), Birth Order Statistics in Stable Condition by Brass& Coale (1968), the Reverse Survival Method (Shryock & Seigel, 1976) Brass's P/F Ratio Method (1968), Rele's Method (1967, 1987), Stable Population Method (United Nations, 1983), Coale's Method (1981), Generalized Population Method by Preston (1983), Palmore Method (1978), Gunasekaran-Palmore Method (1984), etc.].

In India, Bhat (1996) has used the regression method to estimate the Total Fertility Rate (TFR) from the Crude Birth Rate (CBR) for state level data of SRS for the periods 1979-81 and 1989-91. However, low coverage of birth registration in the vital registration system has dissuaded many demographers from utilizing these data to estimate fertility. So far fertility estimates at regular intervals below the state level are not readily available from any other source. A few researchers [Parasuraman & Ram (1988), Bhat (1996), Guilmoto & Rajan (2002) and the Registrar General of India (1989, 1997) have used different indirect techniques to estimate fertility rates at the district level using census data. However, possibly due to the absence of reliable mortality information (life tables) none attempted to estimate NRR at the district level of India

Districts in India have high levels of mortality, particularly, at infant and childhood ages. Therefore, the NRR would be more worthy than the TFR to measure replacement level fertility. One may also argue that the unavailability of reliable mortality data can be corrected by applying model life table or hypothetical assumption. However, it is often found that model life tables differ considerably with the SRS life tables of many states of India. For instance, the SRS life tables of Tamil Nadu (Rural-Female: 1993-97), and Orissa (Urban-Female: 2001-05) differ considerably with the South Asian pattern of the United Nations Model Life

Tables for Developing Countries (1982). Another problem of using the model life table is that it will yield the same life table for the different districts of different states having the same life expectancy at birth (e_0^0). For example, the e_0^0 of a developed district of Assam may be the same as that of a less developed district of say, Kerala or Punjab, and the life tables constructed from a model one with the given e_0^0 will be identical. But these states generally differ in population structure, religion, culture and the people are from different racial and ethnic background. With so many differences in socio-cultural and demographic factors it is unlikely that districts of different states will have the same mortality pattern even if they have the same e_0^0. For example, consider the SRS life tables of Uttar Pradesh (2000-04) and Assam (1989-93) for urban female; Haryana and Tamil Nadu (1993-97) for rural female; though their e_0^0's are same, the life table functions ${}_nq_x$'s (probability of dying in the age group x to x + n) and e_x^0's (life expectancy at age x) differ (Choudhury & Sarma, 2011b).

Objective

The present paper attempts to estimate the NRR for the districts of some representative states of different zones of India, viz., Rajasthan from North Zone, Kerala from South Zone, West Bengal from East Zone, Gujarat from West Zone, Uttar Pradesh from Central Zone, and Assam from North East Zone. It is hoped that selection of these states will bring out the contrast prevailing in the NRR in the districts of different zones of India.

Data and Methodology

Choudhury and Sarma (2011a) have generated one parameter model life tables for the major states of India where life expectancy at birth (e_0^0) is the only input. The e_0^0 for the districts can be estimated by the regression method using the estimated infant mortality rates of the districts and the proportions of persons above 65 years of age. Thus, the life tables for the districts of the major states can be obtained from the estimated e_0^0.

Guilmoto and Rajan (2002) estimated the Total Fertility Rate (TFR) for the districts using 2001 census data for the districts of India. These are the recent estimates at district level and have been used in the present study for estimating the GRR (Gross Reproduction Rate) and NRR for the selected states and their districts. In doing so the following formulas have been used:

$$GRR = TFR * \frac{1}{1+SRB} \qquad \text{(Preston et al., 2003)}$$

where SRB is the sex ratio at birth computed as $SRB = \frac{BR\,(M)}{BR\,(F)} = \frac{BR\,(T) - BR\,(F)}{BR\,(F)}$, *and BR (M), BR(F) and BR(T) denote the male, female and total Birth Rates respectively.*

Birth Rates for the selected major states and their districts can be estimated by the reverse survival technique and using the 0-4 population of the 2001 census and the 0-4 survival probabilities from our generated life tables. These Birth Rates are centered on mid 1998 as the 0-4 population in the 2001 census refers to the births during 1996-2001. The population at the midpoint of 1998 is computed by

$P_{mid\,1998} = P_{2001}\, e^{-2.5r}$; where P_{2001} is the total population in 2001, r is the exponential growth rate of population during 1991 to 2001.

The BR for the midpoint of 1998 is computed by the Reverse Survival Method as

$$BR\,(1998) = \frac{1}{5}\frac{{}_5P_0 \big/ P_{2001}\, e^{-2.5r}}{{}_5L_0 \big/ 5l_0} = \frac{l_0\ {}_5P_0}{P_{2001}e^{-2.5r}\ {}_5L_0} = \frac{l_0\ {}_5p_0}{p_{2001}e^{-2.5r}({}_1L_0 + {}_4L_1)}$$

where l_0 = 100000, ${}_5L_0 \big/ 5l_0$ is the probability of survival in the age group 0-4 and ${}_5P_0$ is the population aged 0-4 in 2001 census.

This estimation process is sensitive to the level of age misstatement of the 0-4 population. However, with rapid improvement in the literacy level the intensity of age misstatement is decreasing rapidly and the quality of age data in the 2001 census has most probably improved compared to the previous censuses (Guilmoto & Rajan, 2002).

$$NRR = GRR * p(A_M) \qquad \text{(Preston et al., 2003)}$$

Where $p(A_M)$ is the probability of survival from birth to the mean age of childbearing. The mean age of childbearing is to a close approximation equal to the mean length of generation (T) (Preston et al., 2003) and T is fairly constant at about 29 years (Namboodiri, 1991).

The probability of survival of a female baby to the mean age of child bearing [$p(A_M) = p(29)$] can be calculated from the generated female life tables by interpolating between ages 25 and 30.

It is to be noted that $\frac{\int_{\alpha}^{\beta} m(a)ada}{\int_{\alpha}^{\beta} m(a)da}$ (Preston et al., 2003)

The analogous form for discrete data of 5 years age group being

$$A_M = \frac{\sum_{15}^{45} {}_5m_a(a+2.5)}{\sum_{15}^{45} {}_5m_a}$$

Where ${}_5m_a$ is the female age specific fertility rate in the age group a to a+5.

From SRS data A_M were computed for the states and found to vary from 25.9 to 29.6 years. However, the estimates of NRR computed by taking $A_M = 29$ do not differ from the ones taking the corresponding estimated values of A_M for these states. So, the assumption of $A_M = 29$ is justified.

It is to be noted that the SRB calculated from the estimated birth rates are centered in mid-1998 while the TFR estimated by Guilmoto and Rajan (2002) are centered on 1997.

It should also be noted that the SRB cannot be computed directly simply because the registration of births in India is neither complete nor reliable. The problem is more acute for the sub state units like the districts. Moreover, the birth rates used for calculation of SRB has to be estimated indirectly by the Reverse Survival Technique using census population data and our generated life tables because the birth rates are not provided by reliable sources such as SRS and NFHS at district level.

Results and Discussion:

Table 1 presents the birth rates for both sexes combined (BR(T)) and for female (BR(F)), TFR as estimated by Guilmoto and Rajan (2002), estimated SRB, GRR and NRR of the selected states and their districts. Table 2 presents the districts with the lowest and highest NRR**s** of each selected state and Table 3 classifies the number of districts of the selected states into different ranges of NRR. For the districts newly created between 1991 and 2001, NRR are not computed due to the absence of 1991 population figures. Instead we have retained the districts of 1991 that were also present in 2001 by including the data of the newly created districts where there was a direct split into two districts. But, for the large districts from which only a small part was taken away to new districts or transferred to other districts the data could not be adjusted. However, considering the large populations of these large districts, it is hoped that leaving out a small part from them will have a trivial effect on the NRR. We have given an account of the changes that took place in the districts between 1991 and 2001 in the appendix.

Under the conditions that if the current age specific rates of fertility and mortality of the districts remain constant and the age specific migration rates are set at zero, it has been found that in only one district of Kerela (viz., Malapuram, NRR = 1.08) the present generation of mothers will be replaced by an 8% larger group of potential mothers in the next generation. And in all other districts the present generation of mothers will be reduced by 11 to 21% in the next generation.

Under the same set of conditions, it has been found that, in Uttar Pradesh only one district will experience a reduction of 0.01% (viz., Kanpur Nagar), 3 districts will experience a growth of less than 50%, 43 districts will experience 50 to below 100 % growth and 7 districts will experience more than 100% growth in the next generation of potential mothers. In Rajasthan, 5 districts will have a growth of below 50%, 19 districts will have a growth of 50 to below 100% where as 3 districts will have more than 100% growth in the next generation of potential mothers. In Gujarat, 3 district will experience a reduction, 13 districts will have a growth of below 50%, 2 districts will have a growth of 50 to below 100% in the next generation of potential mothers. In West Bengal, 6 districts will experience a reduction in the next generation of potential mothers by 0.01% (viz., Bardhaman, NRR = 0.99) to 42 percent (viz., Kolkata, NRR = 0.58) whereas 8 districts will have a growth of below 50%, 2 districts will have a growth of 50 to below 100%. Assam has only one district with below replacement level fertility

(viz., Jorhat, NRR = 0.94) where there will be a 6% reduction, while 17 districts will have a growth of below 50% and 5 districts will have a growth of 50 to below 100 % of potential mothers in the next generation.

The different levels of NRR of the districts of the selected states may be attributed to different levels of social development which can possibly be measured by a combination of factors such as female literacy, age at marriage, poverty or income. However, studies of Kerala's rapid fertility decline during the last two decades of the 20th century reveals that drastic fertility transition can be achieved even in the absence of a threshold level of the much - needed structural changes on the socioeconomic and health fronts (Nair, 2010).

Table 1: The birth rates for both sexes combined (BR(T)) and for female (BR(F)), TFR as estimated by Guilmoto and Rajan, (2002); estimated SRB, GRR and NRR of the selected states and their districts

District	1998		1997			
	BR(T)	BR(F)	TFR	GRR	NRR	SRB
Kerala	18.1	8.8	1.7	0.83	0.81	1.05
Kasaragod	20.5	10.0	1.9	0.93	0.86	1.04
Kannur	17.5	8.6	1.7	0.83	0.80	1.04
Wayanad	21.6	10.6	2.0	0.98	0.89	1.04
Kozhikode	18.6	9.1	1.7	0.83	0.80	1.04
Malappuram	24.2	11.8	2.4	1.17	1.08	1.04
Palakkad	18.6	9.2	1.8	0.88	0.84	1.04
Thrissur	16.6	8.1	1.6	0.78	0.77	1.04
Ernakulam	16.5	8.1	1.5	0.73	0.71	1.05
Idukki	18.2	9.0	1.6	0.79	0.74	1.03
Kottayam	16.0	7.9	1.6	0.79	0.79	1.02
Alappuzha	16.0	7.9	1.5	0.74	0.73	1.03
Pathanamthitta	14.7	7.3	1.5	0.75	0.75	1.01
Kollam	17.2	8.4	1.6	0.79	0.75	1.04
Thiruvananthapuram	17.3	8.5	1.6	0.79	0.75	1.04
Uttar Pradesh	29.0	14.1	4.4	2.14	1.76	1.06
Saharanpur	28.6	13.5	4.0	1.89	1.59	1.11
Muzaffarnagar	29.5	13.8	4.4	2.06	1.73	1.14
Bijnor	30.4	14.6	4.6	2.20	1.86	1.09

Table 1 (cont.)

District	1998		1997			
	BR(T)	BR(F)	TFR	GRR	NRR	SRB
Moradabad (including Jyoti Phule Nagar)	31.4	15.1	5.0	2.40	2.04	1.07
Rampur	32.9	16.0	5.1	2.48	1.95	1.06
Jyotiba Phule Nagar *						
Meerut (including Baghpat)	26.1	12.2	3.9	1.82	1.55	1.15
Baghpat *						
Ghaziabad !	26.1	12.1	3.9	1.81	1.54	1.15
Gautam Buddha Nagar *						
Bulandshahr !	28.5	13.3	4.4	2.06	1.63	1.14
Aligarh !	27.8	13.4	4.5	2.17	1.64	1.08
Hathras *						
Mathura	28.0	13.3	4.6	2.18	1.92	1.11
Agra	29.1	13.9	3.8	1.81	1.39	1.10
Firozabad	31.6	15.1	4.8	2.30	1.79	1.09
Etah	31.0	14.8	4.9	2.34	1.86	1.09
Mainpuri	28.3	13.5	4.4	2.10	1.76	1.10
Budaun	33.3	15.9	5.5	2.63	2.13	1.09
Bareilly	30.8	14.8	4.9	2.35	1.95	1.08
Pilibhit	31.4	15.4	4.9	2.39	1.88	1.05
Shahjahanpur	30.7	14.7	4.8	2.30	1.86	1.09
Kheri	30.7	15.1	4.7	2.31	1.92	1.04
Sitapur	30.0	14.7	4.7	2.31	1.95	1.04
Hardoi	29.7	14.3	4.8	2.31	1.95	1.08
Unnao	26.6	12.8	4.1	1.97	1.64	1.08
Lucknow	22.8	11.0	3.1	1.49	1.28	1.08
Rae Bareli	28.2	13.8	4.3	2.09	1.75	1.05
Farrukhabad (including Kannauj)	28.2	13.6	4.3	2.07	1.67	1.07
Kannauj *						
Etawah (including Auraiya)	26.3	12.5	4.0	1.90	1.69	1.10
Auraiya *						
Kanpur Dehat !	24.9	11.7	4.2	1.98	1.61	1.13
Kanpur Nagar !	24.0	11.2	2.6	1.22	0.99	1.14
Jalaun	24.3	11.6	3.7	1.76	1.52	1.10

Table 1 (cont.)

District	1998		1997			
	BR(T)	BR(F)	TFR	GRR	NRR	SRB
Jhansi	24.6	11.4	3.4	1.58	1.37	1.15
Lalitpur	33.1	15.8	4.9	2.34	2.00	1.09
Hamirpur (including Mahoba)	30.5	14.6	4.4	2.11	1.80	1.09
Mahoba *						
Banda (including Chitrakut)	30.7	14.9	4.6	2.23	1.92	1.06
Chitrakoot *						
Fatehpur	27.1	13.2	4.5	2.18	1.83	1.06
Pratapgarh	27.5	13.5	4.2	2.05	1.76	1.04
Kaushambi *						
Allahabad (including Kaushambi) !	28.8	14.2	4.2	2.06	1.65	1.04
Barabanki !	29.2	14.3	4.7	2.31	1.84	1.04
Faizabad (including Ambedkar Nagar) !	27.8	13.7	4.0	1.97	1.78	1.04
Ambedkar Nagar *						
Sultanpur	28.9	14.2	4.4	2.16	1.84	1.04
Bahraich (including Shwawasti)	30.7	15.2	4.1	2.03	1.73	1.02
Shrawasti *						
Balrampur *						
Gonda	29.3	14.4	4.7	2.31	2.01	1.03
Siddharthnagar !	32.9	16.2	5.1	2.52	2.04	1.02
Basti (including Sant Kabir Nagar)	30.1	14.8	4.7	2.31	1.97	1.04
Sant Kabir Nagar *						
Maharajganj	32.9	16.2	5.0	2.47	2.02	1.03
Gorakhpur	26.7	13.1	4.3	2.11	1.85	1.04
Kushinagar *						
Deoria (including Kushinagar)	28.8	14.3	4.4	2.19	1.88	1.01
Azamgarh	30.8	15.4	4.5	2.24	1.83	1.01
Mau	30.5	15.0	4.6	2.27	1.90	1.03
Ballia	26.4	13.1	3.8	1.88	1.70	1.02
Jaunpur	30.6	15.0	4.3	2.10	1.77	1.04
Ghazipur !	29.2	14.4	3.9	1.92	1.69	1.03
Chandauli *						

Table 1 (cont.)

District	1998		1997			
	BR(T)	BR(F)	TFR	GRR	NRR	SRB
Varanasi (including S R Nagar & Chandauli)	28.4	13.9	4.1	2.01	1.71	1.04
Sant Ravidas Nagar Bhadohi *						
Mirzapur	29.8	14.6	4.7	2.30	2.00	1.04
Sonbhadra	33.6	16.5	4.8	2.35	1.89	1.04
Rajasthan	30.4	14.6	4.2	2.02	1.66	1.08
Ganganagar (including Hanumangarh)	22.9	10.6	3.4	1.58	1.32	1.15
Hanumangarh *						
Bikaner	38.9	18.8	4.4	2.13	1.77	1.07
Churu	32.1	15.4	4.2	2.02	1.69	1.08
Jhunjhunun	27.4	12.8	3.8	1.77	1.50	1.15
Alwar	31.3	14.9	4.5	2.14	1.76	1.10
Bharatpur	32.6	15.6	4.9	2.34	1.88	1.09
Dhaulpur	37.1	17.8	5.7	2.73	2.02	1.08
Karauli *						
Sawai Madhopur (including Karauli) !	26.1	12.4	4.4	2.09	1.64	1.10
Dausa *						
Jaipur !	27.2	13.0	3.8	1.81	1.48	1.10
Sikar	28.7	13.6	3.9	1.85	1.56	1.11
Nagaur	30.3	14.6	4.2	2.03	1.69	1.07
Jodhpur	31.5	15.2	4.4	2.13	1.76	1.07
Jaisalmer	37.9	17.8	5.8	2.73	2.21	1.12
Barmer	37.5	18.1	5.7	2.75	2.22	1.07
Jalor	42.4	20.5	5.2	2.51	1.99	1.07
Sirohi	33.0	15.9	4.7	2.26	1.80	1.08
Pali	30.3	14.6	4.4	2.13	1.68	1.07
Ajmer	27.8	13.4	3.7	1.79	1.47	1.07
Tonk	29.7	14.4	4.2	2.03	1.62	1.07
Bundi	28.6	13.8	4.0	1.93	1.55	1.08
Bhilwara	29.1	14.2	4.0	1.95	1.56	1.05
Rajsamand *						
Udaipur (including Rajsamand)	28.4	13.9	4.1	2.01	1.55	1.04

Table 1 (cont.)

District	1998		1997			
	BR(T)	BR(F)	TFR	GRR	NRR	SRB
Dungarpur	37.0	18.1	4.5	2.20	1.63	1.04
Banswara	37.3	18.2	4.8	2.35	1.72	1.04
Chittaurgarh	28.1	13.7	3.8	1.84	1.44	1.06
Kota (including Kota)	24.0	11.6	3.5	1.69	1.38	1.07
Baran *						
Jhalawar	27.9	13.6	4.0	1.95	1.61	1.05
Gujarat	23.4	11.2	2.6	1.23	1.06	1.09
Kachchh	25.3	12.3	NA			1.05
Banas Kantha !	29.9	14.4	3.9	1.88	1.57	1.08
Patan *						
Mahesana !	18.3	8.4	2.5	1.14	1.00	1.20
Sabar Kantha	24.8	11.7	2.9	1.37	1.19	1.11
Gandhinagar !	28.7	13.0	2.4	1.09	0.92	1.20
Ahmadabad !	20.6	9.6	2.3	1.07	0.92	1.16
Surendranagar	25.8	12.3	3.4	1.62	1.42	1.09
Rajkot	20.9	9.8	1.9	0.89	0.79	1.13
Jamnagar	22.3	10.8	2.4	1.16	1.03	1.07
Porbandar *						
Junagadh (including Porbandar)	21.4	10.4	2.6	1.26	1.11	1.07
Amreli !	20.6	10.0	2.5	1.21	1.09	1.06
Bhavnagar !	23.9	11.4	3.0	1.43	1.27	1.09
Anand *						
Kheda (including Anand) !	22.2	10.5	2.6	1.23	1.06	1.11
Panch Mahals (including Dahod)	29.8	14.8	3.5	1.73	1.49	1.02
Dohad *						
Vadodara	21.1	10.1	2.4	1.15	1.00	1.09
Narmada *						
Bharuch (including Narmada)	23.1	11.3	2.5	1.22	1.06	1.05
Surat	23.4	11.0	2.5	1.17	1.01	1.13
The Dangs	33.7	16.9	3.8	1.90	1.58	1.00
Navsari *						

Table 1 (cont.)

District	1998		1997			
	BR(T)	BR(F)	TFR	GRR	NRR	SRB
Valsad (including Navasari)	21.4	10.4	2.5	1.22	1.06	1.05
West Bengal	21.4	10.4	2.6	1.28	1.13	1.05
Darjiling	19.2	9.5	2.1	1.04	0.89	1.02
Jalpaiguri	23.7	11.8	2.8	1.40	1.15	1.01
Koch Bihar	23.5	11.6	3.0	1.48	1.26	1.03
Uttar Dinajpur *						
Dakshin Dinajpur *						
Maldah	30.9	15.4	4.0	1.99	1.57	1.01
Murshidabad	27.6	13.6	3.5	1.73	1.45	1.02
Birbhum	24.5	12.0	3.0	1.47	1.25	1.04
Barddhaman	19.5	9.5	2.3	1.12	0.99	1.05
Nadia	20.0	9.8	2.4	1.18	1.04	1.03
North 24 Parganas	17.9	8.7	2.1	1.02	0.91	1.05
Hugli	18.1	8.8	2.0	0.98	0.86	1.05
Bankura	21.4	10.4	2.6	1.27	1.12	1.05
Puruliya	23.7	11.6	3.1	1.52	1.35	1.04
Medinipur	21.4	10.4	2.6	1.26	1.12	1.06
Haora	18.0	8.8	2.1	1.03	0.90	1.05
Kolkata	12.5	6.0	1.4	0.68	0.58	1.07
South 24 Parganas	23.0	11.2	4.3	2.10	1.86	1.04
Assam	26.0	12.9	3.2	1.60	1.31	1.02
Kokrajhar	27.0	13.3	3.3	1.63	1.33	1.03
Dhubri	33.7	16.5	4.3	2.11	1.68	1.04
Goalpara	30.7	15.2	3.9	1.94	1.59	1.01
Bongaigaon	27.9	13.8	3.5	1.74	1.44	1.02
Barpeta	28.9	14.3	3.8	1.88	1.60	1.02
Kamrup	21.5	10.6	2.6	1.29	1.11	1.02
Nalbari	21.7	10.8	2.7	1.34	1.16	1.02
Darrang	28.2	14.1	3.4	1.70	1.34	1.00
Marigaon	29.7	14.7	3.9	1.93	1.62	1.02
Nagaon	28.7	14.4	3.6	1.80	1.52	1.00
Sonitpur	25.1	12.5	3.0	1.50	1.23	1.00

Table 1 (cont.)

District	1998		1997			
	BR(T)	BR(F)	TFR	GRR	NRR	SRB
Lakhimpur	25.5	12.7	3.3	1.65	1.39	1.01
Dhemaji	25.8	12.9	3.5	1.75	1.47	1.00
Tinsukia	24.0	12.0	2.9	1.45	1.22	1.01
Dibrugarh	21.4	10.6	2.4	1.19	1.02	1.01
Sibsagar	21.5	10.7	2.4	1.20	1.01	1.01
Jorhat	20.0	10.0	2.2	1.10	0.94	1.01
Golaghat	22.5	11.2	2.7	1.34	1.12	1.01
Karbi Anglong	28.3	14.1	3.7	1.85	1.47	1.00
North Cachar Hills	25.6	12.7	3.1	1.54	1.25	1.02
Cachar	24.4	12.1	3.1	1.54	1.30	1.01
Karimganj	27.5	13.7	3.6	1.79	1.47	1.01
Hailakandi	29.3	14.1	3.8	1.83	1.49	1.07

* indicates the districts newly created between 1991 and 2001.

! districts from which only a small part was taken away to new districts or transferred to other districts between 1991 and 2001.

Table 2: The districts with lowest and highest NRR of each selected states

State	Dist with Lowest NRR	Dist with Highest NRR
Kerala	Ernakulam (NRR = 0.71)	Malapuram (NRR = 1.08)
Uttar Pradesh	Kanpur Nagar (NRR = 0.99)	Budaun (NRR = 2.13)
Rajasthan	Ganganagar (NRR = 1.32)	Barmer (NRR = 2.22)
Gujarat	Rajkot (NRR = 0.79)	The Dangs (NRR = 1.58)
West Bengal	Kolkata (NRR = 0.58)	South 24 Parganas (NRR = 1.86)
Assam	Jorhat (NRR = 0.94)	Dhubri (NRR = 1.68)

Table 3: Classification of the number of districts of the selected states into different ranges of NRR

State	Total No of Districts (no. of districts NRR computed)	No of Districts with NRR<1	No of Districts with 1≤NRR<1.5	No of Districts with 1.5≤NRR<2	No of Districts with NRR≥2
Kerala	14 (14)	13	1	0	0
Uttar Pradesh	70 (54)	1	3	43	7
Rajasthan	32 (27)	0	5	19	3
Gujarat	25 (18)	3	13	2	0
West Bengal	18 (17)	6	8	2	0
Assam	23 (23)	1	17	5	0

Note: Number of districts is as per 2001 census.

Appendix

Changes in the districts of the selected states during 1991 and 2001 with dates:

Kerala

1993: English names of districts of Kerala were modified to reflect their pronunciation in Malayalam. Thus, Alleppey became Alappuzha; Cannanore became Kannur; Quilon became Kollam; Calicut became Kozhikode; Palghat became Palakkad; Trivandrum became Thiruvananthapuram; Trichur became Thrissur; and Wynad became Wayanad. The city Cochin became Kochi.

Uttar Pradesh

1994-05: Kushinagar district split from Deoria.

1995-02-11: Mahoba district split from Hamirpur.

1995-09-30: Udham Singh Nagar district split from Nainital.

1996: Ambedkar Nagar district split from Faizabad; Sant Ravi Das Nagar district split from Varanasi; Shravasti district split from Bahraich; part of Barabanki district transferred to Faizabad; part of Kanpur Dehat district transferred to Kanpur Nagar.

1997-04-24: Kaushambi district split from Allahabad; Jyotiba Phule Nagar district split from Moradabad.

1997-05-03: Hathras district formed from parts of Aligarh and Mathura.

1997-05-06: Chhatrapati Shahuji Mahraj-Nager district split from Banda.

1997-05-25: Chandauli district split from Varanasi; Balrampur district split from Gonda.

1997-09-05: Sant Kabir Nagar district formed from Basti and a small part of Siddharth Nagar.

1997-09-06: Gautam Buddha Nagar district formed from parts of Bulandshahr and Ghaziabad.

1997-09-15: Champawat district formed from parts of Pithoragarh and Nainital.

1997-09-16: Rudra Prayag district formed from parts of Chamoli, Pauri Garhwal, and Tehri Garhwal.

1997-09-17: Auraiya district split from Etawah.

1997-09-18: Kannauj district split from Farrukhabad.

1998: Baghpat district split from Meerut.

1998-09-04: Name of Chhatrapati Shahuji Mahraj-Nager district changed to Chitrakoot.

1998: Bageshwar district split from Almora.

2000-11-09: Uttaranchal state formed by taking Almora, Bageshwar, Chamoli, Champawat, Dehradun, Haridwar, Nainital, Pauri Garhwal, Pithoragarh, Rudra Prayag, Tehri Garhwal, Udham Singh Nagar, and Uttarkashi districts from Uttar Pradesh.

Rajasthan

1991-04-10: Baran district split from Kota.

1996: Dausa district formed from parts of Jaipur and Sawai Madhopur; Rajsamand district split from Udaipur.

1997: Karauli district split from Sawai Madhopur.

1998: Hanumangarh district split from Ganganagar.

West Bengal

1992-04-01: West Dinajpur district split into Dakshin Dinajpur (Dinajpur South) and Uttar Dinajpur (Dinajpur North).

2001-01-01: Name of Calcutta district changed to Kolkata.

Gujarat

1997-10-02: Anand district split from Kheda; Dahod district split from Panch Mahals; Narmada district formed from Bharuch and a small part of Vadodara; Navsari district split from Valsad; Porbandar district split from Junagadh.

2000: Patan district formed from parts of Banas Kantha and Mahesana.

Assam

No change.

Source: www.statoids.com assessed on Dec 30, 2011

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