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Background

India is the largest democracy in the world. It accounted for more than 17 per cent of the world's population in 2010 according to the estimates prepared by the United Nations (United Nations, 2008). This 17 per cent of the world population lives on less than 2.5 per cent of the total land area of the planet Earth. Between 2000 and 2010, world's population is been estimated to have increased at the rate of 1.22 per cent per year, adding an average of 79 million persons each year. Very close to 22 per cent of this increase is estimated to have accounted for by the increase in population in India and this contribution has been the largest, even larger than the contribution of China, the most populous country in the world today (United Nations, 2008). Projections prepared by the United Nations suggest that by the year 2050, population of India will increase to 1614 million which will account for almost 19 per cent of the estimated world population of 9150 million at that time. This means that of the projected 2854 million increase in world population in the 50 years between 2000 and 2050, more than 571 million or almost 19 per cent in crease in the world population will be confined to India alone. These projections also indicate that by the year 2050, India will become the most populous country in the world surpassing China. Obviously, population stabilization in the world as a whole will depend on the pace of demographic transition in India.

During the nineties, the government of India has taken a number of key policy initiatives that have relevance to future population growth in the country. The first of these initiatives was the National Population Policy 2000 which aimed at achieving zero population growth in the country by the year 2045 through reducing fertility to the replacement level by the year 2010 (Government of India, 2000). In the year 2005, the National Rural Health Mission was launched with the objective of inducing architectural corrections in the public health care deliver system in the country so as to meet the health and family welfare needs of the people, especially, people living in rural and remote areas (Government of India, 2005). At the same time the process of economic reforms that started in 1990 continued with varying pace throughout this period. A revival of economic reforms and better economic policies during the first decade of the present century has accelerated the economic growth rate. Today, India is the second fastest growing major economy of the world.

These facts explain the special interest with which the results of the 2011 population census in India have been awaited. Provisional results of the 2011 population census have now been released. They supply basic information about population size, rate of population growth, population sex ratio and levels of literacy for the country as a whole as well as for its constituent states and Union Territories. This paper analyses salient features of the demographic situation in the country as revealed by the preliminary results of 2011 population census.

Growth rate trends

The population of India as of 1 March 2011 was 1,210,193,422 persons. This implies an increase of 17.653 per cent in the ten-year period since the 2001 population census. The proportionate increase in the population of the country during the decade 1991-2001 was 21.353 per cent which means that the population increase in the country has continued to slow down and the rate of retardation in population growth appears to have increased. In terms of the average annual growth rate, the population of the country increased at a rate of 1.626 per cent per year, well below the average annual increase of 1.935 per cent per year during 1991-2001. In fact, after achieving the peak growth rate of 2.22 per cent per year during the period 1961-71, population growth in the country has slowed down in every decade and appears to be picking up the momentum.

A notable feature of the provisional population figures is that they are very close to the population projected by the Government of India for the period 2001-2011 on the basis of the 2001 population census. Government of India had projected that the population of the country will increase to 1,192,506 thousand by the year 2011 (Government of India, 2006). Similarly, United Nations had estimated that India's population would increase to more than 1214 million by the year 2010 (United Nations, 2008). The provisional population figures of 2011 population census suggest that the enumerated population in the country exceeded the projected population by almost 18 million. During the period 1991-2001, the enumerated population of the country exceeded the project population by around 16 million whereas, the enumerated population exceeded the projected population by less than 9 million during the period 1981-91(Chaurasia and Gulati, 2008). In fact, the average annual population growth rate during the period 2001-2011 based on the provisional figures of the 2011 population census works out to be almost 1.63 per cent per year which is substantially higher than the project average annual growth rate of 1.48 per cent per year. This suggests that demographic transition - reduction in fertility and mortality - in the country has been slower than the projected one. Population projections prepared by the Government of India are based on the assumption that the replacement fertility will be achieved by the year 2021 - not in 2010 as aimed in the National Population Policy 2000 - and by the year 2010, the total fertility rate will decline to 2.6 birth per woman of reproductive age. However, the average annual population growth rate during the period 2001-2011 derived from the provisional figures of the 2011 population census suggests that the decrease in fertility in the country has been slower than the project one which means that the country will not able to achieve replacement fertility even by the year 2021. This means that there is only a distant possibility of achieving stable population by the year 2045 as stipulated in National Population Policy 2000.

Table 1: India: Population and population growth, 1901-2011.

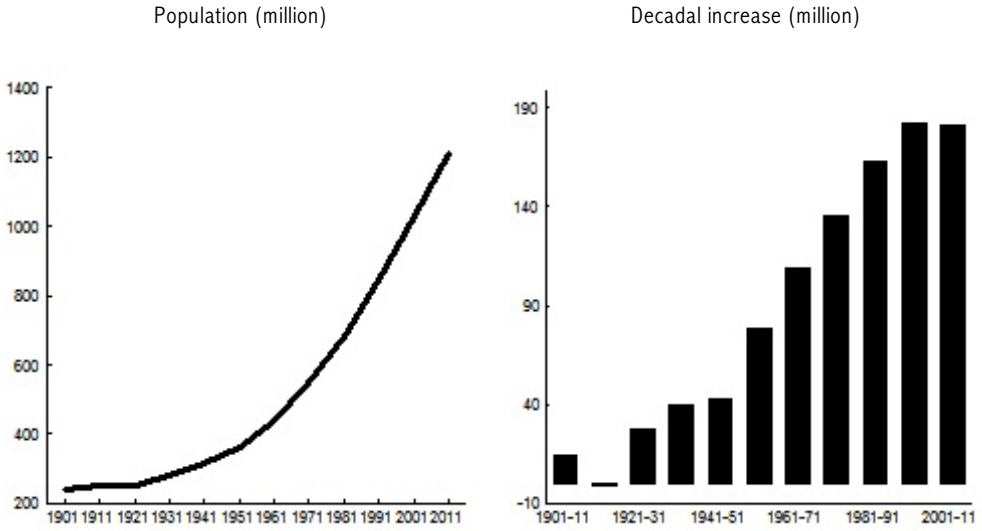
Year	Population (million)	Decadal change in population		Average annual growth rate during decade (Per cent)
		Million	Percent	
1901	238.396			
1911	252.093	13.697	5.75	0.56
1921	251.321	-0.772	-0.31	-0.03
1931	278.977	27.656	11.00	1.04
1941	318.661	39.684	14.22	1.33
1951	361.088	42.427	13.31	1.25
1961	439.235	78.147	21.64	1.96
1971	548.16	108.925	24.80	2.22
1981	683.329	135.169	24.66	2.20
1991	846.303	162.974	23.85	2.14
2001	1028.615	182.312	21.54	1.95
2011	1210.193	181.578	17.65	1.63

Source: Census reports

Increase in population size

As the result of the slow down in the population growth, the net addition to the population decreased in India for the first time during the period 2001-2011. During the period 1991-2001, the net addition to the population of the country was around 182.32 million (Table 1) whereas, the net addition to the population of the country during the period 2001-2011 was 181.6 million. This decrease in the net addition to the population is perhaps the most remarkable feature of population transition in India during the period 2001-2011. This is an indication that the population growth in the country has now started shrinking. Had the average annual population growth rate during the period 2001-2011 would have been the same as the average annual population growth rate during the period 1991-2001, the population of the country would have increase to 1246.315 million and the net addition to the population of the country would have been almost 218 million - 56 million more than the actual addition to the population during the period 2001-2011 as revealed through provisional figures of the 2011 population census. This trend in the net addition to the population of the country again confirms that population transition in the country is picking the momentum and the net addition to the population of the country has now peaked. However, actual slow down in the growth of the population during the period 2001-2011 has been slower than the projected one. Has the actual population growth in the country followed the projected path, the decrease in the net addition to the population would have been even more substantial.

Figure 1: India: population, 1901-2011



Source: Census reports

The outstanding feature of the population growth in India, however, is not the high rate of growth but the size of the population to which growth accrues. The net addition to the population of the country during the period 2001-11 is almost the population of Brazil in 2005. Brazil, incidently, is the fifth most populous country of the world (United Nations, 2008). Between 1951 and 2001, more than 849 million people have been added to 361 million people enumerated at the 1951 population census while almost 972 million people have been added to the population of the country since 1901. Clearly, despite moderately high levels of population growth rate, India is adding huge numbers year after year putting enormous pressure on its limited resources to meet the survival and development needs of its people.

Regional differentials in growth

Regional diversity or inequality in the growth of population in India is well known. Moreover, this diversity in population growth has persisted over time. Any discussion about India's population growth, therefore, is incomplete without a discussion on regional differences in the growth of population. The provisional results of 2011 population census provide information on population size and growth for all the states and Union Territories of India. This information is summarized in table 2 which includes data on population for the year 2001 and 2011 and estimates of population growth rate for the period 2001-11. This information covers all 29 constituent states and 6 Union Territories of the country[2].

Table 2 reveals considerable geographic variation in the population growth rate across the states and Union Territories of the country. Some states of the country grew relatively slowly, well below the growth of the country as a whole. Since the size of the population of different states and Union Territories of the country varies widely, the population growth rate of different states and Union Territories has different impact on the population growth rate of the country as a whole. Because of the varying population size, it is customary to group the states and Union Territories of the country into three broad categories; major states (states with a population of at least 20 million at the 2001 census), small states (states with a population of less than 20 million at the 2001 census), and Union Territories. According to the 2001 population census, there were 17 states in the country with a population of 20 million and more while the population of 12 states was less than 20 million. In addition, there are 6 Union Territories all of which had a population of less than 20 million. The provisional results of 2011 population census suggest that the 17 major states of the country account for almost 95 per cent of the population of the country while the 12 small states accounted for only about 5 per cent of the country's population. Union Territories, on the other hand, account for just around 0.3 per cent of the population of the country. Trends and patterns of India's population growth, therefore, are primarily determined by population growth trends and patterns in the 17 major states. The contribution of small states and Union Territories to the growth of the population of the country has always been almost negligible, although trends and patterns of population growth in Union Territories are themselves an important area of interest and analysis.

Among the major states of India, the population growth during the period 2001-2011 has been the most rapid in Bihar followed by Chhattisgarh and Jharkhand. These states are the only three major states of India where the average annual population growth rate was more than 2 per cent year during the period under reference. Interestingly, these three states constitute a geographical continuity.

The average annual population growth rate has also been more than 2 per cent per year in Jammu and Kashmir, Meghalaya, Manipur, Arunachal Pradesh and Mizoram during the period under reference. These states are the smaller states of the country. Population growth rate has also been quite high in Rajasthan, Madhya Pradesh, Uttar Pradesh and Haryana. In these states, population increased at an average annual rate of more than 1.8 per cent year during the period under reference which is well above the population growth rate of the country as a whole. In all, there are 18 states and Union Territories where the average annual population growth rate has been estimated to be higher than the national average during the period under reference. These states and Union Territories account for more than 638 million or almost 53 per cent of the population of the country.

Table 2: India: population size and growth- states and Union Territories, 1991-2001

Country/State	Population (million)			Population growth				
	1991	2001	2011	Absolute (million)		Percent		
				1991-2001	2001-20	1991-2001	2001-11	2001-11 (P)
India	846.303	1028.610	1210.193	182.307	181.583	21.54	17.65	15.93
Major States								
Uttar Pradesh	132.062	166.198	199.581	34.136	33.383	25.85	20.09	20.80
Maharashtra	78.937	96.879	112.373	17.942	15.494	22.73	15.99	16.29
Bihar	64.531	82.999	103.805	18.468	20.806	28.62	25.07	17.74
West Bengal	68.078	80.176	91.348	12.098	11.172	17.77	13.93	11.63
Andhra Pradesh	66.508	76.21	84.666	9.702	8.456	14.59	11.10	11.19
Madhya Pradesh	48.566	60.348	72.598	11.782	12.25	24.26	20.30	19.64
Tamil Nadu	55.859	62.406	72.139	6.547	9.733	11.72	15.60	8.07
Rajasthan	44.006	56.507	68.621	12.501	12.114	28.41	21.44	20.04
Karnataka	44.977	52.851	61.131	7.874	8.28	17.51	15.67	12.43
Gujarat	41.31	50.671	60.384	9.361	9.713	22.66	19.17	16.48
Orissa	31.66	36.805	41.947	5.145	5.142	16.25	13.97	10.72
Kerala	29.099	31.841	33.388	2.742	1.547	9.42	4.86	8.55
Jharkhand	21.844	26.946	32.966	5.102	6.02	23.36	22.34	16.80
Assam	22.414	26.656	31.169	4.242	4.513	18.93	16.93	14.68
Punjab	20.282	24.359	27.704	4.077	3.345	20.10	13.73	13.63
Chhattisgarh	17.615	20.834	25.54	3.219	4.706	18.27	22.59	16.44
Haryana	16.464	21.145	25.353	4.681	4.208	28.43	19.90	20.31

Country/State	Population (million)			Population growth				
	1991	2001	2011	Absolute (million)		Percent		
				1991-2001	2001-20	1991-2001	2001-11	2001-11 (P)
Small States								
Delhi	9.421	13.851	16.753	4.43	2.902	47.02	20.95	33.22
Jammu and Kashmir	7.719	10.144	12.549	2.425	2.405	31.42	23.71	15.52
Uttarakhand	7.051	8.489	10.117	1.438	1.628	20.39	19.18	17.12
Himachal Pradesh	5.171	6.078	6.857	0.907	0.779	17.54	12.82	11.77
Tripura	2.757	3.199	3.671	0.442	0.472	16.03	14.75	13.03
Meghalaya	1.775	2.319	2.964	0.544	0.645	30.65	27.81	13.03
Manipur	1.837	2.167	2.722	0.33	0.555	17.96	25.61	13.02
Nagaland	1.21	1.99	1.981	0.78	-0.009	64.46	-0.45	13.01
Goa	1.17	1.348	1.458	0.178	0.11	15.21	8.16	31.12
Arunachal Pradesh	0.865	1.098	1.383	0.233	0.285	26.94	25.96	13.03
Mizoram	0.69	0.889	1.091	0.199	0.202	28.84	22.72	12.99
Sikkim	0.406	0.541	0.608	0.135	0.067	33.25	12.38	13.16
Union Territories								
Puducherry	0.808	0.974	1.244	0.166	0.27	20.54	27.72	42.76
Chandigarh	0.642	0.901	1.055	0.259	0.154	40.34	17.09	59.67
Andaman and Nikobar	0.281	0.356	0.38	0.075	0.024	26.69	6.74	38.70
Dadra and Nagar Haveli	0.138	0.22	0.343	0.082	0.123	59.42	55.91	60.55
Daman and Diu	0.102	0.158	0.243	0.056	0.085	54.90	53.80	70.67
Lakshadweep	0.052	0.061	0.064	0.009	0.003	17.31	4.92	25.31

Table 3: Average annual population growth rate in India and states/Union Territories.

Country/State	Average annual growth rate (Per cent)		
	1991-2001	2001-2011	2001-2011(P)
India	1.951	1.626	1.478
Major States			
Uttar Pradesh	2.299	1.830	1.890
Maharashtra	2.048	1.484	1.509
Bihar	2.517	2.237	1.633
West Bengal	1.636	1.304	1.100
Andhra Pradesh	1.362	1.052	1.060
Madhya Pradesh	2.172	1.848	1.793
Tamil Nadu	1.108	1.449	0.776
Rajasthan	2.500	1.942	1.826
Karnataka	1.613	1.455	1.171
Gujarat	2.042	1.754	1.525
Orissa	1.506	1.308	1.018
Kerala	0.901	0.474	0.820
Jharkhand	2.099	2.017	1.553
Assam	1.733	1.564	1.370
Punjab	1.832	1.287	1.277
Chhattisgarh	1.678	2.037	1.522
Haryana	2.502	1.815	1.849
Small States			
Delhi	3.854	1.903	2.868
Jammu and Kashmir	2.732	2.128	1.443
Uttarakhand	1.856	1.754	1.581
Himachal Pradesh	1.616	1.205	1.112
Tripura	1.488	1.376	1.225
Meghalaya	2.673	2.455	1.225
Manipur	1.651	2.280	1.224
Nagaland	4.975	-0.048	1.223
Goa	1.414	0.785	2.709
Arunachal Pradesh	2.385	2.305	1.225
Mizoram	2.529	2.052	1.221
Sikkim	2.868	1.165	1.236
Union Territories			
Puducherry	1.872	2.447	3.560
Chandigarh	3.385	1.579	4.679
Andaman and Nikobar	2.370	0.647	3.272
Dadra and Nagar Haveli	4.686	4.414	4.734
Daman and Diu	4.389	4.288	5.345
Lakshadweep	1.539	0.604	2.256

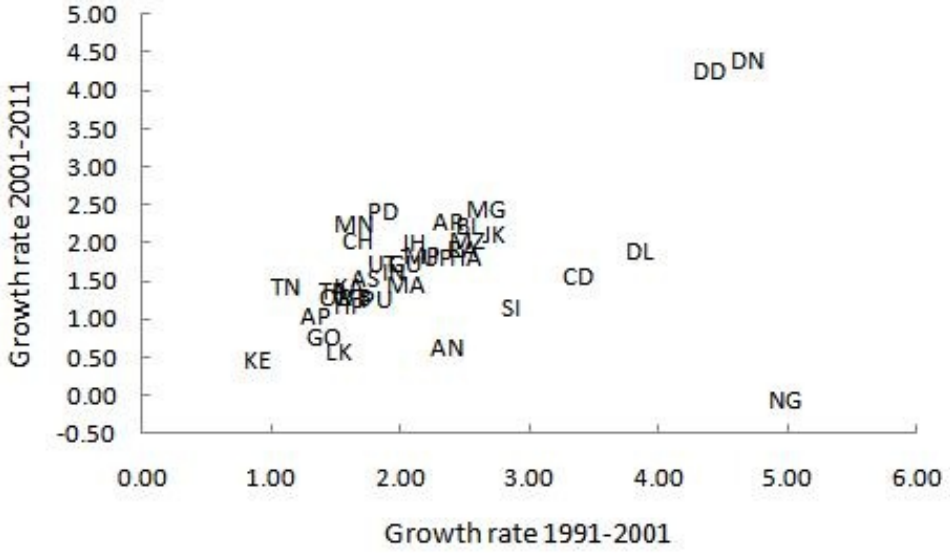
Source: Author's calculations. Projected average annual population growth rate has been estimated on the basis of the project population prepared by the Government of India (2007).

On the other hand, Nagaland is the only state in the country which has recorded a negative population growth during the period under reference. During the period 1991-2001, the population of Nagaland increased by a whopping 64.5 million but, during 2001-2011, the population of the state decreased. This appears to be a very conspicuous finding of the provisional results of 2011 population census. Moreover, there are only two states - Kerala and Goa - and two Union Territories - Andaman and Nikobar and Lakshadweep - where the average annual growth rate during 2001-2011 is estimated to be less than 1 per cent per year.

Another encouraging feature of the provisional results of the 2011 population census is that the growth in population slowed down in all but 3 states and Union Territories of the country during the period 2001-2011 as compared to the period 1991-2001 (Table 3). The three states where the average annual population growth rate appears to have increased during the period 2001-2011 compared to the period 1991-2001 are Tamil Nadu, Chhattisgarh and Manipur. Among these three states, Tamil Nadu recorded a very low growth rate during the period 1991-2001 whereas the growth rate in Chhattisgarh and Manipur was more than 2 per cent per year. It appears that rapid population growth situation has continued in these states during the period 2001-2011 also.

The situation is however not so encouraging when the population growth estimated on the basis of provisional figures of 2011 population census is compared with the projected population growth based on the projected population for the year 2011. This comparison suggests that in 20 states and Union Territories of the country, the actual population growth has been faster than the projected population growth rate with the difference being the largest in Tamil Nadu followed by Bihar among the major states of the country (Table 3). In these states and Union Territories, actual population transition during the period 2001-2011 has been slower than the projected one. At the same time, in 9 out the 12 small states, the actual population growth rate based on the provisional figures of 2011 population census has been faster than the project one. However, in all Union Territories of the country, the actual population growth during 2001-2011 has been slower than the project one. This comparison suggests that the pace of population transition in the country during the period 2001-2011 has been slower than what was projected or expected. Obviously, the population transition scenario in the country and in most of the states, as revealed through the provisional figures of the 2011 population census, does not appear to be very encouraging. It is obvious from table 3 that the country has missed the projected target of average annual population growth rate for the period 2001-2011, set on the basis of the results of the 2001 population census. This means that the country will take more time to achieve the goal of population stabilization as stipulated in the National Population Policy 2000.

Figure 2
Average annual population growth rate 1991-2001 and 2001-2011



There has been considerable variation in regional changes in the growth rate over time with acceleration in population growth in some states and Union Territories during 2001-2011 as compared to 1991-2001 and slowdown in other states and Union Territories. This is shown in figure 2 which compares the average population growth rate registered in 1991-2001 with the average population growth registered in 2001-2011. Deviations from the 45-degree line indicate the extent of change in the average annual population growth rate between 1991-2001 and 2001-2011. Most of the states fall very close to the 45-degree line. The deviation from the line is marked in Andaman and Nikobar, Sikkim, Chandigarh, Delhi and Nagaland and in Tamil Nadu, Chhattisgarh, Manipur and Puducherry. In the first group of states and Union Territories, average annual population growth rate has slowed down during the period 2001-2011 as compared to the average annual growth rate during 1991-2001 with the change in the average annual population growth rate being the most typical in Nagaland. In the second group of states and Union Territories, it has accelerated. In other states, the average annual population growth rate registered during 2001-2011 is what that could have been predicted on the basis of the average annual population growth rate recorded during the period 1991-2001. This suggest that, although, the population growth rate in the states and Union Territories of the country have shown a decline on the basis of the provisional results of 2011 population census, this decline appears to be, at best, a normal pattern in most of the states and Union Territories. There are only a few marked deviations.

Population Distribution

One implication of population growth pattern observed on the basis of the provisional results of 2011 population census is a change in the distribution of the population across the states and Union Territories of the country. An understanding of population distribution over administrative areas can be achieved through a consideration of the components of population distribution. Population distribution, essentially, has two components - extensiveness and intensiveness. Extensiveness is nothing but the size of the population of an administrative unit relative to the size of other administrative units. Intensiveness, on the other hand, implies the denseness of the population within the administrative unit. In any analysis of the change in population distribution, it is important to take both into consideration.

We have measured the extensiveness of population distribution in terms of the proportion of the population of a state/Union Territory to the population of the country as a whole. If P_s denotes the population of the state/Union Territory s, then the index of extensiveness (E_s) is (P_s/P) where P is the population of the country. E_s has the additive property that the sum of E_s over all states/Union Territories is always equal to 1. Moreover, E_s is always positive and less than 1 expect in the extreme case when all population is confined to one state/Union Territory only.

Intensiveness, on the other hand, is usually measured by population density but population density does not have additive and multiplicative properties. A more refined measure of intensiveness may be constructed by using proportions rather than absolute numbers. We define an index of intensiveness as $I_s=\log(P_s/A_s)$ where A stands for the geographical area of the state/Union Territory. I_s takes both positive and negative values and is zero when $P_s=A_s$, positive when $P_s>A_s$ and negative when $P_s<A_s$. E_s and I_s can be combined to obtain the index of population distribution for state/Union Territory s, $D_s = E_s*I_s$. Finally, summing over all states/Union Territories, we obtain the index of population distribution of the country as a whole, $D = \sum E_s * I_s$.

It is possible to decompose the change in the index D_s into the change in the index of extensiveness and the change in the index of intensiveness. It is straightforward to show that the change in D_s at over time is equal to

$$D_{s2} - D_{s1} = (E_{s2} - E_{s1})*I_{s1} + (I_{s2}-I_{s1})*E_{s1} + (E_{s2} - E_{s1})*(I_{s2} - I_{s1}).$$

The first term on the right is the contribution of the change in E_s while the second term is the contribution of Is. Lastly, the third term is an interaction term which is the combined effect of the change in E_s and the change in Is on D_s. We use the aforesaid approach to analyze how has the distribution of the population across the states and Union Territories of the country changed during the period 2001-2011.

Table 4: Population distribution in India and change in population distribution.

Country/State	2001			2011			Change in Ds			
	E_s	I_s	D_s	E_s	I_s	D_s	Absolute	Due to E_s	Due to I_s	Interaction
India			11.645			11.693				
Andaman and Nikobar	0.0346	-0.8602	-0.0298	0.0314	-0.9027	-0.0283	0.0014	0.0028	-0.0015	0.0001
Andhra Pradesh	7.4090	-0.0528	-0.3913	6.9960	-0.0777	-0.5437	-0.1525	0.0218	-0.1846	0.0103
Arunachal Pradesh	0.1067	-1.3778	-0.1471	0.1142	-1.3483	-0.1540	-0.0070	-0.0103	0.0031	0.0002
Assam	2.5914	0.0358	0.0929	2.5756	0.0332	0.0854	-0.0074	-0.0006	-0.0069	0.0000
Bihar	8.0690	0.4498	3.6292	8.5775	0.4763	4.0856	0.4564	0.2287	0.2142	0.0135
Chandigarh	0.0876	1.4022	0.1228	0.0872	1.4002	0.1220	-0.0007	-0.0006	-0.0002	0.0000
Chhattisgarh	2.0254	-0.3076	-0.6230	2.1104	-0.2898	-0.6115	0.0115	-0.0261	0.0362	0.0015
Daman and Diu	0.0154	0.6174	0.0095	0.0201	0.7331	0.0147	0.0052	0.0029	0.0018	0.0005
Delhi	1.3465	1.4749	1.9860	1.3843	1.4869	2.0584	0.0724	0.0558	0.0162	0.0005
Dadra and Nagar Haveli	0.0214	0.1569	0.0034	0.0283	0.2780	0.0079	0.0045	0.0011	0.0026	0.0008
Goa	0.1310	0.0657	0.0086	0.1205	0.0292	0.0035	-0.0051	-0.0007	-0.0048	0.0004
Gujarat	4.9262	-0.0830	-0.4087	4.9896	-0.0774	-0.3863	0.0225	-0.0053	0.0274	0.0004
Haryana	2.0556	0.1842	0.3787	2.0950	0.1925	0.4032	0.0245	0.0072	0.0169	0.0003
Himachal Pradesh	0.5909	-0.4573	-0.2702	0.5666	-0.4756	-0.2694	0.0008	0.0111	-0.0108	0.0004
Jharkhand	2.6196	0.0336	0.0881	2.7240	0.0506	0.1378	0.0497	0.0035	0.0445	0.0018
Jammu and Kashmir	0.9862	-0.8360	-0.8245	1.0369	-0.8142	-0.8443	-0.0198	-0.0425	0.0215	0.0011
Karnataka	5.1381	-0.0552	-0.2837	5.0513	-0.0626	-0.3162	-0.0326	0.0048	-0.0380	0.0006
Kerala	3.0956	0.4180	1.2941	2.7589	0.3680	1.0153	-0.2787	-0.1408	-0.1548	0.0168
Lakshadweep	0.0059	0.7823	0.0046	0.0053	0.7379	0.0039	-0.0007	-0.0004	-0.0003	0.0000
Maharashtra	9.4184	0.0027	0.0251	9.2855	-0.0035	-0.0326	-0.0576	-0.0004	-0.0581	0.0008

Country/State	2001			2011			Change in Ds			
	E_s	I_s	D_s	E_s	I_s	D_s	Absolute	Due to E_s	Due to I_s	Interaction
Meghalaya	0.2254	-0.4810	-0.1084	0.2449	-0.4450	-0.1090	-0.0006	-0.0094	0.0081	0.0007
Manipur	0.2107	-0.5084	-0.1071	0.2249	-0.4800	-0.1080	-0.0009	-0.0072	0.0060	0.0004
Madhya Pradesh	5.8669	-0.2035	-1.1940	5.9988	-0.1939	-1.1629	0.0311	-0.0268	0.0566	0.0013
Mizoram	0.0864	-0.8706	-0.0752	0.0902	-0.8521	-0.0768	-0.0016	-0.0033	0.0016	0.0001
Nagaland	0.1935	-0.4161	-0.0805	0.1637	-0.4888	-0.0800	0.0005	0.0124	-0.0141	0.0022
Orissa	3.5781	-0.1218	-0.4359	3.4662	-0.1356	-0.4701	-0.0342	0.0136	-0.0494	0.0015
Puducherry	0.0947	0.8013	0.0759	0.1028	0.8370	0.0861	0.0102	0.0065	0.0034	0.0003
Punjab	2.3681	0.1891	0.4479	2.2892	0.1744	0.3993	-0.0486	-0.0149	-0.0349	0.0012
Rajasthan	5.4935	-0.2776	-1.5252	5.6703	-0.2639	-1.4963	0.0289	-0.0491	0.0755	0.0024
Sikkim	0.0526	-0.6134	-0.0323	0.0502	-0.6334	-0.0318	0.0004	0.0015	-0.0011	0.0000
Tamil Nadu	6.0670	0.1857	1.1264	5.9609	0.1780	1.0611	-0.0653	-0.0197	-0.0465	0.0008
Tripura	0.3110	-0.0112	-0.0035	0.3033	-0.0221	-0.0067	-0.0032	0.0001	-0.0034	0.0001
Uttar Pradesh	16.1575	0.3433	5.5472	16.4917	0.3522	5.8085	0.2614	0.1147	0.1437	0.0030
Uttarakhand	0.8253	-0.2954	-0.2438	0.8360	-0.2899	-0.2423	0.0015	-0.0031	0.0046	0.0001
West Bengal	7.7946	0.4604	3.5890	7.5482	0.4465	3.3702	-0.2188	-0.1135	-0.1087	0.0034

Source: Author's calculations. Based on provisional figures of 2011 population census, 2001 population census and population projections prepared by the Government of India (2007).

Remarks: E_s is presented as a multiple of 100 while I_s is presented in absolute terms so that D_s is presented as a multiple of 100.

Estimates of the index of population distribution (D_s) for India and states/Union Territories and indexes of extensiveness (E_s) and Intensiveness (I_s) for states/Union Territories are presented in table 4. At the national level, there has been only an insignificant increase in D_s between 2001 and 2011 which suggests that there has been little change in the distribution of population across states/Union Territories of the country during the 10 years between 2001 and 2011. In other words, variation in the rate of population growth across different states and Union Territories has virtually no impact on the distribution of population across states and Union Territories.

Among different states and Union Territories, D_s is estimated to be the highest in Uttar Pradesh, followed by Bihar, West Bengal, Delhi and Kerala. These are the only four states in India where D_s is estimated to be more than 1. The relative contribution of the extensiveness and intensiveness of population distribution, however, varies in these states. In Uttar Pradesh, a high D_s is primarily the result of very high E_s; Uttar Pradesh alone accounted for almost 16.5 per cent of the population of the country according to provisional figures of 2011 population census. By contrast, a high value of D_s in Delhi is largely due to very high intensiveness of population. Delhi has the highest index of intensiveness in the country. Besides Delhi, the only other state/Union Territory having an index of intensiveness of more than 1 is Chandigarh.

On the other hand, the index of intensiveness has been found to be the lowest in Arunachal Pradesh which is the only state where the index of intensiveness has been estimated to be less than -1. The provisional figures of 2011 population census suggests that in 19 states and Union Territories of the country, the index of intensiveness is estimated to be negative which suggests that $P_s<A_s$ in these states and Union Territories.

As regards the change in D_s between 2001 through 2011, it decreased in 13 states and Union Territories but increased in others. The decrease in D_s has been the sharpest in Kerala followed by West Bengal and Andhra Pradesh. On the other hand, the increase in D_s has been the highest in Bihar followed by Uttar Pradesh which account for more than one fourth of the population of the country. In both these states, the growth of population slowed down considerably during 2001-2011, yet the concentration of population in these states, vis-a-vis other states and Union Territories has increased. According to the 2001 population census, the two states accounted for about 24.3 per cent population of the country. This per cent has increased to almost 25.1 at the 2011 population census. It appears that because of the increase in the index of intensiveness in these two states, the index of population distribution, D_s, showed a marginal increase for the country as a whole. In any case, the pattern of within-country variations in the index of extensiveness and the index of intensiveness and the change in these indexes remains quite complex (Table 4).

Prospects for future growth

In view of the fact that population growth rate in the country during 2001-2011 has been faster than the population growth rate assumed in the projection exercises carried out by the Government of India prior to the 2011 population census, the future growth of population of the country needs to be reworked by taking into account the provisional results of the 2001 population census. The projection exercise carried out by the Government of India employs the standard cohort-component procedure which requires detailed information about age and sex structure of population and information about levels and trends in fertility, mortality and migration in addition to a number of other information. This detailed information is not yet available through the 2001 population census. In the absence of detailed information about different components of the population growth, it is possible to project the future population growth through the application of the dynamic logistic model (Mari Bhat, 1999). Unlike the conventional logistic model, the dynamic logistic model assumes that upper asymptote of the model varies with time. The functional form of the upper asymptote of the dynamic logistic model may take many forms. In practice, however, two types of forms have been suggested. The first form assumes linear change in the upper asymptote over time while the second assumes that the ceiling on the population of the area being projected is a constant proportion of a larger area. In the present case, we have fitted a dynamic logistic model with a linear change in the upper asymptote.

Fitting of the dynamic logistic model to the population data of the country for the period 1901 through 2011 produced the following equation:

$$r_t = 0.09628 + 0.0446\ t - 0.00036\ P_t \qquad R^2 = 0.87,\ N = 11$$
$$(5.14) \quad (6.05) \quad (3.97)$$

where r_t is the inter-census exponential growth rate with t as the transformed calendar year with the origin at 1901 and P_t is the population size at time t. The figures in the parentheses show the t-statistic of the estimated model parameters. As indicated by the R^2 of 0.87, the mode fits very well to the observed data. According to this model, population of the country in the year 2011 is estimated to be 1214.184 million which is very close to the provisional population size of 1210.193 million as revealed through the 2011 census.

Projecting future population growth of the country on the basis of the above equation indicates that India's population is expected to reach 1410 million by the year 2021 if the trends observed during the nineties are continued in the near future. This number is 80 million more than the population projected by the Expert Committee on Population Projections constituted by the government of India (Government of India, 2006). The application of the dynamic logistic model also suggests that the population of the country is expected to increase to approximately 1923 million by the year 2051 and will cross the 2600 million mark by the turn of the current

century and will still be increasing. If the provisional figures of the 2001 population census are any indication then, it is clear that rapid population growth conditions still persist in the country despite the fact that the average annual rate of population growth in the country is declining. It is also clear from table 5 that with the current pace of population transition, there is only a distant possibility to achieve the cherished goal of stable population during the current century.

Table 5 India: projected population and population growth: 2001-2101

Year	Project population (million)	Projected change in population		Projected average annual growth rate (Per cent)
		Million	Percent	
2011	1214.184			
2021	1410.739	196.555	16.19	1.50
2031	1596.859	186.120	13.19	1.24
2041	1767.563	170.703	10.69	1.02
2051	1923.890	156.327	8.84	0.85
2061	2069.803	145.913	7.58	0.73
2071	2209.268	139.465	6.74	0.65
2081	2345.016	135.749	6.14	0.60
2091	2478.576	133.560	5.70	0.55
2101	2610.715	132.139	5.33	0.52

Source: Author's calculations

Conclusions

Provisional results of the 2001 population census released recently provide little solace to the challenge of population growth in India. There are unmistakable signs that population transition in India has progressed and the average rate of population growth in the country has declined substantially during 2001-2011. However, the actual growth of population between 2001 and 2011 has been faster than the population growth projected by the Government of India on the basis of the results of the 2001 population census and observed trends in fertility, mortality and migration (Government of India, 2006). Obviously, efforts to moderate the growth of the population during 2001-2011 appear to have fallen short of the projected, most likely, path. Provisional results of the 2011 population census also indicate that there is little possibility of realizing the expectations laid down in the National Population Policy 2000 and there is little probability that the country will be able to reach stable population by the year 2045. These results do not provide any indication that the country will be able to achieve the cherished goal of population stabilization during the current century until and unless a serious effort is made to reinvigorate population stabilization efforts. It is in this context that there is a need of revisiting

the goals and objectives of the National Population Policy and reviewing ongoing population stabilization efforts after taking into consideration the provisional results of the 2011 population census.

The provisional results of the 2011 population census, released recently, do not provide information to analyze the about the determinants of population growth. Once the information about the determinants of the population growth - fertility mortality and migration as well as information related to the age structure of the population - is available through the 2011 population census and from other sources, it would be possible to carry out a detailed analysis of factors that have contributed to the population growth revealed through 2011 population census. It will also be possible to analyze the contribution of population momentum to the future population growth as more and more of the future population growth in India will be the result of momentum built in the age structure of the population. Evidence available from the sample registration system and from other sources suggests that more and more states and Union Territories in the country will be reaching replacement fertility and, in these states and Union Territories, future population growth will be the result of population momentum. As of now, the provisional results of 2011 population census presents a mixed scenario - there are good signs but, at the same time, bad omens.

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