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Research Article

Demographic Drivers of Future Population Growth in India

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Abstract

This paper analyses the contribution of the change in the demographic drivers of population growth to the future population growth in India during the period 2015 through 2100. Based on the zero-migration variant of 2015 revision of population projections prepared by the United Nations Population Division, the paper observes that the population decreasing effects of the change in fertility, mortality and age structure of the population in India during the period 2015-2100 will be offset by the population increasing effect of the size of the population stock. The paper calls for reinvigorating fertility reduction efforts in the country in order to minimise the future population growth in the country.

Introduction

The 2015 revision of population projections prepared by the Population Division of the United Nations suggests that India's population is the most likely to increase from an estimated 1311 million in 2015 to 1754 million by 2068 and then to decrease to 1660 million by 2100 (United Nations 2015). These estimates are based on the assumption that the country will achieve the replacement fertility sometimes during 2030-35 only. It is also projected that the total fertility rate in the country will continue to decrease till 2075-2080, will remain unchanged during 2080-2095 and will increase marginally to reach 1.80 during 2095-2100. On the other hand, the expectation of life at birth is projected to increase to almost 85 years by 2095-2100. It is also projected that along with the increase in the population size, there will be significant changes in the age and sex structure of the population leading to significant changes in the population stock. These projections also suggest that India will become the most populous country of the world by 2022 surpassing the population of China.

The projected change in the population stock (size and structure) of the country, as revealed through the 2015 projection exercise carried out by the United Nations Population Division (United Nations, 2015) will be the result of the change in fertility and mortality and the associated changes in the age and sex structure of the population. It is well known that in a population closed to migration, the change in the population stock between two points in time is determined by the initial size of the population, changes in the levels of fertility and mortality and changes in the population age and sex structure. The contribution of the change in the initial population size and the contribution of the change in the age and sex structure of the population are closely related to the concept of population momentum (Keyfitz, 1971; Schoen and Kim, 1991; Horiuchi, 1995).

The analysis of the demographic drivers of future population growth has always been an area of interest to demographers. The approach that has commonly been adopted for such analyses is based on the projection of the population stock at a future date under a set of assumptions about future trends in fertility and mortality (Andreev, Kantorova and Bongaarts, 2013; Bongaarts, 2009; 1994; Bongaarts and Bulatao, 1999; Frejka, 1973; 1981). These analyses are built upon the hypothetical cohort-component projection methodology which is based on the classical demographic transition model. For example, the recent paper by Andreev, Kantorova and Bongaarts (2013) compares four

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types of population projections - standard, natural, replacement and momentum - to analyse the contribution of different demographic components to future world population growth. This analysis suggests that population momentum resulting from changes in the age and sex structure of the population will be the main demographic driver of the future population growth in the world under the assumption that fertility will sooner or later decrease to the replacement level and will remain at that level for a long period. As regards India, it has been estimated that the change in the age structure of the population, alone, will account for an increase of around 447 million in the population of the country between 2010 and 2100 (Chaurasia and Gulati, 2008).

The present paper decomposes the projected population growth in India during 2015 through 2100 into the population growth attributed to the change in fertility, the change in mortality, the change in the age and sex structure effects on the birth rate and the death rate and the change in the initial population size to identify the demographic drivers of the future population growth. The analysis has been carried out for different quinquennials of the period 2015-2100 and for the entire period 2015 through 2100. The analysis has relevance to population stabilisation policies and programmes. It is obvious that if the change in the age structure of the population and the change in the initial population size account for, say, 80 per cent of the future population growth, then there is little relevance of fertility and mortality reduction policies and programmes in the context of population stabilisation. In such a scenario, population policies and programmes should be directed to addressing the momentum effects of future population growth which are the result of fertility and mortality levels in the past which can at best delay the momentum effects through appropriate policy and programme interventions (Bongaarts, 1994). An analysis of the demographic drivers of the future population growth, therefore, has relevance to reviewing and reformulating population stabilisation policies and programmes.

Data

The analysis is based on the 2015 revision of the population estimates and projections prepared by the United Nations Population Division (United Nations, 2015). The preparation of each new revision of the world population prospects involves two distinct processes. The first is related to the incorporation of new information about the demography of each country or area of the world and, in some cases, a reassessment of the past. The second, on the other hand, is related to the formulation of detailed assumptions about the future path of fertility, mortality and international migration for every country or area of the world (United Nations, 2015a). The projection exercise follows the most commonly used component projection method. This method involves calculation of the effect of the assumed future course of fertility, mortality, and international migration on population at some given point in the future (Preston et al, 2001). The underlying assumption is that both fertility and mortality will continue to decrease in future. Three assumptions have been made about the future course of the decrease in fertility - medium decrease, slow decrease and fast decrease and corresponding to the three assumptions, three variants - medium, high and low - of population projections have been prepared. On the other hand, only one assumption has been made about the future course of mortality whereas two assumptions have been made about international migration. For each country, eight variants of population projections have been prepared in the 2015 revision: 1) low fertility; 2) medium fertility; 3) high fertility; 4) constant fertility; 5) instant replacement fertility; 6) constant mortality; 7) no change; and 8) zero-migration. Details of the assumptions related to different variants of population projections prepared by the United Nations Population Division are discussed elsewhere (United Nations, 2015a).

In the present analysis, we have used zero-migration variant of the 2015 revision of United Nations population projections. Assumptions made for this variant of population projection are the same as the medium variant of population projections with the only difference that, the international migration is set to zero throughout the projection period. This assumption essentially implies that the projected growth of the population of the country will be the result of the projected change in the annual number of births and annual number of deaths in the country which, in turn, will be determined by the change in the levels of fertility and mortality and changes in the age and sex structure of the population.

Methodology

The change in the population stock is the result of changes in factors that affect the stock (Schoen, 2002). In the absence of migration, there are only two factors that affect the population stock - number of births and number of deaths. A birth leads to an increase in the population stock whereas a death leads to a decrease in the population stock. The larger is the difference between the two in a given time period, the larger is the increase in the population stock during that period. The change in the population stock, therefore, is determined by three factors: 1) the initial size of the population stock; 2) the natural population growth rate or the difference between the birth rate and the death rate; and 3) the length of the period during which the given natural population growth rate prevails (Vallin, 2006). A synthetic index that characterises the change in the population stock over time is the population multiplier, which is the number by which the population is multiplied between two points in time (Chesnais, 1979; 1986). The population multiplier can be calculated theoretically as well as empirically. The theoretical approach involves the approximation either through an analytical model (Keyfitz, 1977) or by numerical simulation (Frejka, 1973). The empirical approach, on the other hand, involves examination of historical evidence complemented by long range population projections (Chesnais, 1990).

The number of births and the number of deaths in a population during a given time period, on the other hand, is determined by the size of the population and the birth rate and the death rate during the time period. The birth rate, it is well known, is determined not only by the probability of a birth or the fertility of individual women but also by the age and sex structure of the population as only females have the biological capacity to produce a birth which varies by the age of the woman. Similarly, the death rate is determined by both the probability of death or the force of mortality and the age and sex structure of the population as the force of mortality varies by age and is different for males and females of the same age. This means that any analysis of the change in the population stock should be carried out in terms of the change in the initial size of the population, the change in individual fertility, the change in the force of mortality and the change in the age and sex structure of the population as it affects the birth rate and the death rate. Fundamentally, the change in the population stock may be described in terms of the elaboration of the basic differential equation

$$\partial P/\partial t = mP \quad (1)$$

where P is the population stock and m is the force of transition with respect to the demographic variable of interest (Schoen, 2002). Equation (1) shows how the population stock changes over time with the change in the demographic variable. A useful feature of the change in population stock is that it is logically closed. Classically, this is reflected through the balancing equation

$$P(t) = P(0) + B(0,t) - D(0,t) + I(0,t) - O(0,t) \quad (2)$$

where t stands for time, B(0,t) is the total number of births; D(0,t) is the total number of deaths; I(0,t) is the total immigrations and O(0,t) is the total emigration during time t. Assuming that population is closed to migration or the net migration is either zero or close to zero, equation (2) may be written as

$$P(t) - P(0) = B(0,t) - D(0,t). \quad (3)$$

Dividing both the sides by PY(0,t), person years lived during time t, we get

$$r = b - d. \quad (4)$$

Here r is the natural population growth rate, b is the birth rate and d is the death rate. In the absence of migration, r serves as a useful indicator of the change in population stock. When r=0, population stock remains unchanged over time. When r>0, population stock increases and when r<0, population stock decreases. The quantum of increase or decrease in the population stock depends on the size of the population stock at time 0 and the magnitude of the natural population growth rate r.

The change in the natural population growth rate over time may now be decomposed as

$$\nabla r = r_2 - r_1 = (b_2 - b_1) - (d_2 - d_1) = \nabla_b - \nabla_d. \quad (5)$$

Let f denotes the probability of a birth or the average fertility of women, then we can write

$$b = f*(b/f) = f*ab \quad (6)$$

Equation (6) suggests that the birth rate b consists of two components. The first component is the average fertility of women f while the second component reflects the age and sex structure effects on the birth rate ab. Now, following Kitagawa (1955), the change in the birth rate may now be decomposed as

$$\nabla b = (b_2 - b_1) = f_2*ab_2 - f_1*ab_1 = [(f_2 - f_1)*(ab_1 + ab_2)/2] + [(ab_2 - ab_1)*(f_1 + f_2)/2] = \partial_f + \partial_{ab} \quad (7)$$

Similarly, if l denotes the force of mortality, then

$$d = l*(d/l) = l*ad \quad (8)$$

and

$$\nabla d = (d_2 - d_1) = l_2*ad_2 - l_1*ad_1 = [(l_2 - l_1)*(ad_1 + ad_2)/2] + [(ad_2 - ad_1)*(l_1 + l_2)/2] = \partial_l + \partial_{ad} \quad (9)$$

Substituting from (8) and (9) in (5), we get

$$\nabla r = (\partial_f + \partial_{ab}) - (\partial_l + \partial_{ad}) = (\partial_f - \partial_l) + (\partial_{ab} - \partial_{ad}) = \partial_i + \partial_a \quad (10)$$

Equation (10) suggests that the change in the natural population growth rate r over time is the algebraic sum of the change in fertility, change in mortality, change in the age and sex structure effects on the birth rate and the change in the age and sex structure effects on the death rate. It is obvious that a decrease in fertility and a decrease in the age and sex structure effects on the birth rate results in a decrease in the natural population growth rate. Similarly, a decrease in mortality and a decrease in the age and sex structure effects on the death rate result in an increase in the natural population growth rate. Equation (10) also suggests that the change in the natural population growth rate can be broken down into two components: 1) the change in the intrinsic population growth rate (i) which is determined by the difference between the birth rate independent of age and sex structure effects and the death rate independent of age and sex structure effects and 2) the change in the age and sex structure of the population as reflected through its effect on the birth rate and the death rate (a). The change in the natural population growth rate attributed to the change in population age and sex structure reflects the momentum effects on population growth. They are the result of the past fertility and mortality dynamics (Horiuchi, 1995). Equation (10) thus permits analysing how much of the change in the nature population growth rate is due to the change in the intrinsic population growth rate attributed to changes in fertility and mortality and how much of the change is attributed to the inbuilt momentum of growth in the population.

Application of equation (10) requires estimates of fertility (f) and mortality (l) which are independent of population age and sex structure. The most commonly used measure of fertility which is independent of population age and sex structure is the total fertility rate (TFR). Horiuchi (1991) has shown that the ratio of the birth rate (CBR) to the total fertility rate (CBR/TFR) is a measure of age and sex structure effects on the birth rate. One problem in using the ratio CBR/TFR as a measure of the age and sex structure effects on the birth rate, however, is that CBR is measured in terms of the population whereas TFR is measured in terms of individual woman. TFR is popularly conceptualised as a hypothetical rate which expresses how many births a woman is likely to produce, on average, during in her reproductive life span. It may however be noted that TFR is actually the un-weighted sum of the age-specific birth rates in women aged 15-49 years. Dividing the TFR by 35, the length of the reproductive life span, gives the average birth rate per woman of reproductive age. Finally, multiplying the average birth rate per woman of reproductive age by the proportion of reproductive age women in the population (w) gives the birth rate independent of population age and sex structure. In other words, the measure of fertility (f) having the same unit of measurement as the birth rate (b) may be defined as

$$f = w * (\text{TFR}/35)$$

It may be noticed that *f* is nothing but the scalar multiple of TFR. Arguing in the same manner, a measure of mortality which is independent of population age and sex structure may be defined in terms of the expectation of life at birth (e_0). Thus, the measure of mortality (*l*) having the same unit of measurement as the death rate (*d*) may be defined as $l = 1/e_0$.

Future Population Growth in India

Key indicators of the future population growth in India during 2015 through 2100 are presented in table 1. These indicators are based on the zero-migrant variant of 2015 revision of population projections prepared by the United Nations Population Division (United Nations, 2015). The medium variant of these population projections suggests that India's population will continue to increase till 2068 to peak around 1755 million. This means that around 443 million people will be added to the population of the country during 2015-2068. After 2068, country's population is projected to decrease to almost 1660 million by 2100 meaning that during 2068-2100, the population of the country will decrease by around 94 million. This medium variant projection is based on the assumption that the country will achieve the replacement fertility sometime during 2030-35 and then the total fertility rate will continue to decrease till 2080-85 to reach an all-time low of 1.792 births per woman of reproductive age. After 2085, the total fertility rate is assumed to increase marginally to almost 1.80 births per woman of reproductive age during 2095-2100. At the same time, it is assumed that the expectation of life at birth will increase steadily from around 69 years during 2015-20 to almost 85 years during 2095-2100. By comparison, the zero-migration variant of the 2015 revision of population projections suggests that India's population will increase to more than 1778 million by 2065 and then decrease to around 1701 million by 2100 so that the net addition to country's population during 2015-2100 will be around 490 million. The comparison of zero-migration variant with medium variant projections suggests that around 41 million Indians will be migrating out of the country during the period 2015 through 2100. In the present analysis, the zero-migration variant of 2015 revision of the population projections prepared by the Population Division of the United Nations has been used to take account of international migration.

The projected trend in the natural population growth rate is presented in table 2 which suggests that the average annual population growth rate in the country will continue to decrease throughout the period under reference. It is the most likely that the average annual population growth rate will turn negative only during 2070-75 and will continue to decrease till 2100. It is also projected that both birth rate independent of age and sex structure effect, *f*, and the death rate independent of age and sex structure effects, *l*, will continue to decease throughout the period under reference with the decrease in *f* being faster than the decrease in *l*. Table 2 also suggests that the age and sex structure effects will inflate *f* by around 11 percent during 2015-20. The inflating effect of the age and sex structure of the population on *f* will however tend to decrease and will turn negative during 2055-60 so that instead of inflating, age and sex structure effects will deflate *f* after 2055. The age and sex structure effects on the birth rate will continue to decrease till 2070-75 but will increase marginally after 2075.

On the other hand, the age and sex structure effects will continue to deflate *l* throughout the period 2015-2100. These effects are projected to deflate *l* by almost 50 percent during 2015-20 but the deflating effect of the population age and sex structure on *l* is projected to decrease with time so that this effect, instead of deflating, will inflate *l* during 2095-2100. The decrease in the deflating effect of the population age and sex structure on the death rate independent of age and sex structure effects, *l*, is a reflection of the fact that India's population the age structure will get increasingly older during the period under reference as the result of the decrease in fertility and mortality.

Drivers of Future Population Growth

Table 3 decomposes the change in the natural population growth rate, *r*, into the change in the birth rate independent of population age and sex structure, *f*, change in the death rate independent of population age and sex structure, *l*, change in the age and sex structure effects on the birth rate, *ab*, and the change in the age and sex structure effects on the death rate, *ad*. It may be noticed that the decrease in *f* and *ab* decreases *r* while the decrease in *l* and *ad* increases *r*. The table suggests that primary drivers of the decrease in the natural population growth rate in India in the coming years will be the decrease in the birth rate independent of age and sex structure effects or the probability of a birth and the increase in the population age and sex structure effects on the death rate. On the other hand, the decrease in the death rate independent of age and sex structure effects will tend to marginally slow down the decrease in the natural population growth rate.

Table 4 presents the projected change in the net addition to the population in different 5-years intervals of the period 2015 through 2100. For example, it is projected that the net addition to the population during 2020-25 will be around 5 million less than the net addition to the population during 2015-2020. This change in the net addition to the population can be decomposed into the change attributed to: i) the change in the size of the population; ii) the change in the birth rate independent of the age and sex structure effects; iii) the change in the death rate independent of age and sex structure effects; iv) the change in the age and sex structure effects on the birth rate; and v) the change in the age and sex structure effects on the death rate. Table 4 suggests that the change in birth rate independent of age and sex structure effects, the change in the age and sex structure effects on the birth rate and the change in the age and sex structure effects on the death rate will contribute to decrease the net addition to the population. On the other hand, the change in the death rate independent of age and sex structure effects and the change in the size of the population will contribute towards increasing the net addition to the population of the country.

Table 4 also suggests that the net addition to the population in a quinqhennials is projected to decrease by almost102 million from 2015-20 through 2095-2100. During 2015-2020, the net addition to the population is projected to be around 80 million whereas the net addition to the population during 2095-2100 is projected to be around -22 million which means a decrease, not increase, in the net addition to the population. The projected change in the net addition to the population during 2095-2100 as compared to the change during 2015-20 is attributed to projected decrease of 62.7 million (62 percent) as the result of the decrease in fertility; projected decrease of 57.2 million (56 percent) as the result of the change in the age and sex structure effects on the death rate; projected decrease of 13.8 million (14 percent) as the result of the change in the age and sex structure effects on the birth rate; projected increase of 16.3 million (16 percent) as the result of the increase in population size; and projected increase of 15.7 million (15 percent) as the result of the decrease in mortality. The projected decrease in the net addition to the population as the results of the decrease in fertility, the change in the age and sex structure effects on the birth rate and the change in the age and sex structure effects on the death rate will be around 134 million. On the other hand, the projected increase in the net addition to the population as the result of the increase in population size and the decrease in mortality will be around 32 million so that the net decrease in the net addition to the population during 2095-2100 as compared to that during 2015-2020 will be around 102 million.

Alternatively, the intrinsic population growth rate is projected to decrease from 2.769 per 1000 population during 2015-20 to -2.112 per 1000 population during 2095-2100. On the other hand, the natural population growth rate attributed to population age and sex structure or the growth rate attributed to population momentum is projected to decrease from 0.605 per 1000 population to -0.039 per 1000 population during this period. The intrinsic population growth rate is projected to turn negative during 2045-50 but the growth rate attributed to population momentum is projected to turn negative only during 2090-95. The decrease in the intrinsic population growth rate is expected to result in a decrease of around 47 million in the net addition to the population during the period under reference. On the other hand, the decrease in the growth rate attributed to population momentum is expected to result in a decrease of around 71 million in the net addition to the population during this period so that the decrease in the natural growth rate will result in a decrease of around 118 million in the net addition to the population during 2095-2100 as compared to that during 2015-2020. This implies that the net addition to the population during 2095-2100 should be less than that during 2015-2020 by about 39 million. However, the population in 2095 is projected to be higher than the population in 2015 by about 16 million so that the actual decrease in the net addition to the population during the quinquennials 2095-2100 will be less by around 102 million than the net addition to the population during 2015-2020 (Table 4).

Finally, it is projected that India's population will increase by around 390 million or by almost 30 per cent between 2015 and 2100. This increase will be the result of a decrease of around 539 million as the result of the decrease in the intrinsic population growth rate; a decrease of 650 million as the result of the change in population age and sex structure; and an increase of around 1579 million as the result of the increase in population size (Table 5). This means that the decrease in fertility, decrease in mortality and the change in the population age and sex structure will contribute towards decreasing in the size of the population stock of the country in the coming years. However, these population decreasing effects will be offset by the population increasing effect attributed to the increase in population size so that the population of the country is projected to increase by around 471 million between 2015 and 2070. After 2070, the population of the country will start decreasing so that the net addition to the population of the country during 2015-2100 will be around 390 million.

Conclusions

We have attempted in this paper to quantify the contribution of the change in fertility, mortality and population age and sex structure to the projected increase in India's population stock during the period 2015-2100. The analysis suggests that the projected increase in India's population will be driven by its very large population size as the transition in fertility and mortality and the change in population age and sex structure will contribute to decrease, instead increase, the population of the country in the coming years. The analysis also implies that the effects of the decrease in the intrinsic population growth rate and the decrease in the natural population growth rate attributed to the change in population age and sex structure on future population growth will be offset by the momentum of growth resulting from the size of the population. The effect of this growth momentum can be offset only by hastening the pace of fertility transition. However, the country has not been able to achieve fertility targets set in the past. The National Population Policy 2000 had aimed at achieving the replacement fertility by 2010 so as to stabilise population growth by 2040 (Government of India, 2000). This target could not be achieved as the total fertility rate in the country was above the replacement level as late as in 2015 as revealed through the sample registration system and the National Family Health Survey 2015-16 (Government of India, 2016; Government of India, *no date*). The National Health Policy 2017 has now set the target of achieving the replacement fertility at national and sub-national level by the year 2025 (Government of India, 2017). However, the medium or the most likely variant of the 2015 revision of the population projections prepared by the United Nations Population Division suggests that there is little possibility of achieving this target unless there is a comprehensive reinvigoration of fertility reduction efforts. It is obvious from the present analysis that slower than expected fertility transition in the country in the past will have implications for the future population growth. However, there has been a sense of complacency in fertility reduction and population stabilisation efforts in the country in the recent past as is reflected through the decrease in the contraceptive prevalence rate from 56.3 per cent in 2005-06 to 53.5 per cent during 2015-16 (Government of India, *no date*). It was more than 17 years ago that a National Population Policy was announced in 2000. However, despite the fact that the goals of the National Population Policy 2000 could not be realised, there is little initiative to formulate a new population policy taking into account the current and future demographic prospects.

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Table 1: Projected population growth in India 2015-2100

Zero-migration variant of 2015 revision of UN population projections

Year	Population (Million)	CBR (0/00)	CDR (0/00)	TFR	E_0 (Years)	W(15-49) (Million)
2015	1311.051					336.738
2020	1390.891	19.11	7.28	2.34	69.08	359.038
2025	1465.925	17.82	7.31	2.23	70.50	377.482
2030	1534.415	16.6	7.47	2.14	71.72	389.922
2035	1594.607	15.38	7.68	2.06	72.88	397.487
2040	1645.584	14.26	7.97	1.99	73.94	401.385
2045	1688.189	13.43	8.32	1.94	74.93	402.882
2050	1722.794	12.78	8.72	1.89	75.87	401.008
2055	1749.720	12.20	9.10	1.86	76.86	396.005
2060	1768.408	11.65	9.53	1.83	77.79	389.579
2065	1778.842	11.17	10.00	1.82	78.66	383.634
2070	1782.269	10.78	10.40	1.80	79.61	375.913
2075	1779.153	10.47	10.82	1.80	80.48	366.811
2080	1770.763	10.24	11.19	1.79	81.36	356.868
2085	1757.903	10.04	11.50	1.79	82.21	346.909
2090	1742.025	9.86	11.68	1.79	83.13	337.491
2095	1723.206	9.70	11.88	1.79	83.95	328.322
2100	1701.379	9.58	12.13	1.8	84.64	319.323

Source: United Nations (2015)

Table 2: Projected trend in natural population growth rate, fertility, mortality and age and sex structure effects on the birth rate and the death rate in India 2015-2100

Period	*r* Natural population growth rate (0/00)	*f* Birth rate independent of age and sex structure effects (0/00)	*l* Death rate independent of age and sex structure effects (0/00)	*ab* Age and sex structure effects on the birth rate (0/00)	*ad* Age and sex structure effects on the death rate (0/00)
2015-20	11.825	17.245	14.476	1.108	0.503
2020-25	10.510	16.439	14.184	1.084	0.515
2025-30	9.133	15.608	13.944	1.063	0.535
2030-35	7.696	14.790	13.722	1.040	0.560
2035-40	6.294	14.014	13.525	1.018	0.589
2040-45	5.112	13.348	13.346	1.006	0.623
2045-50	4.058	12.739	13.181	1.003	0.662
2050-55	3.102	12.185	13.011	1.001	0.699
2055-60	2.125	11.689	12.854	0.997	0.741
2060-65	1.177	11.308	12.713	0.988	0.786
2065-70	0.385	10.992	12.562	0.981	0.828
2070-75	-0.350	10.697	12.425	0.979	0.871
2075-80	-0.945	10.438	12.291	0.981	0.910
2080-85	-1.458	10.208	12.164	0.984	0.945
2085-90	-1.815	10.011	12.030	0.985	0.971
2090-95	-2.172	9.845	11.911	0.986	0.997
2095-2100	-2.549	9.703	11.815	0.987	1.027

Table 3: Decomposition of the change in the natural population growth rate in India 2015-2100

Period	∇r 0/00	∂f 0/00	∂l 0/00	∂ab 0/00	∂ad 0/00	$\partial i = \partial f - \partial l$ 0/00	$\partial a = \partial ab - \partial ad$ 0/00
2015-20/20-25	-1.315	-0.883	-0.149	-0.404	0.176	-0.734	-0.580
2020-25/25-30	-1.376	-0.892	-0.126	-0.331	0.28	-0.766	-0.611
2025-30/30-35	-1.437	-0.860	-0.121	-0.357	0.341	-0.739	-0.698
2030-35/35-40	-1.402	-0.798	-0.113	-0.320	0.397	-0.685	-0.717
2035-40/40-45	-1.181	-0.674	-0.108	-0.154	0.461	-0.566	-0.615
2040-45/45-50	-1.054	-0.612	-0.106	-0.044	0.504	-0.506	-0.548
2045-50/50-55	-0.957	-0.555	-0.115	-0.020	0.496	-0.440	-0.516
2050-55/55-60	-0.977	-0.496	-0.113	-0.055	0.539	-0.383	-0.594
2055-60/60-65	-0.948	-0.378	-0.108	-0.100	0.579	-0.270	-0.679
2060-65/65-70	-0.792	-0.311	-0.122	-0.081	0.521	-0.189	-0.602
2065-70/70-75	-0.735	-0.289	-0.116	-0.018	0.544	-0.173	-0.562
2070-75/75-80	-0.595	-0.254	-0.119	0.020	0.481	-0.135	-0.461
2075-80/80-85	-0.513	-0.226	-0.117	0.026	0.43	-0.109	-0.404
2080-85/85-90	-0.357	-0.194	-0.129	0.013	0.306	-0.065	-0.293
2085-90/90-95	-0.358	-0.164	-0.117	0.007	0.318	-0.047	-0.311
2090-95/95-2100	-0.377	-0.140	-0.097	0.016	0.351	-0.043	-0.335
2015-20/95-2100	*-14.374*	*-7.902*	*-2.036*	*-1.626*	*6.882*	*-5.851*	*-8.526*

Table 4: Decomposition of the change in the net addition to the population in India 2015-2100

Period	Change in the net addition to the population	Change in the net addition to the population attributed to						
		Change in population size	Change in birth rate independent of age and sex structure effects	Change in death rate independent of age and sex structure effects	Change in age and sex structure effects on the birth rate	Change in age and sex structure effects on the death rate	Change in the intrinsic growth rate	Change in growth rate attributed to age and sex structure change
2015-20/20-25	-4.806	4.329	-6.135	-1.034	-2.809	1.225	-5.101	-4.035
2020-25/25-30	-6.545	3.529	-6.530	-0.923	-2.419	2.048	-5.607	-4.467
2025-30/30-35	-8.297	2.711	-6.591	-0.930	-2.738	2.608	-5.661	-5.347
2030-35/35-40	-9.216	1.947	-6.355	-0.901	-2.549	3.160	-5.454	-5.709
2035-40/40-45	-8.371	1.336	-5.538	-0.890	-1.269	3.791	-4.647	-5.060
2040-45/45-50	-8.000	0.886	-5.158	-0.898	-0.373	4.253	-4.261	-4.626
2045-50/50-55	-7.679	0.551	-4.777	-0.993	-0.176	4.270	-3.784	-4.446
2050-55/55-60	-8.237	0.298	-4.335	-0.985	-0.478	4.708	-3.349	-5.186
2055-60/60-65	-8.255	0.120	-3.337	-0.952	-0.881	5.109	-2.385	-5.990
2060-65/65-70	-7.006	0.027	-2.767	-1.086	-0.721	4.632	-1.681	-5.352
2065-70/70-75	-6.543	0.000	-2.574	-1.035	-0.156	4.847	-1.539	-5.003
2070-75/75-80	-5.274	0.019	-2.258	-1.060	0.182	4.278	-1.197	-4.096
2075-80/80-85	-4.471	0.064	-1.998	-1.040	0.233	3.809	-0.959	-3.576
2080-85/85-90	-3.017	0.118	-1.701	-1.133	0.118	2.684	-0.568	-2.566
2085-90/90-95	-2.942	0.173	-1.425	-1.015	0.060	2.765	-0.410	-2.705
2090-95/95-2100	-3.008	0.240	-1.202	-0.839	0.142	3.027	-0.363	-2.885
2015-20/95-2100	*-101.667*	*16.349*	*-62.681*	*-15.714*	*-13.834*	*57.215*	*-46.967*	*-71.050*

Table 5: Decomposition of the increase in population of India: 2015-2100

Period	Increase in population (million)	Increase attributed to population size (million)	Increase attributed to the birth rate independent of age and sex structure (million)	Increase attributed to age and sex structure effects on the birth rate (million)	Increase attributed to the death rate independent of age and sex structure effects (million)	Increase attributed to age and sex structure effects on the death rate (million)	Increase attributed to the intrinsic growth rate (million)	Increase attribute to growth rate accounted by age and sex structure change (million)
2015-20	79.841	79.841	79.841	79.841	79.841	79.841	0	0
2020-25	75.034	84.17	73.705	77.031	78.806	81.066	-5.101	-4.035
2025-30	68.489	87.699	67.175	74.612	77.883	83.114	-10.708	-8.502
2030-35	60.193	90.41	60.584	71.874	76.953	85.722	-16.369	-13.848
2035-40	50.976	92.357	54.229	69.325	76.053	88.882	-21.824	-19.557
2040-45	42.606	93.693	48.692	68.056	75.162	92.673	-26.47	-24.617
2045-50	34.605	94.58	43.533	67.683	74.265	96.926	-30.732	-29.243
2050-55	26.925	95.131	38.756	67.507	73.272	101.197	-34.516	-33.69
2055-60	18.687	95.429	34.421	67.029	72.287	105.905	-37.866	-38.876
2060-65	10.434	95.55	31.084	66.148	71.334	111.014	-40.25	-44.866
2065-70	3.427	95.577	28.317	65.428	70.249	115.646	-41.932	-50.218
2070-75	-3.116	95.577	25.743	65.272	69.214	120.494	-43.471	-55.222
2075-80	-8.39	95.595	23.485	65.454	68.153	124.771	-44.668	-59.317
2080-85	-12.862	95.659	21.487	65.686	67.114	128.58	-45.627	-62.894
2085-90	-15.878	95.777	19.786	65.804	65.981	131.264	-46.195	-65.46
2090-95	-18.82	95.95	18.361	65.864	64.966	134.029	-46.605	-68.165
2095-2100	-21.827	96.19	17.16	66.006	64.127	137.056	-46.967	-71.05
2015-2100	*390.329*	1579.185	686.36	1168.622	1225.658	1818.18	*-539.298*	*-649.558*