# Birth planning and population prospects in China and India

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**ABSTRACT**

China's fertility decline began almost two decades ago while the Indian fertility has only recently started declining; consequentially India's population is likely to exceed that of China's in another 27-30 years. The effect of demographic transitions seen in these two countries is almost certain to exemplify a 'demographic bonus' reflected in terms of a steady growth in working-age population. The magnitude and directions of future population age structure and growth remain largely uncertain particularly in the context of changing social attitudes towards reproduction and family formation. The future growth trajectories mainly depend on when (timing) and how many (number) children are added in the existing population. This paper quantifies the potential impact of birth planning dynamics in China and India on the future population growth patterns, using cohort component models. Population forecasts will be made exploring the current policy scenarios highlighting the possible shifts in the economically active populations and potential gender discrepancies in the future adolescent, reproductive, and elderly populations.

## INTRODUCTION

1. In the essay on 'Population growth and economic development in low economic societies', Ansley Coale and Edgar Hoover (1958) argued that reductions in fertility in the short and intermediate future has considerable potential in enhancing higher per capita income, higher saving rates and higher productive capacity of working age populations. This observation has been recently verified to be correct in the case of the East Asian Tiger economy countries where fertility has fallen sharply in the last few decades (Bloom and Williamson, 1998; Lutz et al., 2004).

2. However, Coale and Hoover warned that the long-term effects of such a demographic transition in low income economies can also avert the otherwise inevitable return of poverty, unemployment and wealth inequalities, increase in old-age dependencies and high death rates.

3. The so-called 'window of opportunity' or the 'demographic bonus' is in doorstep of the two most populous countries – China and India – together which holds nearly 38% of world population. The magnitude and directions of future population age structure and growth in these countries remain largely uncertain particularly in the context where gender imbalances in population are widening coupled with changing social attitudes towards reproduction and family formation.

4. This paper quantifies the potential impact of birth planning dynamics in China and India on the future population growth patterns, their size and composition differentials. Population forecasts will be made exploring the current policy scenarios highlighting the possible shifts in the economically active populations and potential gender discrepancies in the future adolescent, reproductive, and elderly populations. We used data from several sources including census, registration and nationally representative cross-sectional surveys. The forecasts were made taking into account of particularly the uncertainty factors related to future development of fertility trajectories and gender compositions. Fertility is still the main driving force of population change (in absolute terms) in both China and India.

5. To set the background, the paper first discusses the past and present family planning policies and evaluates the fertility transition in China and India. The next section

examines the birth planning prospects (timing of events within the reproductive career, gendered fertility preferences and stopping behaviour) and their possible impact on future development of fertility. Fertility, mortality and migration assumptions considered in the population forecast model is then discussed. Following this, we present the results of population projections and the final section discusses the implications of future structural changes in the Chinese and Indian population.

**FERTILITY CONVERGENCE TO REPLACEMENT LEVELS: OBSERVATIONS**

6. China's fertility decline was unprecedented and it began almost two decades ago while the Indian fertility has only recently started declining. Both these countries succeeded in bringing about a substantial reduction in fertility through administratively driven population control measures; the influence was more accentuated in China than in India.

7. To date back, the launch of the post-1979 'one child policy' in China had massive impact in plunging the urban fertility rates whereas reductions in rural fertility was brought out by the 'later, longer and fewer' (*wan xi shao*) campaign (Merli and Smith, 2002; Lavely and Freedman, 1990). This policy was amended from time to time, however not deviating from the main goal – which is solely the control of numbers (quantity). Rural couples were allowed to have a delayed second child if the first born is a girl (Li, 1995). Ethnic minorities (non-Han) were exempted from these national family planning policy enforcements and were allowed to have two or three children. There was no particular restriction imposed on the rural Tibetan population. It is important to note here that these nationally driven policies were implemented at the local levels considering the demographic conditions (Short and Zhai, 1998; Greenhalgh, 1986). The western region lagged behind the eastern and central region in terms of fertility transition and economic development.

8. The policies implemented over time in China exerted enormous influence on the total fertility rates (TFR). Towards the end of the last century, the TFR in many urban cities such as Beijing, Shanghai and Tianjin were below one whereas rural Tibet recorded a TFR of 3.1 children per woman (Peng, 2004). Fertility levels declined by 67% between 1971 and 2001; TFR declined from 5.4 in 1971 to 2.29 in 1990 and to

1.8 in 2001. Recent evidence showed that the national level TFR has plummeted to a very low figure of 1.23 children per woman in the year 2000 (Guo, 2004; Zhang, 2003).

9. Is China's current TFR as low as 1.23? This question cannot be answered easily. The TFR estimates produced by various governmental agencies showed some degree of inconsistency. The primary concern is under-reporting of 0-9 age groups in the national censuses, particularly in rural areas (Lutz, Ren, Scherbov and Zheng, 2005; Zhang et al. 2004). Peng (2004) suggested an overtime urban population expansion scenario where if all Chinese couples adhered to local family planning regulations then the total cohort fertility rate in 1990 would have been 1.62 and 1.50 in 1999. On the other hand if one accounts for possible undercount of births in rural areas or if there is a progression towards second birth in rural China, then the TFR could be as high as on the replacement level boundaries between 2.1 and 2.5. Zeng (1996) asserted a most plausible value of TFR in the range between 1.8 and 2.0.

10. The decline in Indian fertility was relatively slower when compared with that of China. TFR in India fell from 5.2 in 1971 to only 2.8 during 1998-99 – the percentage decline between these two time periods was 45% (Registrar General of India, 1999; International Institute for Population Sciences, 2000). Nevertheless, the 1990s marked an era of rapid fertility decline in India, particularly in the southern India, for e.g. the states Kerala, Tamil Nadu and Andhra Pradesh attained a below replacement fertility in 1988, 1993 and 2002 respectively. Also, when China introduced the one-child policy in 1979, Kerala's fertility rate was even higher (3.0 children per woman) than that of China's (2.8). Later in 1991, China's total fertility was 2.0 whereas Kerala took the same time to reach a fertility level of 1.8. The reduction in fertility in Kerala was brought through social development (improving the levels of female education and health of mothers and children) – a classic example which demonstrates that social strategies can do better than administratively driven population control measures (Sen, 2000). The corresponding decline of the period TFRs in the northern and the central states were relatively less significant, even at the district levels (Bocquet-Appel, Rajan, Bacro and Lajaunie, 2002; Guilmoto and Rajan, 2001). The northern states are expected to wait for a few more decades to reach replacement level fertility (Bhat, 2002; Dyson, 2002).

11. Likewise in China, much of the fertility decline was attributed to a 'target' oriented family planning programme implemented across India which was introduced in the early 1970s (Srinivasan, 1998; Basu, 1985). Incentives were introduced to both the potential users and providers to promote sterilization (Srinivasan, 1998; Cleland and Robinson, 1992). Although India took rigorous steps to curb population growth, through massive male sterilisation camps across the states, the programme did not succeed under the democratic setup and also because of political instabilities and administrative failures. The sterilisation 'target' oriented family planning programme in the country that initially focused on male sterilisation later shifted towards women; female sterilisation later evolved as the most popular and dominant method of contraception among Indian couples.

12. Later in the 1990s following the ICPD recommendations and in response to the documentation of unscrupulous administration of the target-oriented program, the Indian government adopted a target-free approach in April 1996 (Srinivasan 1998). Under the new target free philosophy, grassroots workers were made responsible for offering family planning services to couples who are interested both in spacing births and in limiting their family size. Thus, in recent years, the pressure for women to accept sterilizations after their third child has been, at least theoretically, relaxed.

13. During the same period, the United Nations Population Fund (UNFPA) in association with the National Population and Family Planning Commission (NPFPC) and the Ministry of Health (MOH) launched a series of country programmes in China with the aim of removing the system of birth quota or targets, ensuring voluntary participation, providing free and informed family planning method choices and protecting individual reproductive health rights through quality client-oriented reproductive health services (UNFPA, 2003; Li Bohua et al., 2004). The country program initially launched in 32 counties was then extended to another 30 counties following positive evidence of changes in individual reproductive health and family planning knowledge and behaviour. The UNFPA program which is currently in the experimental phase holds vast potentials in creating a client-friendly reproductive health services system in the whole of China, without any form of coercion and discrimination.

**TOWARDS A GENDERED BIRTH PLANNING APPROACH**

14. Is China's TFR likely to reverse or recuperate to a level above replacement? Is it likely that Chinese women would delay the entry into marital unions? Would Indian fertility eventually converge towards a low fertility as observed in China's? Would there be a significant shift in the childbearing ages in both these populations? Do these countries need a sustainable family planning policy that could oversee the potential problems related to gender imbalances and population ageing? These questions are, no doubt, difficult to answer. Some explanations suggested here tries to address the above mentioned questions.

15. First, evidence from most of the low-income countries indicated a decline in the desired family size to not more than two children (Bongaarts, 2001). The 1997 and 2001 China National Population and Reproductive Health Surveys conducted by the then State Family Planning Commission showed an overtime decline in the mean desired family size among married women aged 20-29 years (from 1.70 in 1997 to 1.61 in 2001). The detailed analyses are reported in Zhang (2004). The National Family Health Surveys (NFHS) in India showed a similar trend – 2.64 during 1992-93 which then declined to 2.13 during 1998-99 (IIPS, 2000; IIPS, 1995). A two-child family norm is regarded almost universal in India, even in Kerala and other Indian states that have either reached below replacement level fertility.

16. Second, regardless of family size preferences, a boy is usually preferred over a girl in both these countries – for most urbanites in China 'one is enough' while for families engaged in farming 'two is best, one son is essential' (Greenhalgh, Zhu and Li, 1994; Gu and Roy, 1995). Younger female generation in China seemed reconciled to having few children than their older counterparts but only at the compromise of having a boy than a girl (Hardee, Xie and Gu, 2003; Greenhalgh, 2001). The value of sons and the neglect of girls in the society are reflected in this traditional Chinese quote from the 'Book of Songs, 1000-700 B.C' (cited in Baculinao, 2004).

'*When a son is born,*
*Let him sleep on the bed,*
*Clothe him with fine clothes,*
*And give him jade to play…*

*When a daughter is born,*
*Let her sleep on the ground,*
*Wrap her in common wrappings,*
*And give her broken tiles to play…'*

17. The sex ratio at birth in China has been close to 106 between 1950s and late 1970s which then increased from 108.5 in 1982 to 115.6 in 1995 and to 116.9 in the year 2000 (UNFPA, 2004). The phenomenal increase in sex ratio disadvantageous to girl children born in China has been due to excess female infant mortality reflected in terms of female infanticide, sex-selective abortions, and underreporting of births in general (Riley, 2004; Attané, 2002; Coale and Banister, 1994). The existence of stringent birth policy measures did not sufficiently allow couples' to have either a boy or girl or both rather restricted their choices to boys alone. The abnormally high parity male dominated sex ratios were attributed to strong son preference among Chinese couples who had mostly girls born in the low parities (Poston, Gu, Liu and McDaniel, 1997). The availability of ultrasound options even in the rural areas is another indirect factor that explains the statistics of 'missing girls' in the country (Attané, 2002).

18. The Indian sex ratios at birth have also been heavily skewed in favour of male children with excess high female infant mortality and extensive use of sex-selective abortions (Sen, 2003; Arnold, Kishor and Roy, 2002; Agnihotri, 2000; Arnold, Choe and Roy, 1996). The ratios ranged between 111 at the national level to around 125 in states such as Punjab and Haryana and 108 in Kerala. These changes were also partly accompanied by the declining sex ratios in the 0-6 age group (945 females per 1000 males in 1991 to 927 in 2001) that suggested two possibilities; a) sex selected distortions in the reported ages of children and b) the prevalence of sex selective abortions leading to excess female mortality. In their analysis, Das Gupta and Bhat (1998) suggested that excess female mortality in the younger ages were because of not only the overall reductions in high parity births but also the increase in the intensification of parity-specific discrimination. This intensification seems highly pronounced in northern India, where sex-selective abortion services have over time steadily increased (Malaviya, 2005; Dyson 2001; Mayer 1999; Basu 1999).

19. The distortions seen in the sex ratios at birth would require only a few decades to significantly influence the population sex ratios, particularly females in the

reproductive ages (Griffiths, Matthews and Hinde, 2000). Notwithstanding the existence of a stagnantly high maternal mortality in China and India, these distortions may have trivial impact on the future elderly populations because of the trade-off between high male adult mortality and relatively lower female mortality rates in the post-reproductive ages.

20. Third, it is imperative to examine the timing and sequencing of events that take place within a woman's reproductive career in order to forecast the future population growth (Willekens, 2002). For example, the age patterns of childbearing in India are restricted to very young ages of women leading to a compression of reproductive spans – as observed in Andhra Pradesh in India that has not seen elsewhere in the world (Padmadas, Hutter and Willekens, 2004). The unique trends reflected in the age patterns of fertility in Andhra Pradesh are illustrated in Figure 1a. Not surprisingly the age profile of fertility of Indian women has been converging to the Andhra Pradesh pattern (Figure 1b). It is clear that as fertility levels dropped childbearing increasingly gets concentrated towards the young ages between 20-24 years. Whereas in China, fertility estimates based on the national survey conducted in 2001 showed a distribution concentrated more towards the upper age group, 25-29 years (Figure 2). The census estimates showed a slightly different pattern, especially those produced by the US Census Bureau where the TFR was 1.66.

    --- FIGURES 1a, 1b and 2 about here ---

21. The convergence of fertility towards very young ages in India could be attributed to three reasons. First, the age at first marriage for females has been stagnantly very low in the Indian context. According to the NFHS, as high as 50% of women in India marry below the legal age at marriage which is 18 years. The median age at first marriage in Andhra Pradesh has been 16 years for the last two decades. The timing of first birth usually follows within the first two years of marriage, second birth follows mostly within 2-3 years of first birth and sterilization (female) follows soon after the second birth. The median age at sterilization in Andhra Pradesh declined marginally from 24.5 to 23.6 years while the figures are 26.6 years and 25.7 years respectively (IIPS, 2000). The rise of sterilization in Andhra Pradesh from 38.1% to 52.7% of married women in just over five years represents one of the largest percentage

increases in sterilization in India. The corresponding figures for India were 27.3% and 34.2% respectively.

22. The pattern is totally different in China where woman are increasingly delaying marriage and first birth; the average female age at marriage was 21.9 years in 1990 which increased to 22.9 and 23.6 years in 1995 and 1999 respectively whereas the average age at first parity has been around 24 years (State Statistical Bureau, 2000). Entry into union and reproduction is relatively late in China than India although first births tend to occur soon after marriage. When a woman in China is ready for marriage, her Indian counterpart has already had the first birth. The second births in India tend to occur in reasonably long intervals (median closed interval: 30 months). Birth intervals in India are explained by breastfeeding behaviour than contraceptive; the share of modern temporary methods to overall modern method use is only roughly 15% whereas female sterilisation dominates any modern method use (IIPS, 2000). The modern method mix patterns are in fact better in China with IUD and female sterilisation as the most popularly accepted methods. Also, once the desired family size is achieved, many couples especially in India accept sterilisation and complete reproduction. The sequencing and timing of events within women's reproductive careers in China and India are shown in Figure (to be completed).

## ASSUMPTIONS REGARDING FUTURE EVOLUTION OF FERTILITY, MORTALITY AND MIGRATION

23. Fertility is the most uncertain demographic component of population change in China and India. Under-reporting of births and deaths, especially female births, the extent of population coverage in the censuses, reproductive behaviour and intentions of future couples are some of the major concerns with regard to making assumptions about future fertility. The absolute population size in the future is also dependent on the timing of reproductive events. The underlying principle of population dynamics is that any upward shift in the mean age of childbearing will reinforce deceleration of population growth and a downward shift will retard the deceleration of population growth, and the population impact would be quite high in the long run (Frejka, 1973, p.149; Matthews et al. 2005).

24. The main concern in the case of China is the debate circumventing the 'true' level of current fertility, the tempo effects and the possibility of recuperation of fertility if there is a progression towards second birth (Lutz, Ren, Scherbov and Zheng, 2005). The age-specific fertility rates are unlikely to push much upwards although the trends in urban China suggest a) delay in marriage ages and a gradual increase in cohabitation and b) preference of either one child or no children. Moreover, massive urbanisation and the shortage of houses are likely to influence couples to delay entering unions and childbearing (Zeng and Vaupel, 1998). In rural areas, there might be a progression to second births or at least birth reporting is likely to be more accurate because of the relaxation in birth and family planning policies. Many couples even in rural China desire not more than two children and that include agrarian families. For pedagogic and policy reasons, we present several projection scenarios where the total fertility rates remain constant throughout the projection horizon ranging between a low of 1.4 and a high level of 2.3. The assumptions regarding age patterns of fertility under various levels of TFR are graphically displayed in Figure 3. The proportion of births in various age groups was assumed to remain constant despite slight changes in the age-specific fertility rates.

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25. In the case of India, many larger states are still in the long way to reach a below replacement fertility, e.g. states such as Bihar, Uttar Pradesh, Rajasthan (Bhat, 2002, Dyson, 2002). In contrast, the states in southern India have either already reached or nearing replacement levels, even among socially disadvantaged populations (Pallikadavath and Wilson, 2005). In India, the Sample Registration System (SRS) has been the major source of fertility and mortality estimates since 1971 apart from those estimated from the NFHS. Bhat (1998) produced adjusted estimates of fertility and mortality after making comparisons with the NFHS estimates and accounting for under enumeration possibilities of births and deaths in the SRS.

26. The official national population projections made by the Registrar General of India used regression equations fitted to estimates of annual period TFRs at state level based on the period 1980-1993 (Registrar General of India 1997). In this case, the TFR was assumed to reach below the replacement level of 2.1 children per woman by the year 2026. Although regional variations were considered, it did not explicitly

consider the pace of fertility transition especially in the northern larger states where fertility levels are also largely underestimated. Dyson (2002) produced non-linear fertility trajectories for India based on some plausible faster rate of decline assumptions using correction factors for SRS-based period TFRs especially for the high fertility states including Uttar Pradesh. Dyson's estimates suggested that a TFR of 2.13 (high variant: 2.30, low variant: 1.98) is plausible in India by 2015-20.

27. We believe that a general assessment of the under enumeration issues based on both SRS and NFHS need to be considered for the estimation of future fertility in India. A revision made by Bhat (2002b, p. 379) suggested the following modifications. First, the base 1984-90 SRS-TFR was adjusted for under enumeration of births taking into account of the under enumeration of births observed in the NFHS. Second, TFRs were projected assuming a Gompertz model (S-shaped curve) instead of linear or log-linear models. Third, all-India TFRs were derived as weighted averages of individual state-specific assumptions. The state-weighted average projected values of TFR at the all India level suggested a replacement fertility level of 2.11 by 2016-20, which was close to that suggested by Dyson (2002). The later approach accounted for the possible social changes in India vis-à-vis a modest increase in the age at first marriage, reproductive behavior of working populations, further uptake of family planning especially sterilization and the enormous heterogeneity between states observed in fertility rates.

28. We used the low, medium and high variant TFR assumptions proposed by Bhat and Dyson and compared with the United Nations (UN) estimates in order to assess the extent of differences that these assumptions would make on the future Indian population. We made another plausible assumption that the Indian ASFRs would eventually converge to early patterns of fertility as observed in Andhra Pradesh. Our justifications for this assumption include a) a negligible increase in the female age at marriage in rural India, b) low intake of spacing methods but further increase in sterilization in both urban and rural India and c) modest increase in female schooling years and labour participation in rural India. It has to be noted that we applied the UN TFRs on the assumed age-specific fertility rates. We discarded the high and low variant TFRs suggested by the UN because the assumed high variant TFR of 2.35 by 2050 is too high or implausible (see UN, 2005) The assumed future patterns of age-specific fertility rates in India are shown in Figure 4 and three sets of total fertility

rates assumptions are illustrated in Table 1. The medium variant TFR proposed by the UN was slightly higher than that suggested by Dyson and Bhat. According to the UN assumptions, fertility will converge to replacement levels during 2020-25 whereas Dyson and Bhat estimates show that India would replace fertility little earlier than what the UN has proposed. Also, it is highly unlikely that the TFRs would fall below 1.8 in the next 40 years as highlighted in the UN low variants.

29. We made assumptions about the future sex-ratios at birth in conjunction with the anticipated decline in fertility levels (Figure 5). The baseline sex-ratio assumption for China has been fixed at 117 males per 100 females which are then assumed to decline gradually until 2020-25 and thereafter assumed to remain constant. The intervention programs aimed to reduce gender disparity are anticipated to exert some influence on the sex ratio at birth. In the Indian case, the sex ratios are expected to increase from the current level of 108 to 112 by 2020-25 and thereafter converge back to the current levels. The rationale put forth here is - gender intensification in favour of males is likely to exaggerate in line with the corresponding fall in fertility levels, for e.g. sex-selective abortion practices as observed in Punjab and a few other southern Indian states.

--- FIGURES 4, 5 and TABLE 1 about here ---

30. To account for mortality changes in India, we estimated the male and female survivorship ratios based on the life expectancies suggested by the United Nations (2004 revision). Relatively slower increases in the life expectancies are assumed for India when compared with China (Figure 6). It is not very unlikely that the age-specific survivorship ratios would be slightly distorted in the future considering the possible stagnant decline in infant and maternal mortality levels and the increases seen in HIV/AIDS mortality. The threat of HIV/AIDS epidemic is likely to be alarming in both India and China. We anticipate a decrease in the newly reported HIV cases in another 10 years taking into account of the impact of knowledge and prevention programs. The real magnitude of HIV/AIDS fatality is largely unknown in both India and China.

31. Net migration was not considered in the model due to paucity of good quality data and also based on the grounds that total net migration size would be considerably

trivial relative to absolute total population size in China and India. Nonetheless, it is important to bear in mind that the growing economic opportunities in China and India are likely to attract economic migrants from neighboring countries, for example Nepal, Bangladesh, Pakistan Vietnam, Philippines and perhaps Sri Lanka. Additionally, one could expect possible return migration of people from the Middle-East countries particularly in the case of India. On the other hand, the inflow of migrants from rural areas into urban areas is expected to increase further in the future within these nations. We ignore these influences in our projection models as the numbers are likely to offset each other in the cohort-component accounting equation. For India, we used the United Nations adjusted 2000 base population by five year age group and sex (UN, 2005). The baseline population data used for China were adjusted for inconsistencies and were different than that of the revised UN estimates. The projections were carried out using EXCEL package in order to implement particularly the ASFR and sex-ratio assumptions. The results are then compared using DEMPROJ package (Futures Group International, USA) for consistency.

--- FIGURES 6 about here ---

## RESULTS FROM POPULATION PROJECTIONS

### a) Total population of China and India

32. Table 2 shows the projected populations of China and India under various scenarios and variants. Under the assumed TFR of 1.8 children per woman, the results show that China's population would exceed the 1400 million mark by 2050. Had the TFR been around replacement level throughout the projection horizon, then China's total population would be 1526 million by 2025 and 1616 million by the middle of this century. Regarding India, the medium projections carried out under the TFRs proposed by the UN and Bhat were found close to each other. Based on the UN-TFR assumptions and presuming that Indian fertility would converge to the Andhra pattern, the total Indian population by 2025 would be 1404 million and 1594 million by 2050. The official UN population projections suggest that Indian population would be 1395 million by 2025 and 1593 million by 2050. The results comparing high and low variants are graphically illustrated in Figures 7a and 7b respectively.

--- FIGURES 7a, 7b and TABLE 2 about here ---

*b) The great population 'crossover'*

33. The results suggest that under the TFR assumptions proposed by Bhat and assuming a continuation of young fertility, Indian population would crossover China's population by 2033 – conditional that the Chinese TFR will be 1.8 throughout the projection period (Figure 8). Whereas the official UN projections of Indian population and the UN TFRs applied on early childbearing trajectory suggest that Indian population would intersect by 2030. A low TFR trajectory as suggested by Dyson indicates that Indian population would cross-over China's population by year 2035. Anyway it is very likely that the cross-over will occur between 2030 and 2035 given our assumptions regarding future fertility developments in India and China.

*c) Age-sex structural transitions*

34. Figures 9 and 10 illustrate the population pyramids for India and China for the years 2000, 2025 and 2050 respectively. The population size is considered in absolute size (in 1000s) and not in terms of percentages, in order to highlight the changes in magnitude in each age group. For the sake of illustration, we present only the medium variant of Chinese (based on TFR of 1.8) and Indian (based on Bhat-TFR) populations. Two important observations can be made from these figures. First, there is clear evidence of increase in the elderly populations, more noticeable in the case of China. Second, there is a clear female disadvantage in the growth of future population by 2050, particularly the Chinese population. There will be female deficit in the adolescent and reproductive age populations (Table 3). For instance, the number of Indian males aged 10-19 in 2000 will be 1070 per 1000 females which will increase to 1103 by 2025 and then decrease to 1093 by 2050. In the reproductive ages, the number of males per females will decrease from 1084 in 2000 to 1064 in 2025 and thereafter increases to 1098 males per 1000 females. A similar pattern was found in the case of China as well. Nonetheless, in the age older age groups there will be a deficit of male populations in the long run, particularly after 80 years. For instance, the sex ratio will reduce almost to one-half by the year 2050 especially in China.

--- FIGURES 9a-c, 10a-c and TABLE 3 about here ---

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35. In proportionate terms, there is a sharp increase in the elderly population in both China and India (Figure 11). Both these populations are ageing because of expected decrease in fertility levels. The proportion of Chinese people aged 80+ years is expected to increase from merely 1% in 2000 to 7% by 2050 while the corresponding increase in the Indian population is 0.7% in 2000 to 3.4% by 2050. On the other hand, both China and India are in the phase of experiencing a 'demographic bonus' in terms of high proportion of people in the economically active age groups. The prospects seem more favourable for Indian population when compared with the Chinese population (Figure 12). The growth rate of total Chinese population seems to exceed that of the working population during 2010-15 and thereafter the working population growth fall on the negative growth scale during 2020-25 and the total population little later during 2030-35. The growth rates of the Indian working population will exceed that of the total population during 2035-40 eventually approaching the growth rates of Chinese population by 2045-50.

    --- FIGURES 11 and 12 about here ---

36. The effective use of this so called 'demographic bonus' depends largely on how China and India plan sensible policies to increasing employment, trading and investment opportunities in order to generate higher per capita income and higher savings rates (Coale and Hoover, 1958). The future economic productivity of especially India will turn out bleak unless efforts are made to curtail the existing levels of unemployment and poverty. China is no exception in this regard. The silent but rapid growth of the so called 'floating population' in urban areas is anticipated to create additional pressure in the urban employment opportunities.

37. The benefits of working population seem not highly rewarding in the long run because of high burden of dependent populations in these two countries. Figure 13 shows the percentage of future dependent child and elderly populations per 100 working age population in China and India. It is interesting to note that the child (0-14) dependent population decrease over time in both China and India whereas the elderly (65+) dependency ratio is steadily increasing. By the year 2050, China and India will have the same child dependent population. However, the scale of elderly

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dependent population is tremendously high in China after 2030 which clearly indicates that China's population is rapidly greying than that of India's population.

--- FIGURE 13 about here ---

## DISCUSSION AND POLICY IMPLICATIONS

38. Forecasting the two most populous countries of the world is not an easy task. We do not claim to have presented the perfect population forecast models for China and India. Nevertheless, we made an attempt in this paper to produce a range of plausible future population estimates for these countries taking into account of the uncertainties in demographic components, particularly the recent changes in reproductive behaviour and birth planning ideologies – perceived in the wake of an 'informed method choices, voluntary and client-centred' era of family planning and reproductive health.

39. The size, structure and composition of the Chinese and the Indian populations are currently undergoing a major transition which appears to reward marginal benefits in the short run but more inclined to create critical population problems and policy challenges in the long run. We believe that a TFR of 1.8 is plausible in China in the coming years considering the ongoing changes in population and family planning policies in the country. India would take roughly another 20 years to reach a below replacement level fertility because of the high but declining fertility levels in the northern region. The Chinese population is likely to cross the 1450 million mark by 2025 which will then further decline to 1415 by 2050 whereas by 2025 the Indian population will be 1377 million which will then increase to 1534 million by the half of this century. The landmark crossover of Indian and Chinese population is expected by 2033. This likely intersection is attributed to the continuing very young fertility and high rates of sterilization acceptance in India and also due to declining in-built momentum seen in the Chinese population.

40. Both China and India will benefit from a 'demographic bonus' in terms of the size of working age populations but our forecasts show that the Chinese working population growth rate is likely to slow down when compared with the total population growth rate. Whereas India has another 30 years to enjoy the benefits of the 'demographic

bonus' if working age populations are made economically productive to the best extent possible. The expected 'demographic bonus' – largely the contributions from cohorts of women born in the 1960-70s, has only temporal effects on the absolute size of future population, especially in China. This is mainly because of fertility changes that happened in China in the early 1980s following the introduction of 'one-child' policy. The expected gains out of the one-child policy were predominantly economic growth (Chen, 1979).

41. Nevertheless, the current policy challenges are to scale-up employment opportunities for both males and females and reduce the education, to reduce the wage and wealth gaps between urban and rural areas in order to effectively utilise the available workforce (Schultz, 2003). Conversely, these nations are also equally vulnerable to get into poverty traps in the absence of appropriate sustainable social, economic and health policies. The high inflow of unregistered (floating) migrants from rural areas into urban areas and cities and the concomitant rise in the prevalence of HIV/AIDS, especially among migrant populations, could furthermore exacerbate the human productivity levels thereby placing additional resource pressure on the governmental systems.

42. Many young couples in China and India prefer to have small families (not more than two in the Indian context and a choice of either one or two or none in the Chinese context), even economically disadvantaged and farming populations. It is also likely that many urban couples, although smaller in proportions, might postpone marriages and reproduction or a few others might even prefer not to have any children at all. The social concerns of ageing and the psychological concerns of bringing up single child may perhaps motivate couples to choose an ideal two-child family. On the other hand, it is likely that the social reproductive span (time spent between union formation and dissolution) would tend to be short as a result of late marriages, increase in divorce, separation and due to temporal nature of partnerships (cohabitation), especially in urban cities and cosmopolitan towns.

43. The decline of large family size in these settings, however, is negotiated at the cost of reproducing more male children in the society. The increases in the demand and availability of obstetric (ultrasound) technologies have helped couples to make a choice between a boy and a girl. The increase in the use of ultrasound technology has

already triggered an increase in sex-selective voluntary abortions and female infanticide (Attané, 2002). In return there will be a shortage of females in the adolescent and reproductive age groups in the future which apparently seem to reverse in the case of older age groups. The dearth of females in the reproductive ages indicates lesser number of future new-borns in the society and hence a very high old-age dependency burden in the long-run. Furthermore, there will be considerable number of men (*potential bachelors*) without a female partner in the prime reproductive ages. Incentive oriented population policies could perhaps encourage couples to understand the importance of gender equity and value of girls in the society (Demeny, 2003). The recent effort in China to pay social security premiums to parents to produce more girl children is a right step in the right directions but it may take a while for the effects to be seen (China Economic Net, 2005).

44. The ultimate benefits of fertility reductions are greater in any society but the possibility of economies of scale can be achieved only with larger numbers (Coale and Hoover, 1958, p.334). Both China and India have vast potentials to invest on human capital and productivity. At the same time both these countries share almost identical population problems – the *growing numbers* and the *widening gender, wealth and health inequalities*. It is worthwhile here to conclude with Amartya Sen (2000, p.225-26) who articulated, whilst comparing China and India, in his classic work on '*Development as Freedom*',

*'The solution of the population problem calls for more freedom, not less. The approach that seems to deserve particular attention involves a close connection between public policies that enhance gender equity and the freedom of women (particularly education, health care and job opportunities for women) and individual responsibility of the family (though the decisional power of potential parents, particularly the mothers)…the effectiveness of this route lies in the close linkage between young mother's well-being and their agency'.*

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**Table 1.** Total fertility assumptions under three different scenarios and variants, 2000-50

| Variants | 2000-05 | 2005-10 | 2010-15 | 2015-20 | 2020-25 | 2025-30 | 2030-35 | 2035-40 | 2040-45 | 2045-50 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | projection horizon | | | | | |
| *UN, 2004 revision* | | | | | | | | | | |
| High | 3.07 | 3.01 | 2.90 | 2.79 | 2.61 | 2.45 | 2.35 | 2.35 | 2.35 | 2.35 |
| Medium | 3.07 | 2.76 | 2.50 | 2.29 | 2.11 | 1.95 | 1.85 | 1.85 | 1.85 | 1.85 |
| Low | 3.07 | 2.51 | 2.10 | 1.79 | 1.61 | 1.45 | 1.35 | 1.35 | 1.35 | 1.35 |
| *Mari Bhat, 2002* | | | | | | | | | | |
| High | 3.07 | 2.78 | 2.52 | 2.33 | 2.21 | 2.20 | 2.14 | 2.09 | 2.09 | 2.09 |
| Medium | 2.99 | 2.65 | 2.37 | 2.16 | 2.01 | 1.91 | 1.84 | 1.79 | 1.79 | 1.79 |
| Low | 2.96 | 2.56 | 2.24 | 2.01 | 1.85 | 1.69 | 1.54 | 1.49 | 1.49 | 1.49 |
| *Dyson, 2002* | | | | | | | | | | |
| High | 2.92 | 2.68 | 2.48 | 2.30 | 2.14 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 |
| Medium | 2.84 | 2.55 | 2.33 | 2.13 | 1.94 | 1.81 | 1.80 | 1.80 | 1.80 | 1.80 |
| Low | 2.81 | 2.46 | 2.20 | 1.98 | 1.78 | 1.59 | 1.50 | 1.50 | 1.50 | 1.50 |

**Table 2.** Projected total populations (in millions) in China and India, 2000-50

| TFR assumptions | Year | | | | |
|---|---|---|---|---|---|
| | 2000 | 2020 | 2025 | 2040 | 2050 |
| **China** | | | | | |
| UN (2004 revision) | | | | | |
| High | 1274 | 1480 | 1519 | 1603 | 1647 |
| Medium | 1274 | 1424 | 1441 | 1433 | 1392 |
| Low | 1274 | 1368 | 1364 | 1278 | 1171 |
| Authors' (most likely) | | | | | |
| High [TFR, 2.1] | 1263 | 1489 | 1526 | 1603 | 1616 |
| Medium [TFR, 1.8] | 1263 | 1431 | 1452 | 1456 | 1415 |
| Low [TFR, 1.6] | 1263 | 1392 | 1403 | 1364 | 1293 |
| *Difference (UN and authors'), medium* | 11 | -7 | -10 | -22 | -23 |
| **India** | | | | | |
| UN official projections (2004 revision) | | | | | |
| High | 1021 | 1387 | 1477 | 1727 | 1890 |
| Medium | 1021 | 1332 | 1395 | 1534 | 1593 |
| Low | 1021 | 1277 | 1315 | 1355 | 1333 |
| UN-TFR (2004 revision) | | | | | |
| High | 1021 | 1396 | 1487 | 1743 | 1900 |
| Medium | 1021 | 1340 | 1404 | 1542 | 1594 |
| Low | 1021 | 1284 | 1322 | 1358 | 1329 |
| Bhat (2002) | | | | | |
| High | 1021 | 1344 | 1414 | 1595 | 1683 |
| Medium | 1021 | 1319 | 1377 | 1498 | 1534 |
| Low | 1021 | 1300 | 1349 | 1419 | 1415 |
| Dyson (2002) | | | | | |
| High | 1021 | 1330 | 1394 | 1560 | 1639 |
| Medium | 1021 | 1305 | 1358 | 1464 | 1494 |
| Low | 1021 | 1286 | 1330 | 1387 | 1378 |
| *Difference (UN official and UN-TFR), medium* | 0 | -8 | -9 | -8 | -1 |
| *Difference (UN official and Bhat), medium* | 0 | 13 | 18 | 37 | 58 |
| *Difference (UN official and Dyson), medium* | 0 | 27 | 38 | 70 | 98 |
| *Difference (Bhat and Dyson), medium* | 0 | 14 | 19 | 34 | 40 |

**Table 3.** Sex composition of projected population by age groups, China and India

| Age group | Males per 1000 females | | |
|---|---|---|---|
| | Year | | |
| | 2000 | 2025 | 2050 |
| *China* | | | |
| 0-9 | 1147 | 1080 | 1071 |
| 10-19 | 1092 | 1124 | 1070 |
| 15-49 | 1067 | 1108 | 1094 |
| 65-79 | 940 | 917 | 896 |
| 80+ | 606 | 614 | 584 |
| All age | 1059 | 1052 | 1037 |
| *India* | | | |
| 0-9 | 1058 | 1118 | 1080 |
| 10-19 | 1070 | 1103 | 1093 |
| 15-49 | 1084 | 1064 | 1098 |
| 65-79 | 920 | 917 | 899 |
| 80+ | 838 | 733 | 719 |
| All age | 1070 | 1047 | 1007 |

Note: The medium variant projected population for China are based on a TFR of 1.8 and that for India is based on the TFRs proposed by Bhat (2002)

**Figure 1a.** Age-specific fertility (%) in Andhra Pradesh, 1971-1999
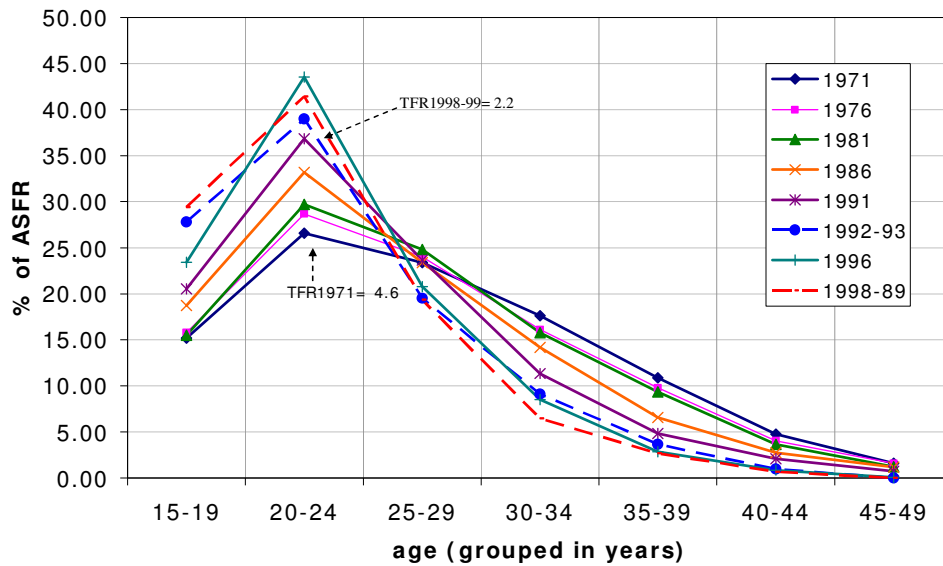


Data source: Registrar General of India, 1999, IIPS (1995, p.96; 2000, p.89)
Note: age specific rates for the period 1992-93 and 1998-99 refer to rates for three-year period prior to the surveys

**Figure 1b.** Age-specific fertility (%) in India, 1971-1999
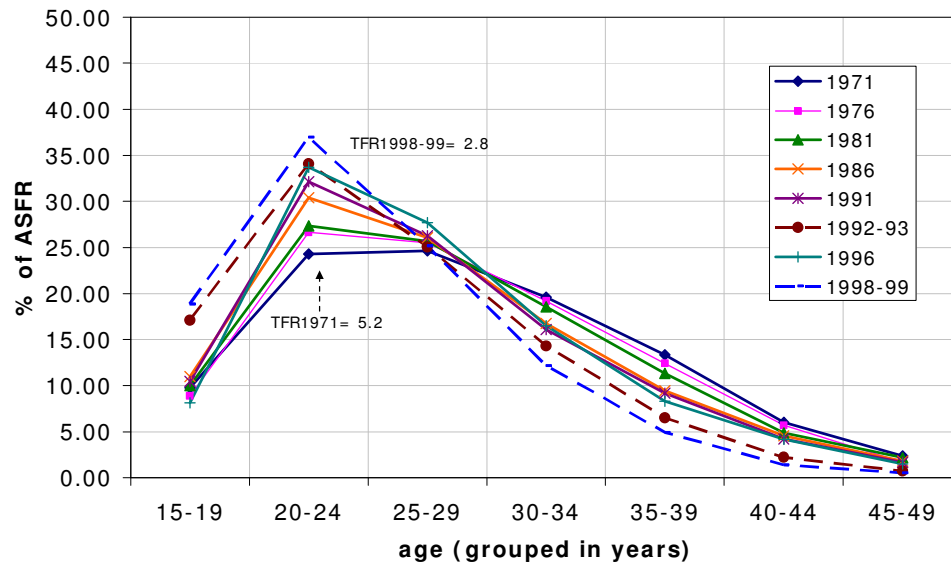


Data source: Registrar General of India, 1999, IIPS (1995, p.96; 2000, p.89)
Note: age specific rates for the period 1992-93 and 1998-99 refer to rates for three-year period prior to the surveys

**Figure 2.** Age-specific fertility (%) in China, 1991-2002
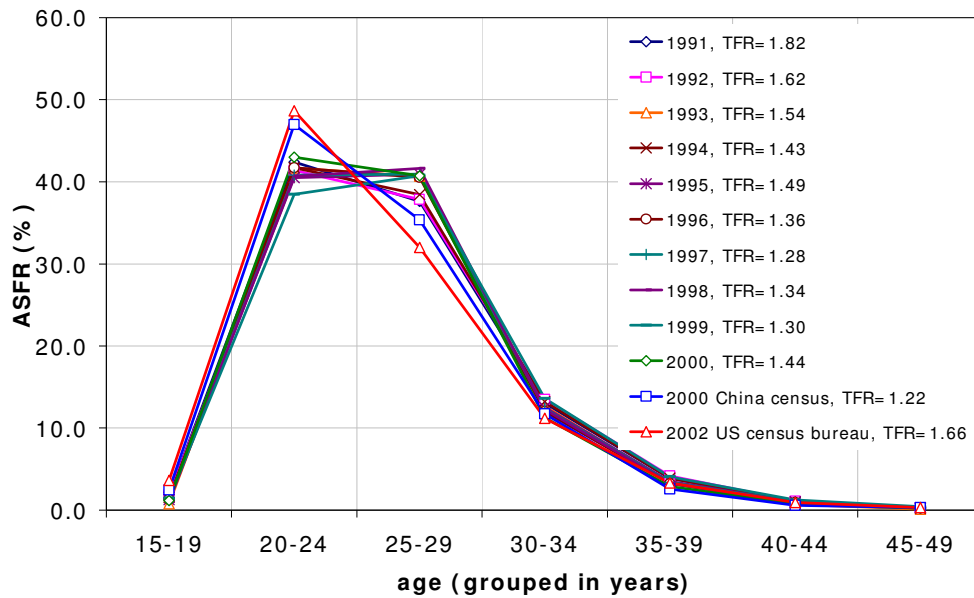


Data source: 1991-2000, 2001 National Family Planning and Reproductive Health Survey
2000 China Census data refers to official Census data by the PR China
2002 US Census bureau estimates are based on US Census Bureau, Global population profile 2002,
Table A-10, p.3 (http://www.census.gov/ipc/prod/wp02/tabA-10.pdf, accessed on 27 June 05)

**Figure 3.** Age-specific fertility rates under various TFR assumptions, China, 2000-50
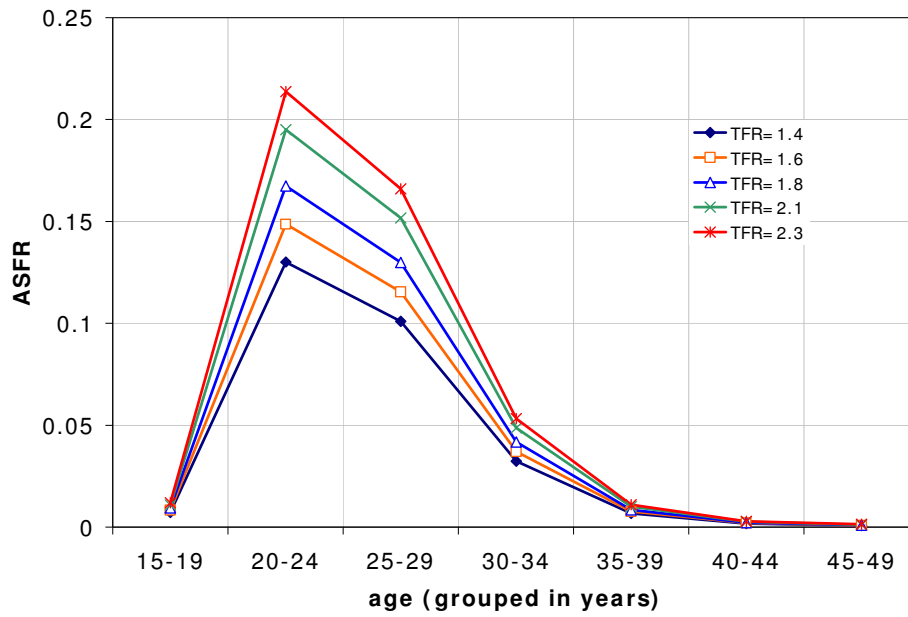
**Figure 4.** Age-specific fertility rates under various TFR assumptions, India, 2000-50
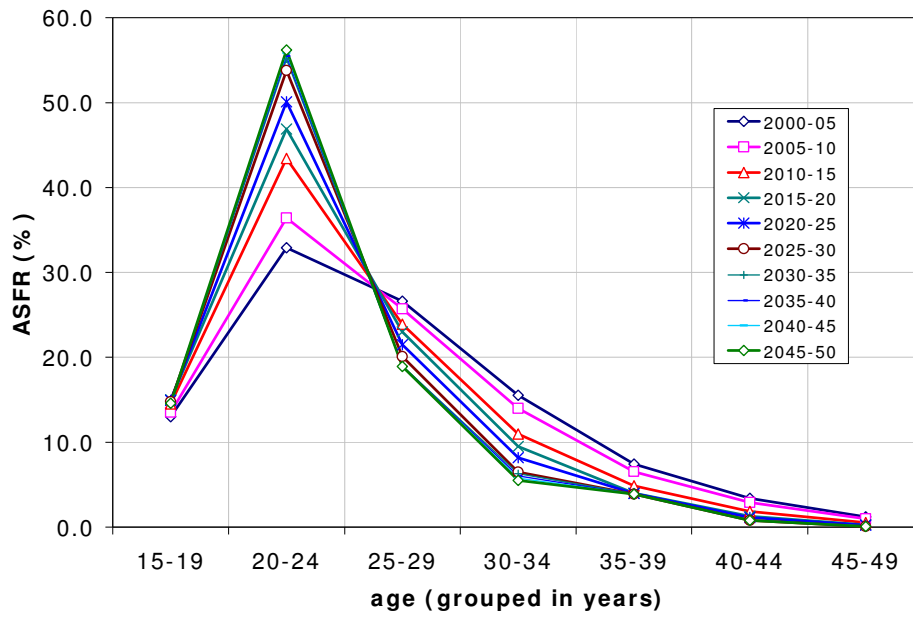
**Figure 5.** Sex ratio assumptions, India and China, 2000-50
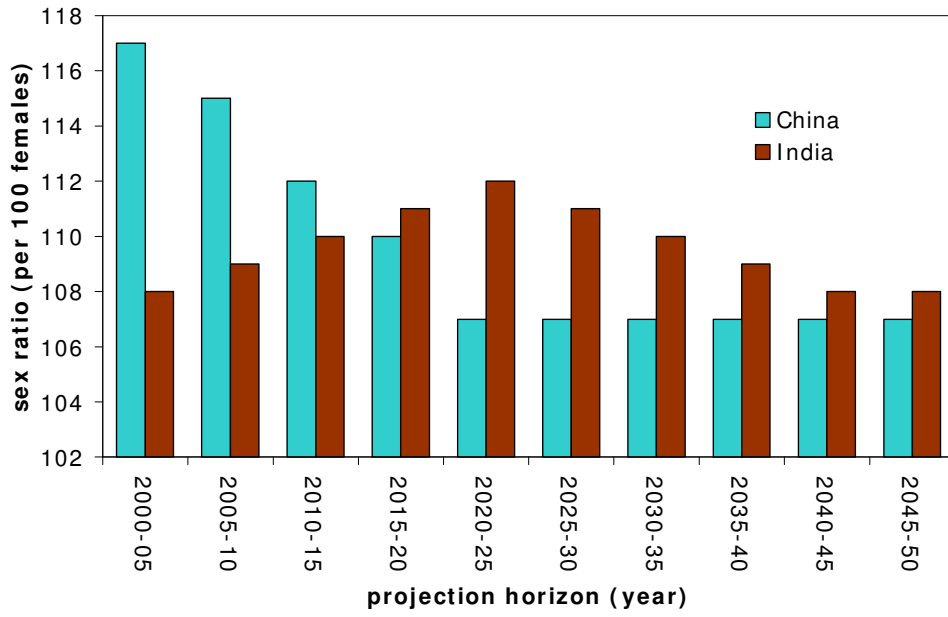
**Figure 6.** Male and female life expectancy assumptions, India and China, 2000-50
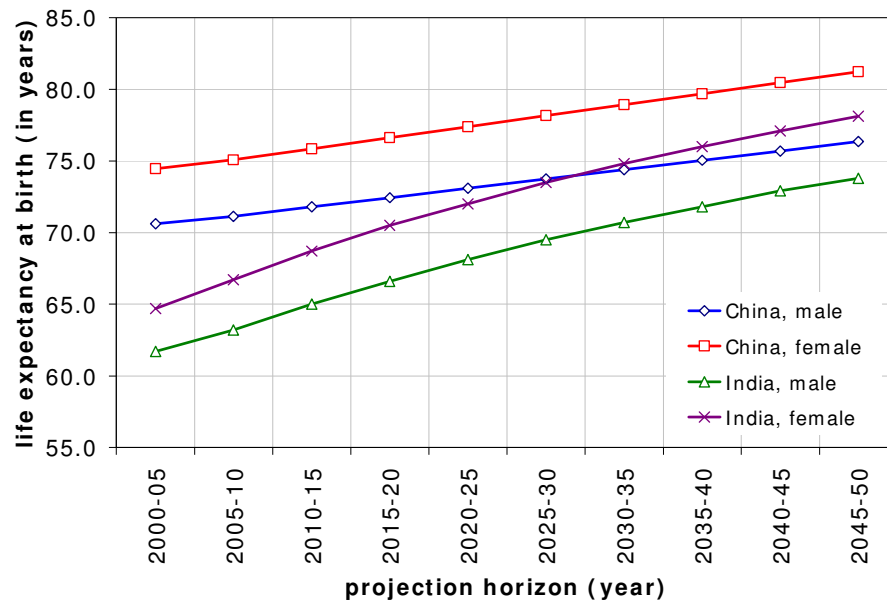
**Figure 7a.** Population projections, China, 2000-50
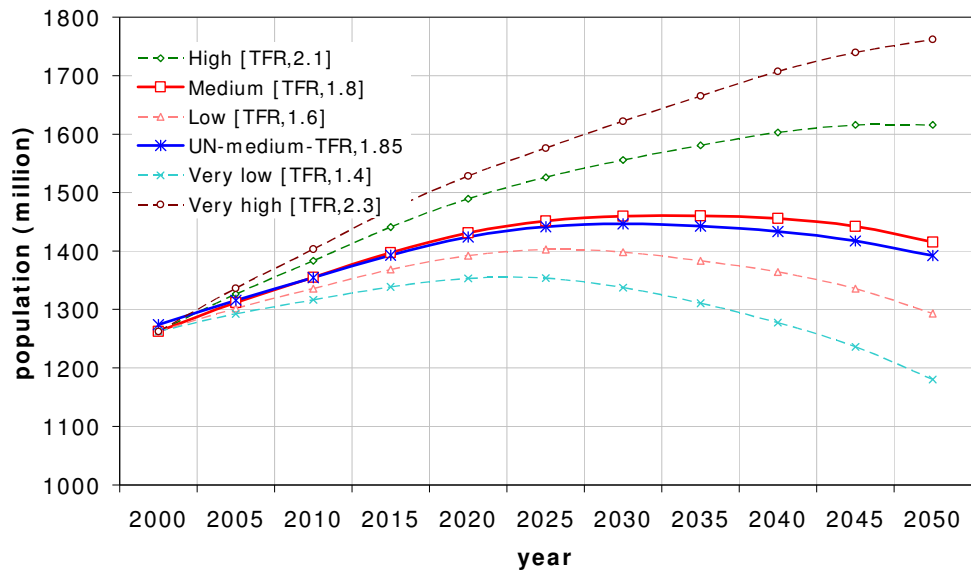


**Figure 7b.** Population projections, India, 2000-50
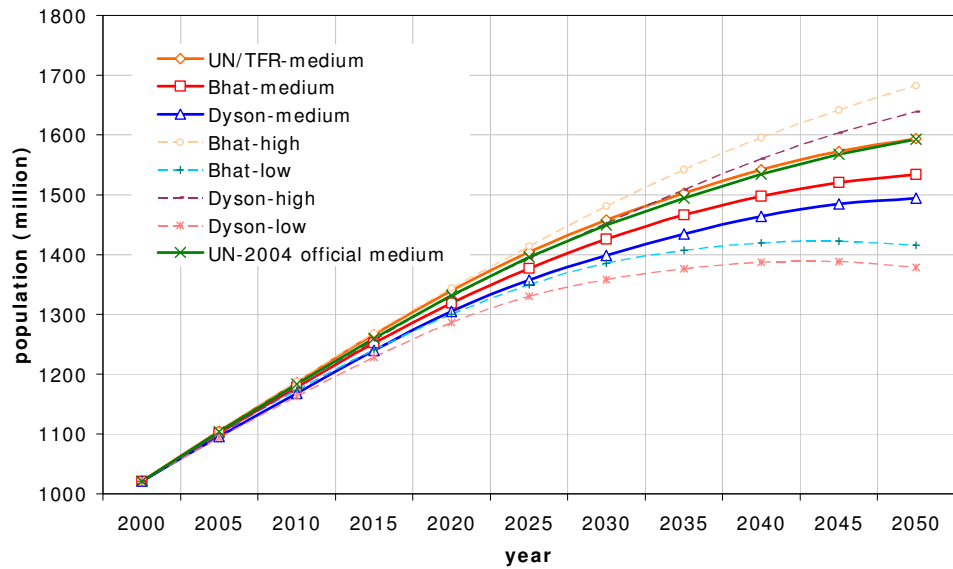
**Figure 8.** The great cross-over of Chinese and Indian population: population projections, 2000-50
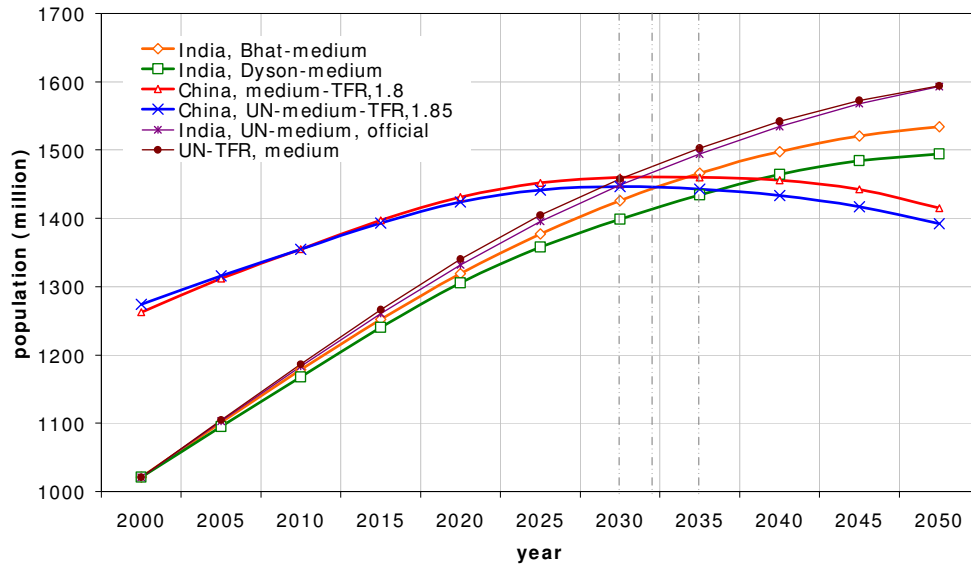
**Figure 9a.** Base population pyramid, China, 2000
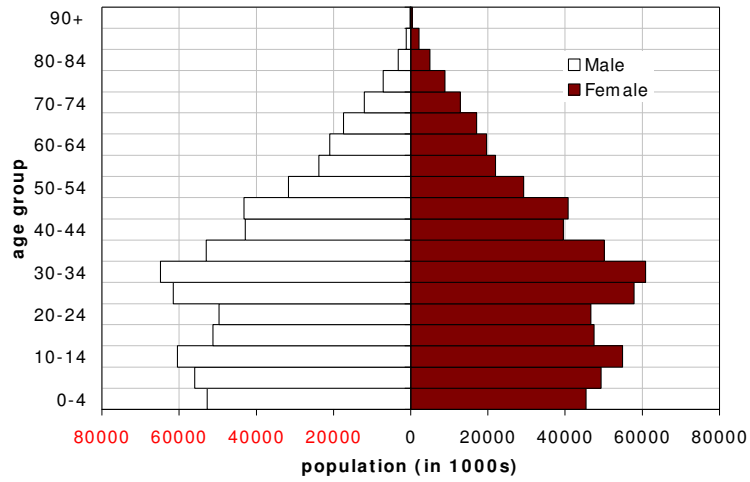


**Figure 9b.** Projected population pyramid, China, 2025
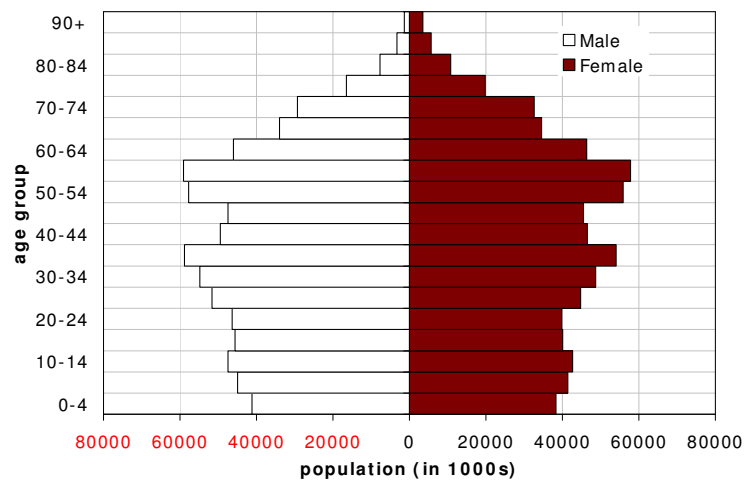


**Figure 9c.** Projected population pyramid, China, 2050
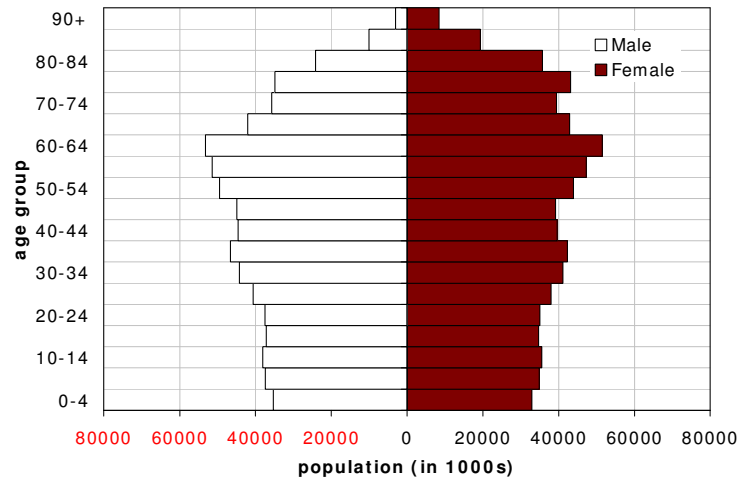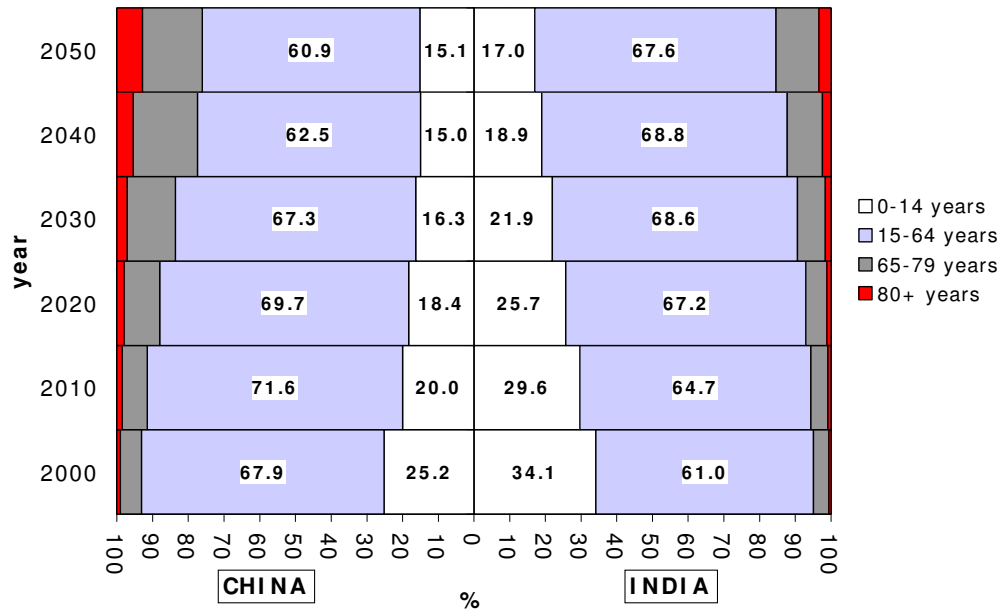
**Figure 10a.** Base population pyramid, India, 2000
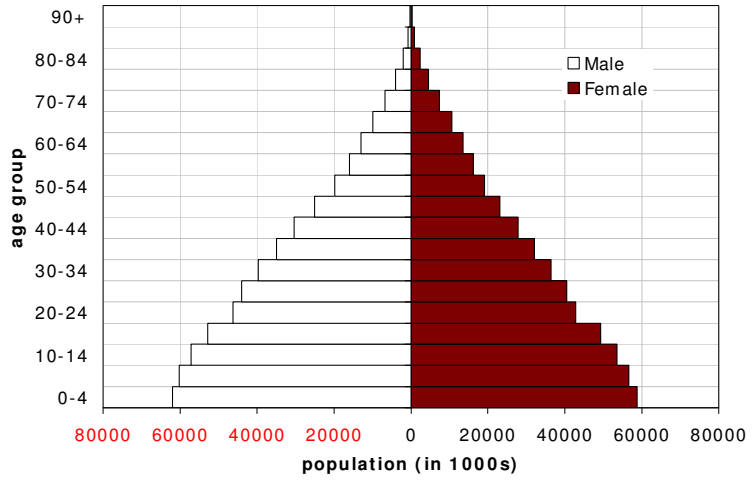


**Figure 10b.** Projected population pyramid, India, 2025
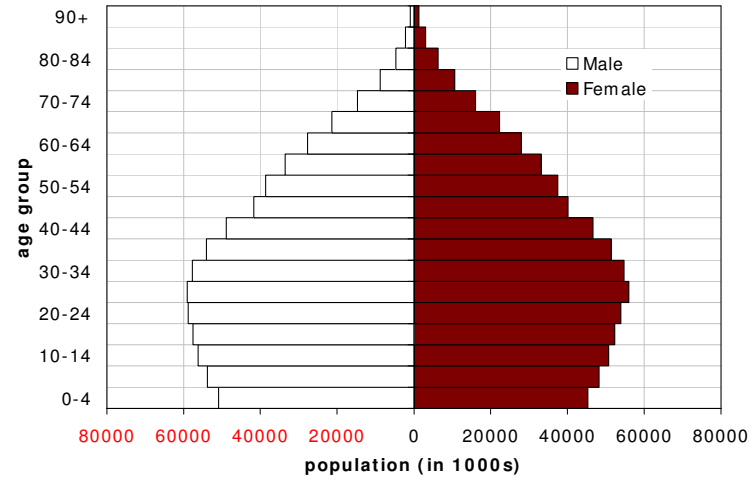


**Figure 10c.** Projected population pyramid, India, 2050
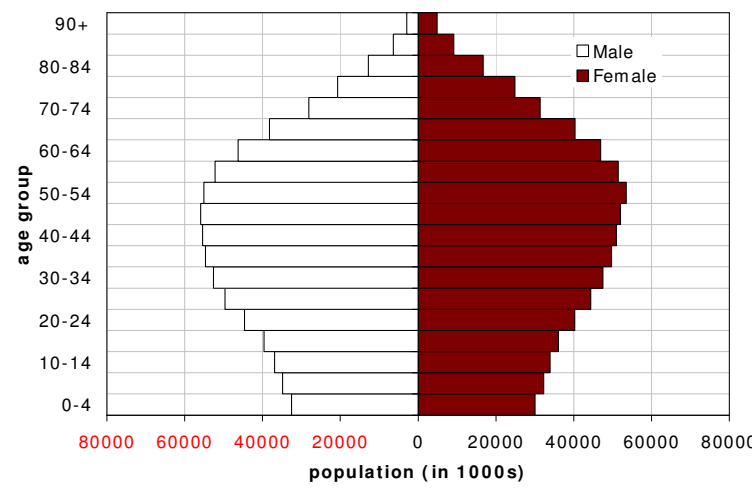
**Figure 11.** Projected population by age group (%), China and India, 2000-50



Note: Chinese population projections based on TFR of 1.8 throughout the projection horizon and Indian population projections based on TFRs proposed by Bhat (2002)
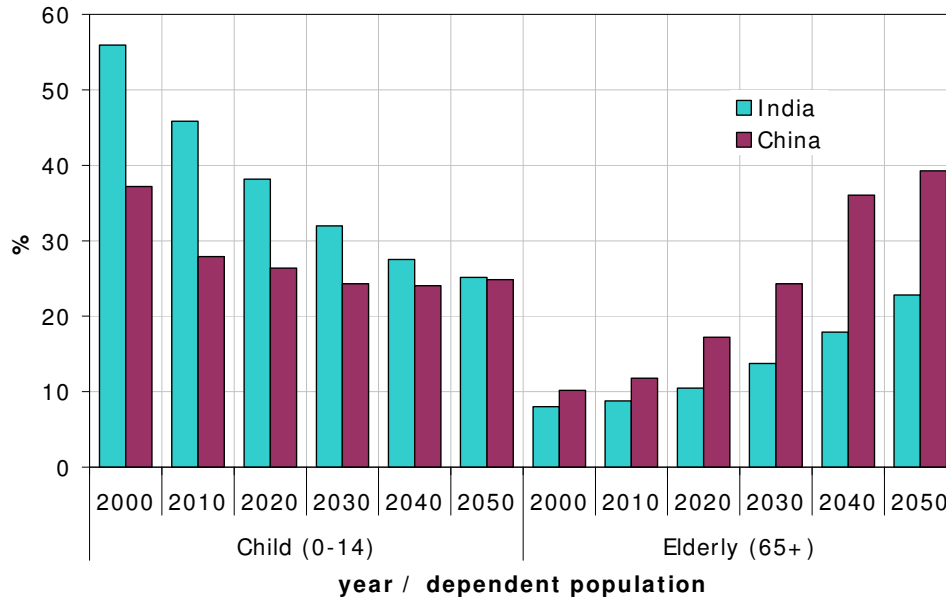
**Figure 12.** Mean annualized growth rates (%) of working and total population in China and India, 2000-50
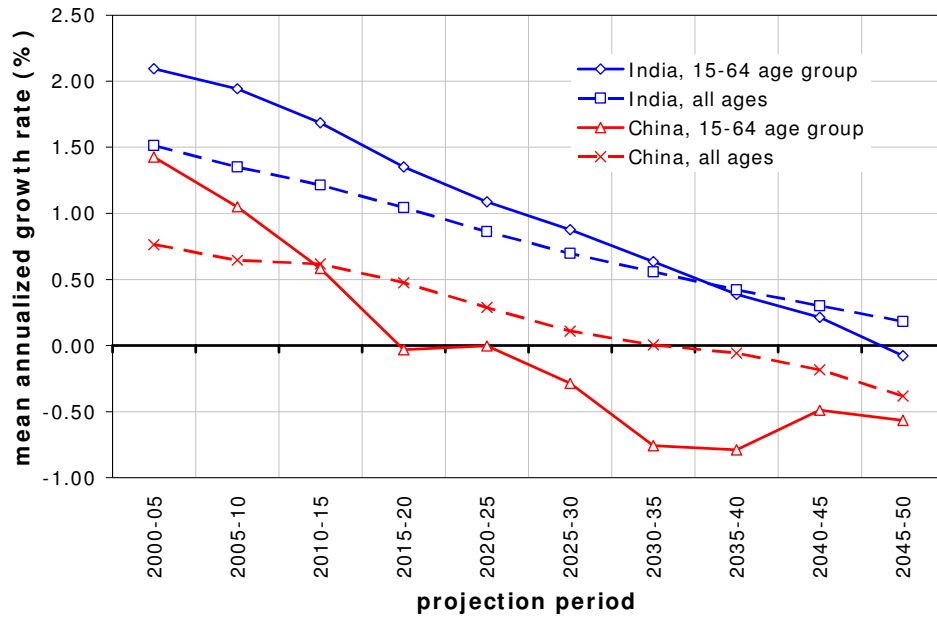


Note: Chinese population projections based on TFR of 1.8 throughout the projection horizon and Indian population projections based on TFRs proposed by Bhat (2002)

**Figure 13.** Burden of future child (0-4) and elderly (65+) dependent populations, China and India



Note: Chinese population projections based on TFR of 1.8 throughout the projection horizon and Indian population projections based on TFRs proposed by Bhat (2002)