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A COMPARATIVE ANALYSIS OF POPULATION TRANSITION IN INDIA AND CHINA

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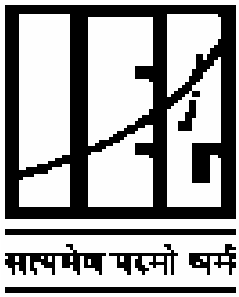

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A Comparative Analysis of Population Transition in India and China

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Introduction

India and China are the only two billion plus countries in the world today. According to the 2004 revision of the world population prospects prepared by the United Nations, the two countries accounted for more than 37 per cent of the world population as of 2005 which suggests that population growth trends in the two countries have strong bearings on the world population growth (United Nations, 2004). Around 1950 when India got freedom from a long and oppressive colonial rule (in 1947) and China became 'Red' (in 1949), the two countries had a very similar population scenario characterised by high fertility and high mortality and a very young population age structure. Since then, population growth trends in China have been significantly different from those in India. China's population appears to have reached the post transition stage during the fifty years between 1950 and 2000. During the period 2000-05, the total fertility rate in China was estimated to be 1.7 live births per woman, much lower than the replacement fertility while the expectation of life at birth was more than 71 years resulting in an average annual population rate of less than 0.65 per cent per year (United Nations 2004). By contrast, with a total fertility rate of 3.07, expectation of life at birth around 63 years and an average annual population growth rate of more than 1.55 per cent, India still appears to be stuck up in the middle of the population transition process. During the period 2000-05, almost 83.7 million people were estimated to have been added to India's population. In China, this number was only around 43.8 million. As the result of the different population transition path followed in the two countries, it is projected that the net addition to the population will be significantly more in India as compared to China in the years to come so that sometimes after the year 2030, India will become the most populous country in the world surpassing China. At that time almost 18 per cent of the world population will be living in India and its population will still be increasing. By contrast, China's population has been projected to start declining after 2030 as the result of continued low fertility and mortality.

Implications of the population transition in the two countries appear to have also been different. In less than twenty year's time between 1982 and 2000, the gross domestic product per capita in China, adjusted for purchasing power parity, increased by more than four times - a record unmatched elsewhere in the world and population transition accounted for a substantial proportion of this increase. According to official estimates, population transition accelerated China's economic growth by 2.3 per cent per year (Vermeer, 2006). In India, there is little

evidence of any significant impact of population transition on economic growth simply because the decrease in fertility and mortality in India has been too slow to induce any significant changes in the age structure of the population.

In this paper, we present a comparative analysis of the population transition path followed by India and China during the second half of the twentieth century. One purpose of the analysis is to identify the distinctive features of population transition in the two countries. The second purpose of the analysis is to explore the factors and conditions that were responsible for the divergent population transition path followed in the two countries when both the countries had a very similar population scenario around the year 1950. The paper also discusses, in brief, the future implications of the population transition path followed by the two countries during the second half of the twentieth century.

Population transition refers to the change in population stock (size, growth and composition) as the result of change in the factors that affect the population stock (Schoen, 2002). At the pre-transition stage, both fertility and mortality levels are high with the result that the population age structure is young and increase in population is slow. With the onset of transition, first mortality and then fertility starts decreasing so that the increase in population first gets accelerated and then slows down. At the end of the transition, both mortality and fertility are very low and increase in population again becomes very slow but the age structure of the population gets older. Throughout the transition process, the size of the population increases, slowly at the beginning of the transition, very rapidly in the middle of the transition, and again slowly at the end of the transition. Thus, the rate of population increase follows a revers U shape curve during the course of population transition. Population transition is affected primarily by changes in the levels of fertility and mortality. Changes in the age structure of the population, resulting from the changes in fertility and mortality also accelerate and decelerate the transition process. Any analysis of population transition, therefore, requires analysis of both changes in the levels of fertility and mortality as well as changes in the age structure of the population.

The paper is organized as follows. The next section outlines the methodology used for the comparative analysis. Section three of the paper describes the data source while section four summarises results of the analysis. Section five discusses key factors that contributed to successful population transition in China. In conclusion, the paper points out some of the limitations of population stabilization efforts in India.

Methodology

Fundamentally, population transition is 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 (Schoen, 2002). The force of transition may be an instantaneous rate or probability or risk of change with respect to the demographic behaviour of interest. One special but useful feature of population transition is that it is logically closed. This means that change in the population stock at a given time can be determined from the population stock at an earlier time and the demographic events that occur between the two time points. The classical expression of this closure property is the well known balancing equation of population change

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

where t stands for time, B is the total number of births between time 0 and time t; D the total number of deaths; I total immigration and O total emigration during this time interval. If it is assumed that population is closed to migration or if the magnitude of immigration and emigration is nearly the same so the net migration is either zero or very near to zero, then,

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

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

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

Here r is the (crude) rate of natural increase, b is the (crude) birth rate and d is the (crude) death rate. In the absence of migration, r serves as a useful indicator of population transition. When r=0, the birth rate is equal to the death rate and the population remains unchanged over time. Now,

$$\triangle r = r_2 - r_1 = \triangle b - \triangle d = (b_2 - b_1) - (d_2 - d_1). \quad (5)$$

It is well known that the birth rate depends upon both the average fertility of individual women in the reproductive age group and the age structure of the population. Similarly, the death rate also depends upon the age-specific probability of death and the age structure of the population. Analysis of the population transition, therefore requires that the fertility and mortality effects are separated from the age structure effects on birth and death rates. The birth rate can be written as

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

where f is the average fertility per woman. The average fertility per woman can be estimated by dividing the total fertility rate by 35, the length of the reproductive span. Horiuchi (1991) has shown that the ratio

of birth rate to total fertility rate measures the age structure effects on the birth rate. Arguing in the same way, the ratio (b/f) can be interpreted as a measure of age structure effects on the birth. Similarly, the death rate can be written as

$$d = l * (d/l), \qquad (7)$$

where l is the life table death rate which is nothing but the reciprocal of the expectation of life at birth. Like the ratio (b/f), the ratio (d/l) can also be interpreted as a measure of age structure effects on the death rate. Substituting from (6) and (7) in (5) yields,

$$\Delta r = \{(f_2*(b_2/f_2)) - (f_1*(b_1/f_1))\} - \{(l_2*(d_2/l_2)) - (l_1*(d_1/l_1))\}$$

or $$\Delta r = \{(f_2*ab_2) - (f_1*ab_1)\} - \{(l_2*ad_2) - (l_1*ad_1)\}, \qquad (8)$$

where ab and ad denote the age structure effects on birth rate and death rate, respectively. Following Kitagawa (1955), we get,

$$(f_2* ab_2) - (f_1* ab_1) = (f_2 - f_1)*(ab_2 + ab_1)/2 + (f_2 + f_1)*(ab_2 - ab_1)/2 \qquad (9)$$

and

$$(l_2* ad_2) - (l_1* ad_1) = (l_2 - l_1)*(ad_2 + ad_1)/2 + (l_2 + l_1)*(ad_2 - ad_1)/2. \qquad (10)$$

Substituting from (9) and (10) in (8), we get the following decomposition of the change in the rate of natural increase:

$$\Delta r = \tfrac{1}{2}[\{(f_2 - f_1)*(ab_2 + ab_1)\} - \{(l_2 - l_1)*(ad_2 + ad_1)\} + \{(f_2 + f_1)*(ab_2 - ab_1)\} - \{(l_2 + l_1)*(ad_2 - ad_1)\}]$$

$$= \Delta f - \Delta l + \Delta ab - \Delta ad. \qquad (11)$$

Here Δf is the contribution of the change in average fertility per woman to the change in the rate of natural increase. Similarly, Δl is the contribution of the change in the life table death rate, Δab is the contribution of the change in the age structure effects on the birth rate and Δad is the contribution of the change in the age structure effects on the death rate to the change in the rate of natural increase. The age structure effects on the birth rate are attributed to the change in the proportion of females in the reproductive age group and their distribution within the reproductive life span as the fertility of a woman varies by age. Similarly, the age structure effects on the death rate are attributed to the proportion of population in different age groups as the risk of death varies by age. Changes in the age structure effects may induce a change in the birth rate and the death rate even if the levels of fertility and mortality remain unchanged.

Equation (11) provides an approach to addressing the controversial issue of which demographic indicators would be more efficient in analysing population transition. In the absence of migration, the logical choice is the rate of natural increase which is the difference between the birth rate and the death rate. However, both the birth rate and the death

rate are essentially crude measures of fertility and mortality which are affected, in addition to the levels of fertility and mortality, by the population age and sex composition. Using only the crude rates may, therefore, hardly capture the actual level of fertility and mortality. The birth and death rates may stay at a rather high level despite low levels of fertility and mortality simply because the age structure of the population contributes to keep them high. On the other hand, the total fertility rate (average fertility per woman) and expectation of life at birth (life table death rate) have their limitations in analysing population transition. First, both these measures are based on hypothetical rather than actual population. Second, change in these indicators does not necessarily lead to change in the birth rate and the death rate and hence the rate of natural increase as the birth and death rates are also influenced by the population momentum resulting from the changes in the age structure. Analysis of population transition requires that both changes in the levels of fertility and mortality and changes in the age structure of the population should be taken into account. Equation (11) provides such a framework for analysing the population transition.

Interpretation of equation (11) is straightforward. The differences in fertility and mortality levels are weighed by the average of the age structure while the differences in the age structure effects on the birth rate and the death rate are weighed by the average levels of fertility and mortality. There are other decompositional procedures also but they introduce a residual or interaction term which is often difficult to interpret and is often unnecessary (Preston, Heuveline, Guillot, 2001).

Data Source

The analysis presented here is based on the estimates of total population, birth rate, death rate, total fertility rate and expectation of life at birth prepared by the United Nations for India and China for different five-year periods between 1950 through 2005 (United Nations, 2004). The Population Division of the United Nations has been preparing consistent estimates and projections of the population of the world and its Member countries and areas since 1950. The present paper uses the 2004 revision, although the 2006 revision has been released by the United Nations very recently (United Nations, 2006). The estimates prepared by the United Nations represent a unique set of consistent estimates of the size and structure of the population and key demographic indicators for the comparative analysis of population transition which is the objective of the present paper.

Findings

The findings of the analysis, presented in the following pages, have been divided into four parts. First we discuss the trends in the levels of fertility and mortality as measured by the total fertility rate and the expectation of life at birth in the two countries. Next, we analyse the trends in the birth rate and the death rate including the age structure effects on the birth rate and the death rate. In the third part, analysis of the trend in the rate of natural increase is presented which also includes an analysis of the contribution of fertility, mortality and age structure to the changes in the rate of natural increase. Finally, in the fourth part of the findings, we summarise the transition in the age structure of the population of the two countries.

Trends in Fertility and Mortality. Figure 1 presents the trend in the total fertility rate in China and India during the period 1950 through 2005. At least three conclusions can be drawn from the figure. First, fertility in China has always been lower than the fertility in India expect for two short time periods, 1950-55 and 1965-70. Second, if we follow the Princeton rule which says that fertility transition begins when the total fertility rate declines by at least 10 per cent (Coale and Watkins, 1986), then fertility transition in China started during the period 1970-75 whereas in India, it started during 1975-80 only. Moreover, the pace of fertility transition has been very rapid in China so that China achieved the replacement level fertility within a very short duration of about 20 years. By contrast, in India, fertility transition has, at best, been slow and the total fertility rate could not be halved even in the 30 years between 1970-75 and 2000-05. Third, the very fact that there was little change in the total fertility rate in India during the period 1950-55 through 1970-75 suggests that the official population policy adopted in India way back in 1951 and the associated official population control programme, appears to have contributed little till 1975 as far as fertility decline is concerned.

Trends in the expectation of life at birth in the two countries are shown in Figure 2. The most striking observation that one can make from the figure is the spectacular decline in mortality in China. In the 20 years between 1950-55 and 1970-75, the expectation of life at birth in China increased by more than 22 years and by more than 10 years in just five years between 1960-65 and 1965-70. By contrast, in India, the life expectancy increased by just around 11 years during this period. By the period 1965-70, the expectation of life at birth in India was only about 50 years compared to the expectation of life at birth of almost 60 years in China.

Figure 1
Total Fertility Rate in China and India

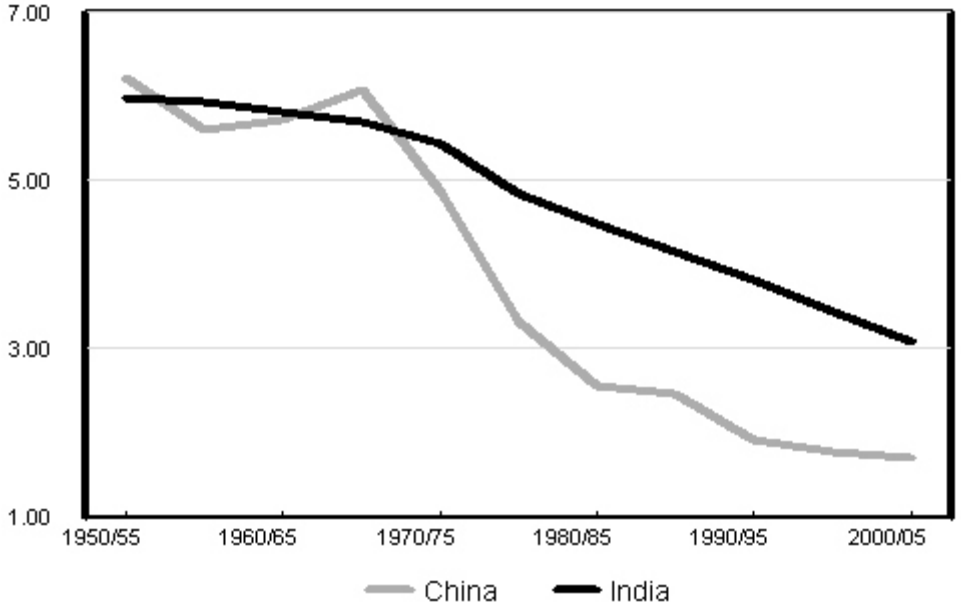
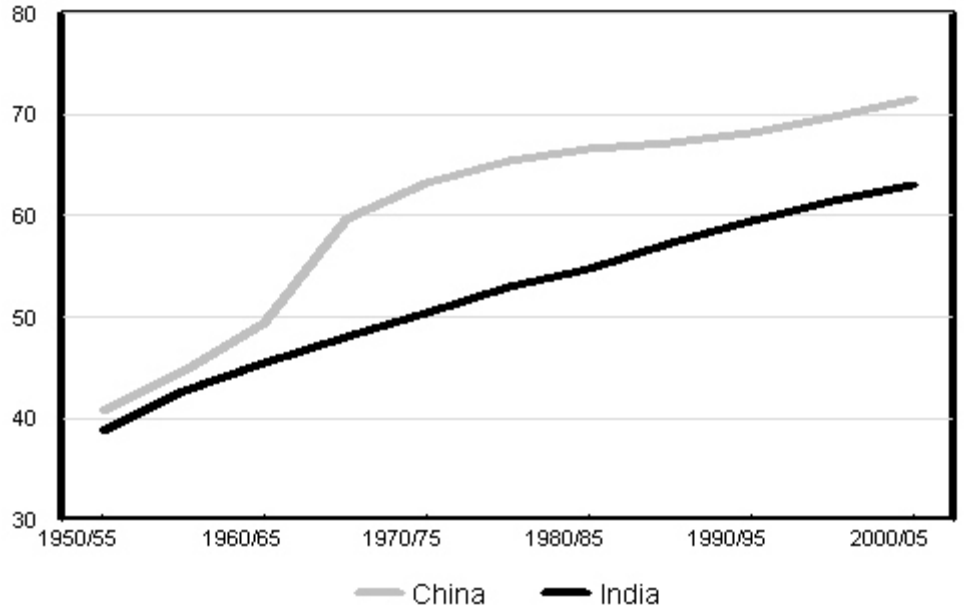


Figure 2
Expectation of Life at Birth in China and India



As a result of the differing pace of decline in mortality in China and India, the gap in the life expectancy between the two countries increased. During 1950-55, the expectation of life at birth in China was about 2 years higher than that in India. By 1970-75 a Chinese lived, on average, almost 13 years longer than an average Indian. Since 1970-75, increase in the expectation of life at birth in China slowed down considerably and nearly stagnated during the period 1980-90; yet during the period 2000-05, the expectation of life at birth in China was still more than 8 years higher than that in India.

Trends in Birth Rate and Death Rate. Figure 3 shows the trends in the birth rate in the two countries while the trends in the death rate are shown in Figure 4. As discussed earlier, the birth rate and the death rate are influenced, in addition to the levels of fertility and mortality, by the age structure of the population. As such, a comparison of the trends in the birth rate and the trends in the total fertility rate reflects that impact of the age structure effects on the birth rate. Similarly, a comparison of the trends in the death rate and the trends in the life table death rate reflects the impact of the age structure effects on the death rate.

As compared to India, the trends in the birth rate in China have been more erratic. In China, the birth rate increased during 1955-60/1960-65 and again during 1980-85/1985-90 but decreased very rapidly during 1965-70 through 1975-80. By contrast, the trend in the birth rate in India has been more consistent. Unlike China, there has never been an increase in the birth rate in India throughout the second half of the last century. More importantly, after 1985-90, India appears to have been able to keep pace with China in terms of the decline in the birth rate.

In the case of death rate, the decline in China has been spectacular. During the period 1950-55, the death rate in China was almost the same as that in India but in the 20 years after 1950-55, the decline in China was almost twice as fast as the decline in India so that by the period 1970-75, the death rate in China reduced to just around 6 per thousand population whereas in India it still hovered around 10 per 1000 population. After 1970-75, China has been able to maintain its death rate between 6-7 per 1000 population whereas in India, the death rate continued to decrease at an increasingly slower rate. Between 1995-2000 and 2000-05, the average annual death rate in India decreased by just about 1 absolute points despite the fact that the death rate in India during 2000-05 was almost 2 absolute points higher than the death rate in China. Reduction in mortality still remains a major public health challenge in India even today.

Figure 3
Trends in Birth Rate in India and China
Per 1000 population

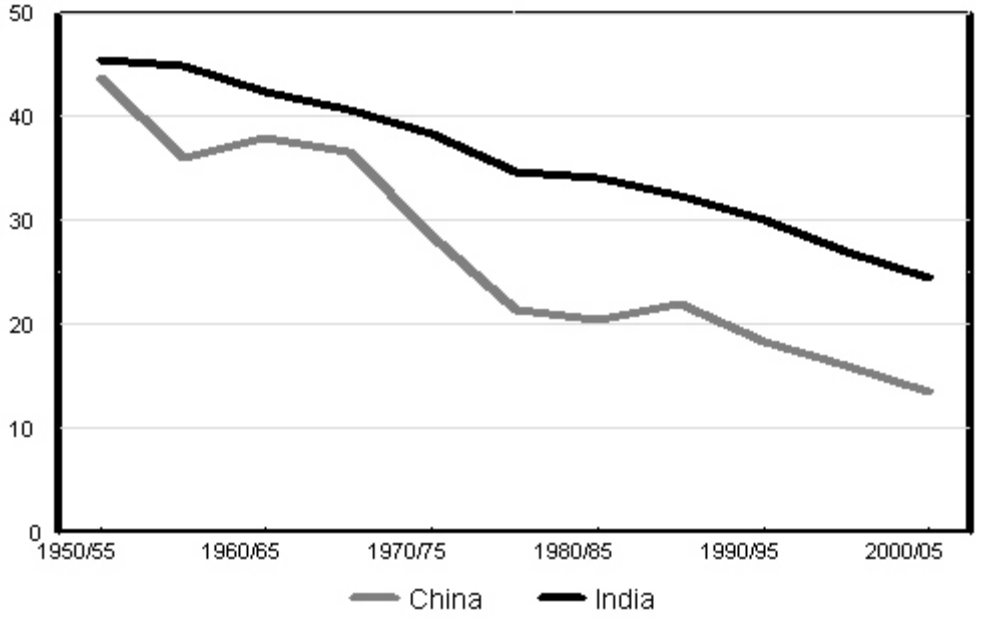
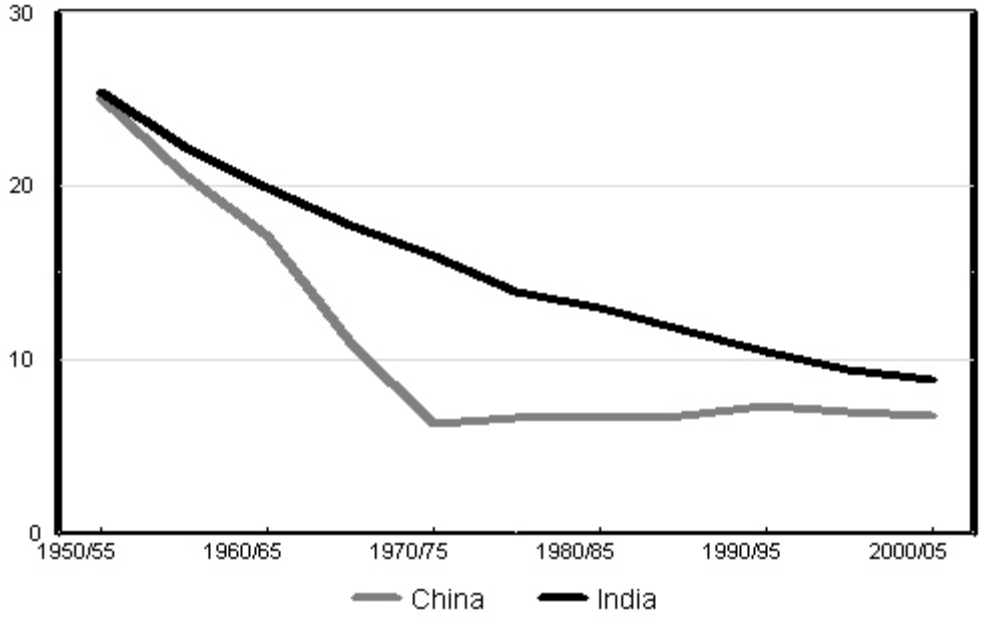


Figure 4
Trends in Death Rate in China and India
Per 1000 population



In addition to levels of fertility and mortality, the birth rate and the death rate are also influenced by changes in the age structure of the population which, in themselves, are induced by the changes in fertility and mortality. The age structure effects on the birth rate result from two factors. First, only a particular section of the population (females in the reproductive age group) is biologically capable of conception and producing a birth. As such, at a given level of average fertility of women in the reproductive age group, the higher is the proportion of females in the reproductive age group, the higher will be the birth rate. Second, the probability of conception is not the same across all ages. Therefore, the age distribution of females in the reproductive age group also affects the birth rate. Similarly, the age structure effects on the death rate result from the fact that the probability or the risk of death varies by age. At a given level of age-specific probabilities of death, the death rate will be higher in a population that has a higher concentration of the people either in the younger ages or in the older ages.

The age structure effects on the birth rate and the age structure effects on the death rate are essentially arithmetic accounting effects. They do not affect the probability of a conception that leads to a birth or the probability or a risk of a death. At very high levels of mortality, the majority of deaths are concentrated in younger age groups and are primarily due to communicable and infectious diseases. When mortality declines, the number of deaths in the younger ages decrease resulting in a shift in the age structure of the population which in turn impacts upon the death rate. Similarly, when fertility declines, the number of births decrease resulting in a decrease in the proportion of population in the younger ages and increase in the proportion of adult population thereby affecting the birth rate.

Figures 5 shows the trend in the ratio of birth rate to the average fertility per woman for the two countries while the trend in the ratio of the death rate to the life table death rate is shown in Figure 6. These figure show that, like fertility and mortality, changes in the age structure effects on the birth rate and the death rate have been more volatile in China than in India. This is expected as the changes in the levels of fertility and mortality have been very sharp in China as compared to India. However, in both the countries, the age structure effects on the birth rate have been lowest during 1970-75 but between 1970-75 and 1990-95, the age structure effects on birth rate have risen very steeply in China primarily because of a very rapid decline in the birth rate whereas in India, this rise has at best been marginal.

Figure 5
Trends in Age Structure Effects on Birth Rate in China and India

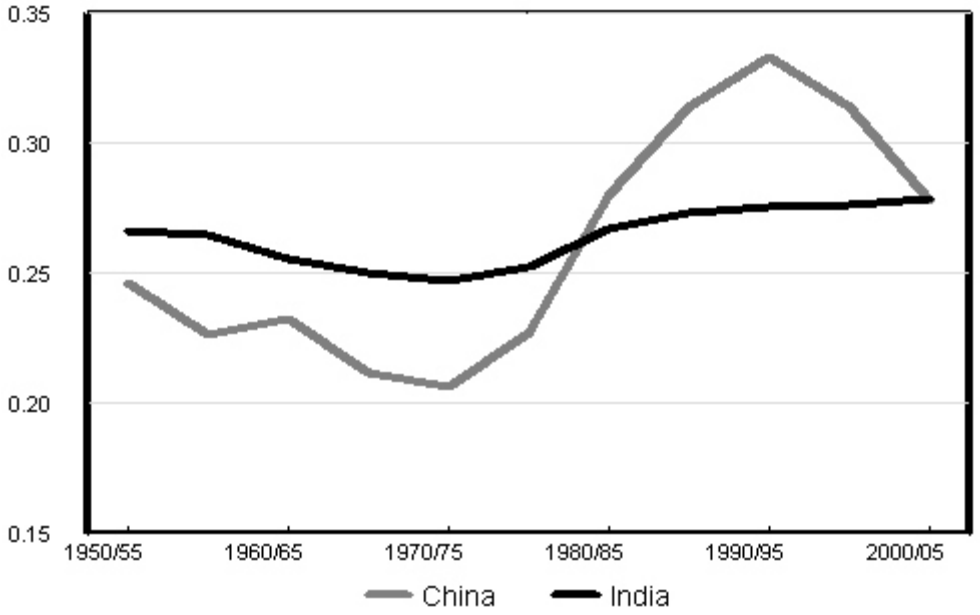
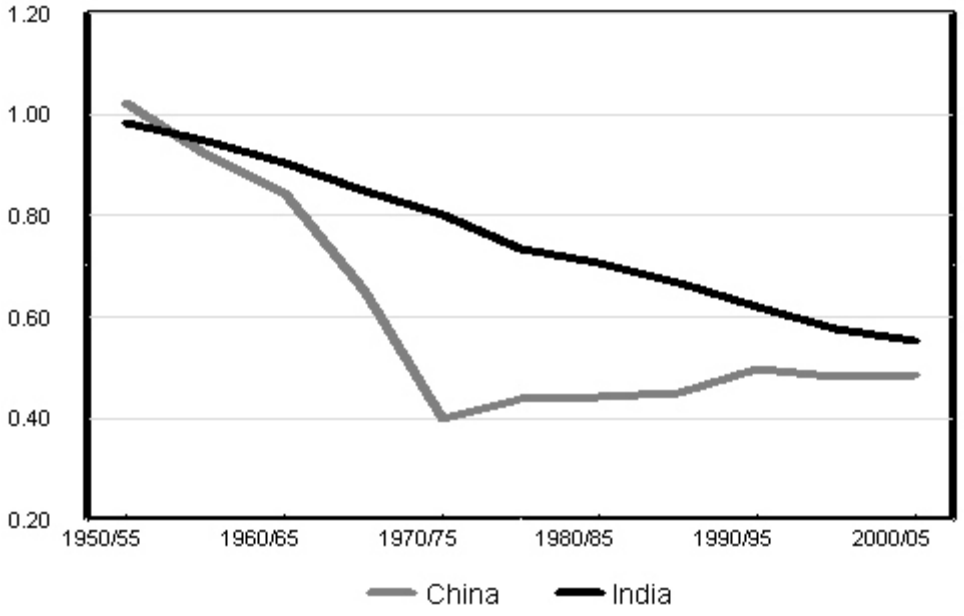


Figure 6
Trends in Age Structure Effects on Death Rate in China and India



The ratio of the death rate to the life table death rate, on the other hand, has always been lower in China than in India except for the period 1950-55 (Figure 6). In China, this ratio decreased very rapidly between 1960 through 1970 as the result of a very sharp decline in mortality so that these effects reached an all time low during the period 1970-75 when the death rate in China was at an all time low. After 1970-75, the age structure effects on the death rate increased at a very slow rate as the result of marginal increase in the death rate because of the ageing of the population. By comparison, in India, the trend in this ratio has been very consistent. However, the ratio of the death rate to the life table death rate has always been higher in India as compared to China except for the period 1950-55 which suggests that the age structure of the population of China has always been older than the age structure of the population of India.

An idea about how changes in the age structure effects on the birth rate affects the change in the birth rate can be made by comparing the trend in the birth rate with the trend in the average fertility per woman simultaneously. Similarly, a comparison of the trend in the death rate with that in the life table death rate shows how the age structure effects on the death rate affect the death rate. Figures 7 and 8 show respectively the trend in the index of the birth rate and the index of average fertility per woman in China and India. The index has been calculated by assuming that during the period 1950-55, the index of both the birth rate and the average fertility rate per woman was 100 and then calculating the index for successive five-year period on the basis of the decrease in the birth rate and the decrease in average fertility per woman. Figure 7 suggests that in China, the index of birth rate decreased at a faster rate than the index of average fertility per woman during the period 1950-55 through 1975-80. This implies that, during this period, the changes in the age structure effects on the birth rate contributed towards an acceleration in the birth rate decline in China. However, during the period 1980-85 through 2000-05, the decrease in the index of birth rate was slower than the decrease in the index of average fertility per woman which means that, during this period, the age structure effects on the birth rate contributed towards a deceleration in the birth rate decline in China. A similar pattern prevailed in India also (Figure 8) but the magnitude of the impact of changes in the age structure changes on the birth rate has been small. In fact, this impact has at best been marginal after the period 1980-85 primarily because the speed of decline in the birth rate has been very slow.

Figure 7
Age Structure Effects on the Birth Rate in China
Index of Birth Rate and Index of Average Fertility per Woman

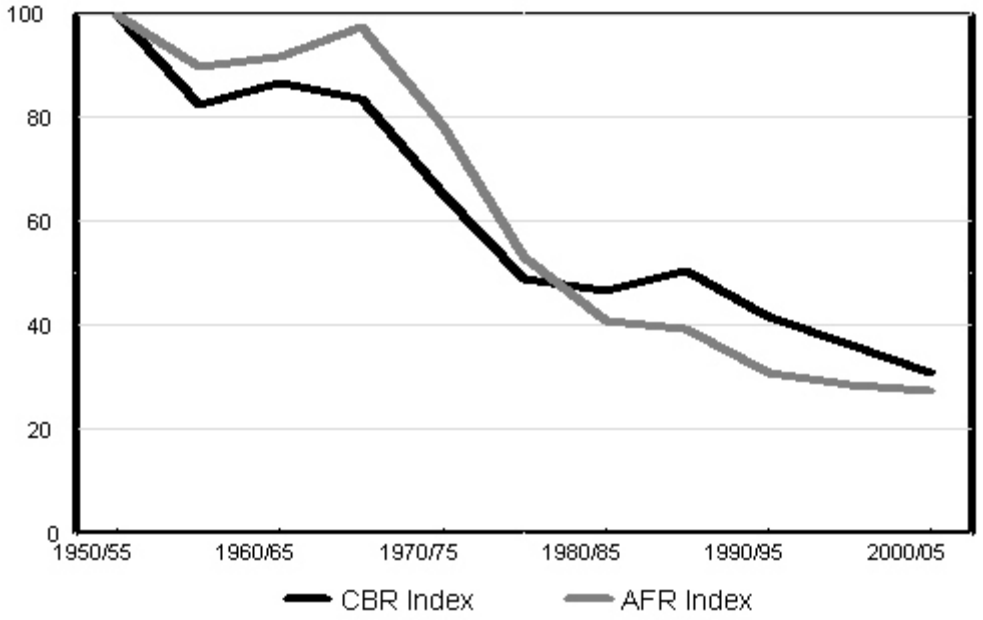


Figure 8
Age Structure Effects on the Birth Rate in India
Index of Birth Rate and Index of Average Fertility per Woman

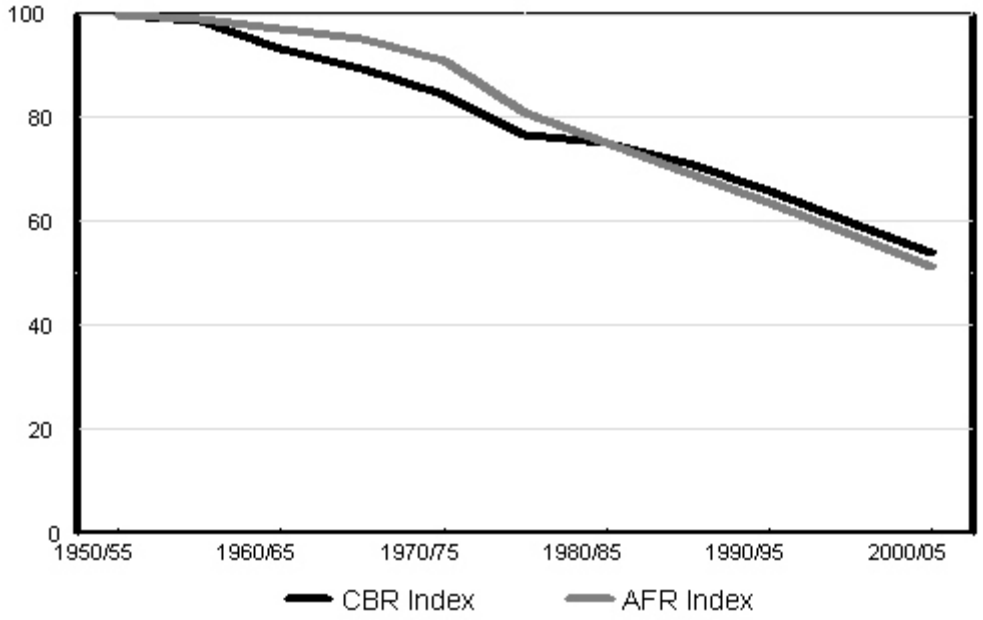


Figure 9
Age Structure Effects on the Death Rate in China
Index of Death Rate and Index of Life Table Death Rate

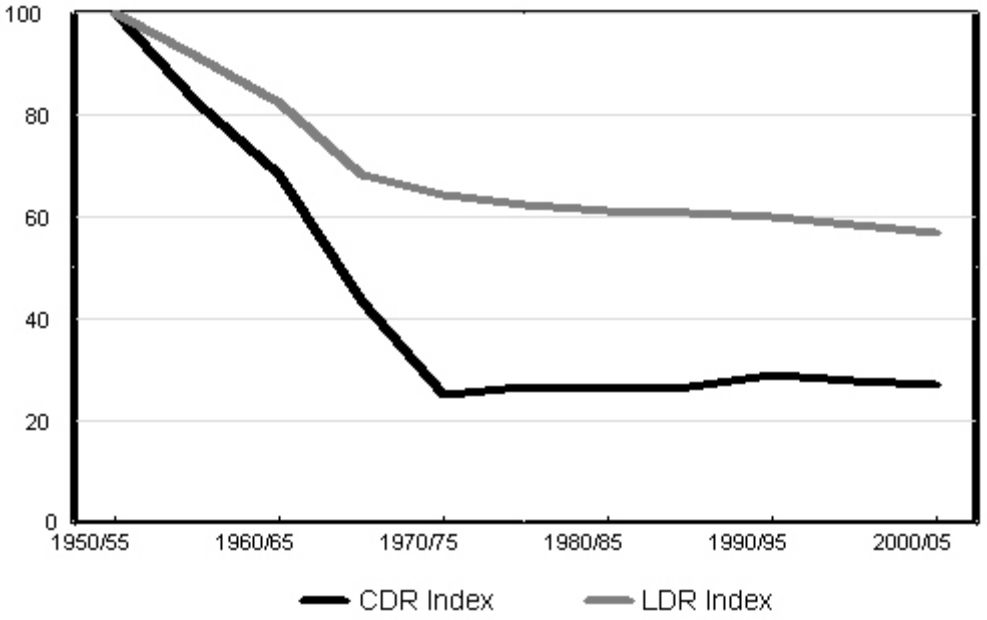
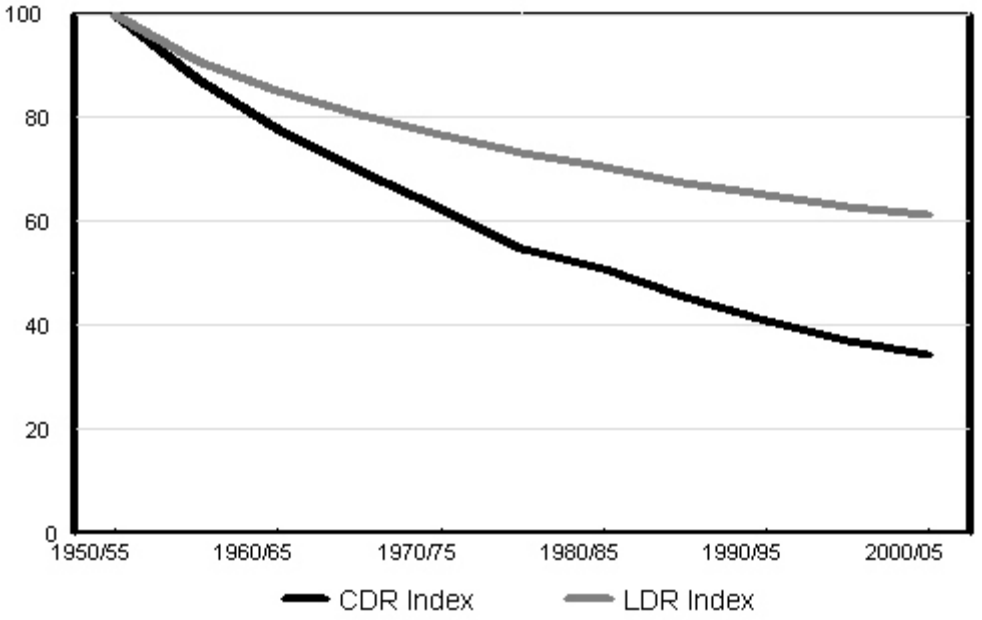


Figure 10
Age Structure Effects on the Death Rate in India
Index of Death Rate and Index of Life Table Death Rate



The age structure effects on the death rate are shown in Figures 9 and 10 for the two countries. In both the countries, the death rate decreased more rapidly than the life table death rate which suggests that a substantial proportion of the observed decrease in the death rate was due to changes in the age structure of the population rather than the decrease in the risk of death per se. In China, for example, the death rate decreased from around 17 during 1960-65 to just around 6 during 1970-75 but the life table death rate decreased from around 20 to around 16 only during this period. Similarly, in India, the death rate decreased from around 25 during 1950-55 to 9 during 2000-05 but the life table death rate decreased from around 26 to just around 16 during the same period. Obviously, changes in the age structure of the population in the two countries have contributed substantially to a decrease in the death rate despite the fact that the decline in the probability or the risk of death has been relatively slow.

Trends in the Rate of Natural Increase. Figures 11 and 12 show the trends in the average annual rate of natural increase in the two countries along with the contribution of the fertility, mortality and age structure. Compared to India, the trend in the rate of natural increase has been more turbulent in China. This is expected as the trends in the birth rate and the death rate have been more volatile in China than in India. In India, the rate of natural increase showed an increasing trend during 1950-60 and again during 1975-85, although the increase during this period was, at best, marginal. By contrast, the rate of natural increase in China increased very rapidly between 1955-60 and 1965-70 and decreased equally sharply between 1965-70 and 1975-80. China also recorded a marginal increase in the rate of natural increase during the period 1980-85 through 1985-90 because of the increase in the birth rate.

In absolute terms, however, the rate of natural increase in China has always been lower than that in India except for the brief period 1965-70. After 1985, the rate of natural increase has recorded a secular decline in both the countries but the rate of decline in China has been faster than that in India. In India, the average annual rate of natural increase hovered around 2 per cent per year and more than 2 per cent per year for most of the second half of the last century which shows a very limited impact of transition in fertility and mortality on population transition in the country. By contrast, in China, a rate of natural increase of more than 2 per cent per year was recorded only for a short ten-year period from 1960-65 through 1970-75 when the life table death rate decreased very rapidly leading to a rapid increase in the rate of natural increase.

Figure 11
Change in the Rate of Natural Increase in China
per 100 000 population

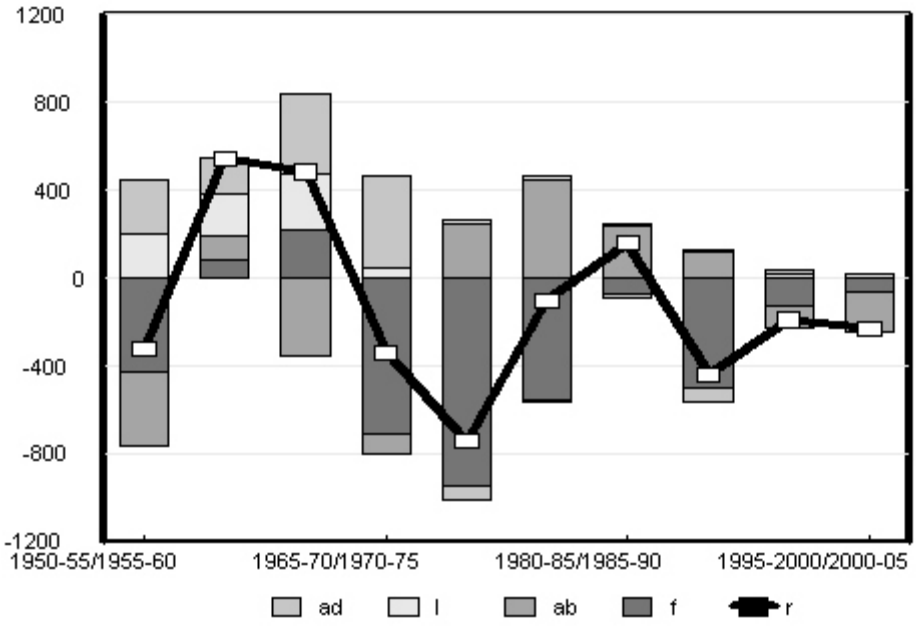
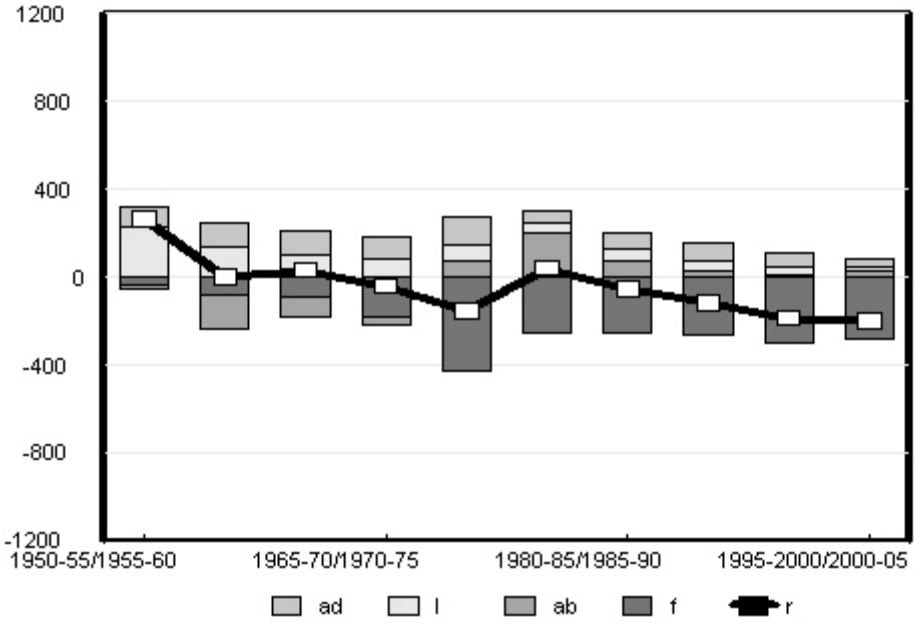


Figure 12
Change in the Rate of Natural Increase in India
per 100 000 population



Figures 11 and 12 also show the contribution of the changes in the levels of fertility, mortality and changes in the age structure of the population to the changes in the average annual rate of natural increase in the two countries. In China, there are two distinct phases of transition. During 1955-60 through 1965-70, changes in both fertility and mortality contributed to increasing the rate of natural increase; fertility increased and mortality declined. During 1965-70 through 1980-85, the slow down in the rate of natural increase was primarily the result of the decrease in fertility. Changes in mortality contributed little to changes in the rate of natural increase during this period and so was the case with the changes in the age structure. On the other hand, increase in the rate of natural increase between 1980-85 and 1985-90 was the result of a considerable slow down in fertility decline.

In India, the rate of natural increase accelerated during 1960-65 and again during 1980-85 but the increase has been marginal as compared to China. The relatively slow transition in fertility and mortality in India is well reflected through the trend in the rate of natural increase. In China, the average annual rate of natural increase decreased by about 1.2 per cent points (1200 per 100 thousand population) between 1950-55 and 2000-05 whereas, in India, this decrease was less than 0.5 per cent points. In China, the decrease in the birth rate, during this period, would have actually accounted for a decrease of about 3 per cent points in the rate of natural increase but the decrease in the death rate during the same period accounted for an increase of about 1.8 per cent points so that the net decrease in the rate of natural increase reduced to 1.2 per cent points (Table 1). In India, on the other hand, the decrease in the average fertility per woman during 1950-55 through 2000-05 would have actually accounted for a decrease of about 2.3 per cent points (2259 per 100 thousand population) in the natural fertility rate but the life table death rate also decreased by about 0.8 per cent points (768 per 100 thousand population) during this period.

The role of age structure changes in population transition in the two countries is also clear from the Figures 11 and 12 and from Table 1. Both the age structure effects on the birth rate and the age structure effects on the death rate have contributed towards decelerating the decrease in the average annual rate of natural increase in the two countries which suggests that the changes in the age structure of the population have tended to slow down the process of population transition in the two countries. This is expected as the decrease in the average fertility of the woman results in a decrease in the number of

births thereby increasing the proportion of females in the childbearing ages so that even if the average fertility of the woman remains unchanged, the number of births increase. Table 1 suggests that the change in the age structure effects on the birth rate induced an increase of 0.35 per cent points in China and 0.16 per cent points in India in the average annual rate of natural increase during the period under reference. Similarly, the change in the age structure resulting from the decrease in the life table death rate induced an increase of more than 1 per cent points in China and almost 0.9 per cent points in India in the average annual rate of natural increase. This induction slowed down the pace of population transition in both the countries.

Table 1: Decomposition of Change in Average Annual Rate of Natural Increase in India and China

per 100 thousand population

	India	China
Change in the average annual rate of natural increase between 1950-55 and 2000-05	-428	-1200
Change in the natural increase accounted by the change in the unweighted fertility per woman	-2259	-3386
Change in the natural increase accounted by the change in the age structure effects on the birth rate	165	354
Change in the natural increase accounted by the change in the Life table death rate.	-768	-793
Change in the natural increase accounted by the change in the age structure effects on the death rate	-897	-1039

Table 1 also suggests that, of the four components of change in the rate of natural increase, the change in the average fertility per woman between 1950-55 actually contributed to decrease the rate of natural increase in India as well as in China. The remaining three factors have

actually contributed to increasing the rate of natural increase or slowing down the population transition during this period, although different five-year periods of this interval showed a fluctuating trend. The decrease in the average fertility per woman, however, has been able to compensate for the decelerating effects on the decrease in the rate of natural increase resulting from the decrease in mortality as well as changes in the age structure of the population.

Age Structure Transition. The foregoing analysis highlights the role of the change in the age structure of the population as it affects the rate of natural increase through the impact of changes in the age structure on birth and death rates. Changes in the age structure of the population, in turn, are induced by the changes in the levels of fertility and mortality. Trends in the selected indicators of age structure are shown in Figures 13 and 14 for the two countries. Changes in the age structure of the population have been more marked in China as compared to India simply because the fertility and mortality transition in China has been more rapid than that in India. In both India and China, the proportion of population in the age group 0-14 years was around 40 per cent around 1965. Between 1965 and 2005, this proportion decreased to around 21 per cent whereas in India, about one third of the population was still below 15 years of age as of 2005 with the result that the population pyramid of India continues to be triangular in shape and the population momentum remains high.

Rapid decrease in the proportion of the young population in China, because of the rapid decrease in fertility, has resulted in a rapid increase in the proportion of working age population. In 1970, the proportion of the working age population (15-59 years) was almost the same in the two countries. By the year 2005, this proportion shot up to more than 68 per cent in China because of some significant changes first in mortality and later in fertility. In India, on the other hand, the proportion of the working age population recorded an increase of less than 7 per cent points between 1970 and 2005. As a result of persistent low fertility, the proportion of young adults in China decreased very rapidly from 22 per cent in 1985 to less than 17 per cent in 2005 whereas the proportion of old adults shot up from around 40 per cent to more than 50 per cent within a short duration of 20 years. In India, by contrast, there has virtually been little change in the proportion of young adults between 1985 and 2005 whereas the proportion of old adults (25-59 years) increased only marginally from around 36 per cent in 1985 to approximately 41 per cent in 2005.

Figure 13
Age Structure Transition in China

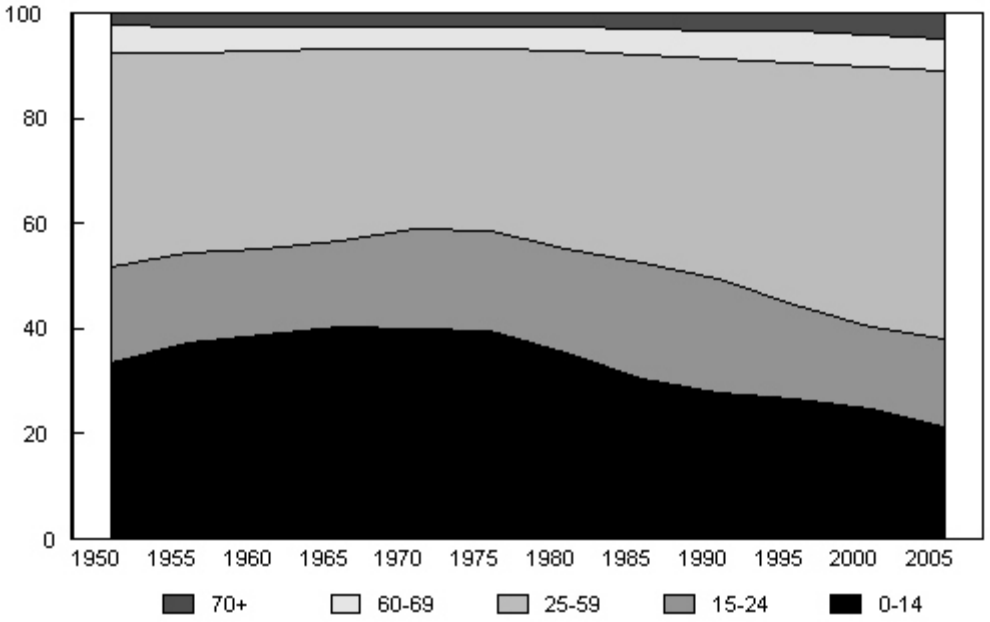


Figure 14
Age Structure Transition in India

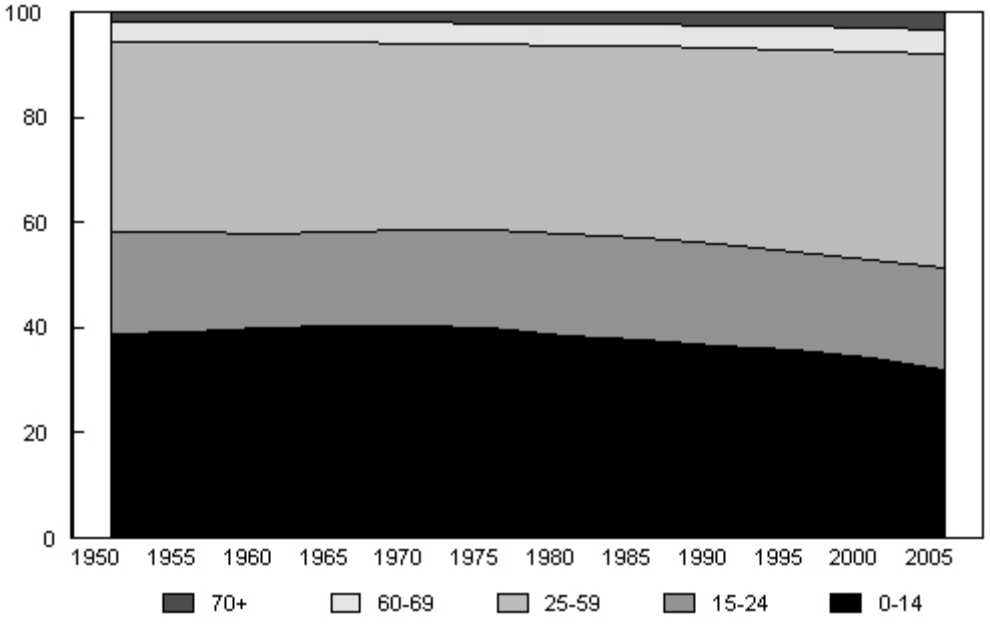


Figure 15
Dependency Ratio in China

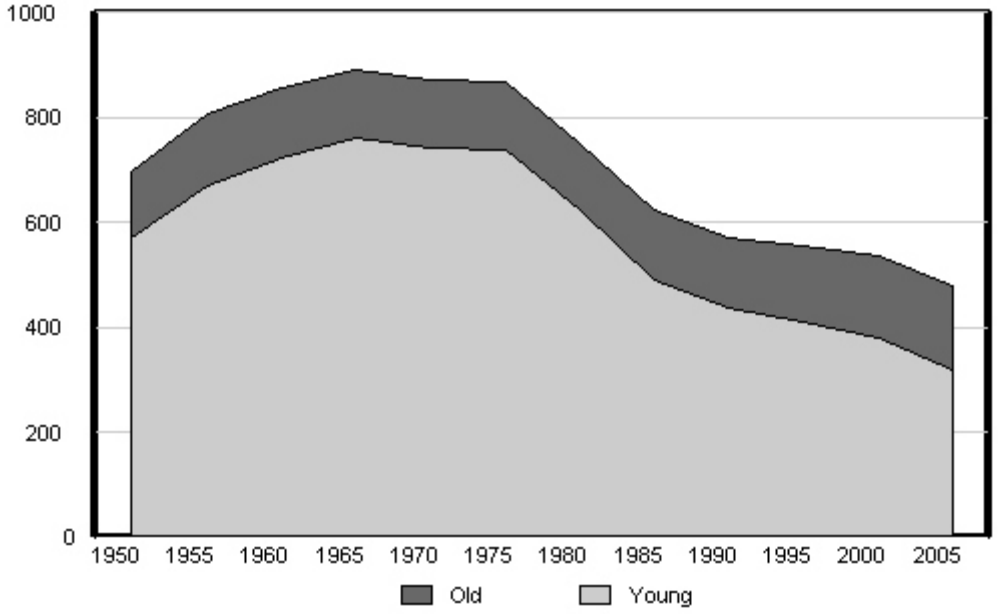
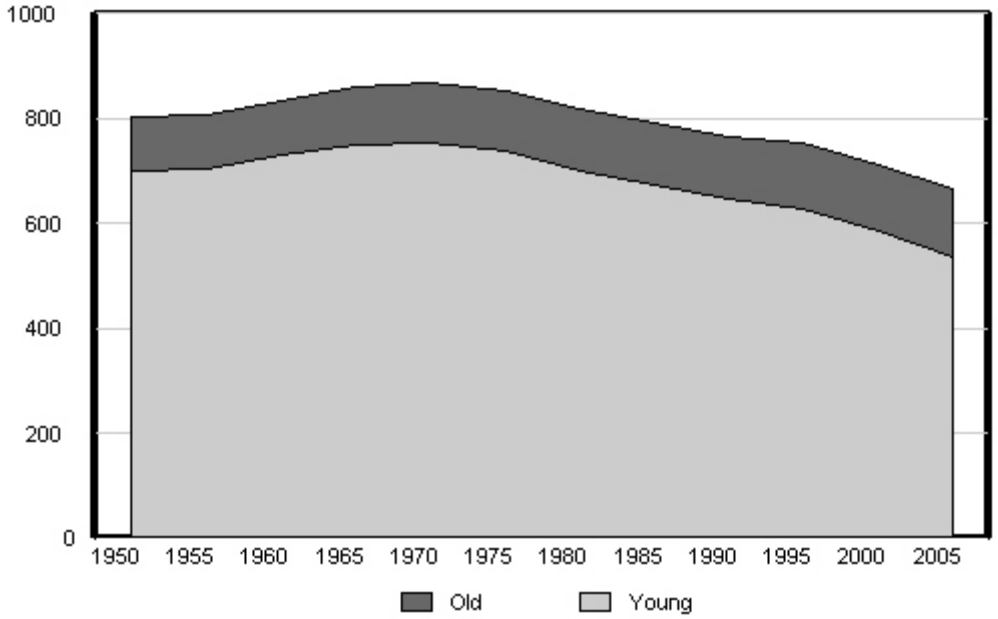


Figure 16
Dependency Ratio in India



Perhaps, the best reflection of the age structure transition in the two countries is in terms of the trend in the dependency ratio which is defined as the ratio of the non-working age population (0-14 years and 65 years and above) to the working age (15-64 years) population (Figures 15 and 16). As the result of a very rapid decline in fertility, the dependency ratio in China decreased from 866 in 1975 to 478 in 2005. By contrast, this ratio decreased from 852 to 666 in India during the same period. Around the year 2005, the working age people in China outnumbered the non working age people by the ratio 2.5:1 whereas in India, this ratio was only about 1.7:1. The observed changes in the age structure of the population have different, yet important implications for the two countries in terms of both future growth of the population as well as in terms of the impact of the population growth and age structure transition on economic growth. China has clearly enjoyed significant gains in output per effective consumer as the result of transition in the age structure of the population induced by rapid declines in fertility (Feng and Mason, 2005). Official estimates suggest that the ratio of workers to dependents increased to 4.3:1 between 1982 and 2000. This increase in the worker to dependent ratio accelerated China's economic growth by 2.3 per cent per year (Vermeer, 2006). In India, by contrast, the impact of age structure transition on economic growth appears to have been limited primarily because fertility still remains high and dependency continues to be high.

Discussions

At the beginning of the second half of the last century, the populations of both India and China were in the pre-transition stage. During the fifty years between 1950 and 2000, China's population appears to have moved from the pre-transition stage to post-transition stage whereas population transition in India still remains a distant dream. Because of a slow decline in fertility and mortality, the age structure of the population in India remains bottom heavy and is conducive to rapid population growth. Because of continued high dependency, the contribution of the age structure transition in accelerating economic growth in India is still, at best, limited whereas the demographic dividend in China contributed handsomely in accelerating economic growth.

The population transition achieved in China in a very short duration has been a subject of intensive research primarily in the context of dramatic changes in fertility. It is generally argued that the rapid decline in fertility in China has been the result of a very 'strong' family planning effort (Bongaarts and Greenlagh, 1985; Mauldin, 1982; Chen,

1984; Coale, 1984; Wolf, 1986; Poston and Gu, 1987; Whyte and Gu, 1987; Lavely and Freedman, 1990). There have however been relatively few attempts to explore the affect of implicit un-intentional social, economic changes that created a conducive environment for the very successful implementation of government-sponsored family planning programme (Cheng, 1991). Similarly, there is no consensus about the factors that contributed to the formulation and evolution of population policy in China (White, 1994).

By contrast, there are a few studies related to population transition, especially fertility transition in India. There are a few studies on fertility transition in some parts of India where higher than average fertility decline has been observed (Caldwell et al., 1982; Zacharia, 1984, Rao et al., 1986; Bhat and Rajan, 1990). Moreover, there are few studies that have compared population transition in India and China despite the fact that the population transition, especially fertility transition, path in the two countries has been different despite having nearly the same population scenario at the beginning of the second half of the twentieth century (Alok Ranjan [Chaurasia], 1999; Kulkarni and Rani, 1995).

India was the first country in the world to adopt a well defined population policy and to launch an official programme directed towards birth limitation way back in 1951. Jawaharlal Nehru, the first Prime Minister of India, was in favour of birth control for national progress. Nehru's wisdom may be gleaned from his famous Discovery of India written during his solitary confinement in the Ahmednagar jail in which he was categorical that India would be better off with a small number of people than with a large, increasing population (Nehru, 1956). The wisdom of Nehru appeared to be instrumental in incorporating population control as one of the highest priority development agenda.

In China, Mao Tse Tung, the hero of the Chinese revolution viewed people as productive assets if they are effectively organized (Vermeer, 2006). As such, the Communist Party in China concentrated, right from the beginning, on organizing the people at the local level and meeting their welfare and development needs through collective action. A collectivization model was evolved for the purpose which focussed on collectivization of assets, resources and work. The approach worked at least in terms of equitable distribution of income and creation of highly effective institutions for the delivery of basic social services, especially health and education. The model also resulted in improved status of women as their work was recognized as an important element of collective productivity. The model also contributed significantly in the

extension of health services to local levels and ensuring the access of all people to hospital services (Quinn, 1972; John E. Fogarty International Centre for Advanced Study in the Health Sciences, 1973).

The implementation of the collectivization model also resulted in increased influence and control of the Communist party and the government on the work and life of the people. The local governments dominated by local level party workers, were entrusted with the responsibility of renting the farmland, allotting jobs in local factories and granting permits of other gainful employment. These local level institutions of the people were also made responsible for meeting the basic development and welfare needs.

The emphasis on organizing the people and controlling their work and life reaped rich dividends in China despite low levels of social and economic development. The infant mortality rate in China decreased very rapidly from around 200 in 1949 to just 50 in the early 1970s leading to significant improvements in child survival and in the life expectancy despite the demographic disaster during the Great Leap Forward and subsequent famine that resulted an estimated 30 million premature deaths and 33 million lost or postponed births (Ashton et al., 1984; Kane, 1988). The collectivization model worked very effectively especially in the delivery of basic social services, particularly education and health, particularly in the rural areas. The committed local level party workers became very successful agents of modernization and social welfare programmes.

In India, despite all talks of socialism, little could be done towards organizing the people into a cohesive lot as far as local level productivity and welfare is concerned. The Congress Party that came into power after independence was a disorganized lot with diversity of views and opinions on almost all aspects of population and development related issues as it was never organized on strict party lines. After independence, India adopted a mixed approach of meeting the needs of the people which clicked in bits and pieces only. The focus, was on industrialization and the thinking was that industry-based economic growth would ultimately percolate down to reach the poorest of the poor as it happened in the west. In the absence of committed party workers, the task of nation building was left to the bureaucracy that inherited the colonial legacy and that was primarily elite in nature, top down in organization and normative in functioning. The highly centralized, top down approach adopted for the implementation of the development agenda set at the national level paid little attention to developing local capacity in meeting

the welfare needs of the people despite the diversity of the nation India. This approach, however was suited to bureaucratic functioning.

In sum, when China made an all out effort to reduce fertility to control population growth in the 1970s, the threshold necessary for the success of the efforts was already in existence. It is argued that without the intrinsic forces of social and economic development, it could hardly be imagined that the dramatic decline in fertility would have smoothly been achieved in China in the 1970s (Leiwen, 2002). In India, such a threshold is missing, even today, especially at the local level. Population stabilization efforts in India have always been conceived, planned and implemented in isolation from the broader social and economic context, although at the policy level, integration of population factors in social and economic development planning has repeatedly been stressed.

In China, serious attempts to bring down fertility started only when very low levels of mortality, especially infant mortality, were achieved. Reduction in the risk of death during infancy and early childhood substantially reduced the demand for children so that when stress was laid on limiting the number of children to one or two, there was little demand supply mismatch. This could not happen in India as both infant and child morality remained high with the result that the demand for large number of children persisted, especially in the rural and remote areas where levels of social and economic development still remain very substandard.

The collectivization model adopted in China also helped in securing popular participation in health and family welfare activities. At the grass roots level, party functionaries provided the much needed leadership to fertility reduction activities and were supported by the local level administrative structures and community organizations. The large say of the party cadres in the implementation of development and welfare activities at the local level contributed effectively to the success of the planned approach to fertility reduction in which each couple was given a plan about the number and timing of births that the couple can have along with a set of incentives for realising the plan and imposing harsh penalties for every 'out of the plan' birth. Couples who violated the 'birth plan' had to pay the 'social expenses of raising the child' and the local authorities had the unlimited powers to impose sanctions and penalties on the offending couples. In this way, China was able to regulate the reproductive behaviour of all of its couples. Every couple was intimated, in advance, the expected reproductive outcomes - to have and not to have

a child - in the coming year and the local level party functionaries monitored the implementation of the plan.

In India, fertility reduction and population control remained largely a bureaucratic activity. One reason is that the political parties in India do not have the type of party cadre that the Communist Party of China has. The other reason is that, unlike China, political parties in India are preoccupied with political activities with little time to get involved in social development and welfare activities. In terms of organization also, political parties in India are loosely organized unlike the Communist Party of China. In the absence of the political commitment and the capacity to implement social development programmes, the government, in India, depended upon the bureaucracy that it inherited from the British for the implementation of development and welfare programmes including the National Family Welfare Programme. Fertility reduction in India still continues to be largely a government prerogative depending upon government initiatives and government inputs.

There have also been differences in the basic approach to the implementation of fertility reduction efforts in the two countries. One example is the way in which the implementation of these efforts was monitored. Both China and India introduced a target-based approach for the implementation of the population control programme and the performance was monitored on the basis of the achievement of the targets allocated. In China, the birth control targets were in the form of an annual quota in terms of the maximum number of births allowed in a village or community or municipality. The local level bodies were to develop local level plan for ensuring that the total number of births remained below the maximum number allowed. This plan essentially consisted of allowing some couples to deliver a birth in a given year while denying others. In India, the targets were in the form of the minimum number of new acceptors of different family planning methods to be recruited annually. These targets were then distributed across the grass roots level family planning service providers. Recruitment of a certain minimum number of acceptors of different methods of family planning, however, does not always ensure reduction in annual number of births because of a host of factors. The observation is supported by the fact that despite an almost secular increase in the number of new acceptors of different family planning methods in India, the decline in the birth rate frequently stagnated. There has rarely been a serious attempt in India to develop and institutionalize a 'couple-based' monitoring system for monitoring the implementation of population control efforts. In 1996, India abolished the

system of allocation of numerical targets for planning and implementing population control activities and introduced the community needs assessment approach for the implementation of the National Family Welfare Programme (Government of India, 1996). This approach calls for assessing the family welfare needs of the people at large and then meeting the felt family welfare needs through the supply of family planning methods and other services. However, the system monitoring the programme remains unchanged with the word 'target' replaced by the term 'expected level of achievement (ELA)'. The whole monitoring approach in India still remains highly mechanical in nature.

Conclusions

The roots of the successful population transition in China within a short duration of just fifty years may be traced to a very highly effective organization of the people at the local level based on the collectivization model and a population control programme that targeted the reproductive behaviour of the couples. The collectivization model played a crucial role in controlling the work and life of the people to a very significant extent. Both the government and the party effectively used this control in micro targeting the reproductive behaviour of the couples and thereby ensure a very rapid reduction in fertility. The process was facilitated by the very strong political commitment that percolated down to the lowest level of the society, a highly conducive social and economic environment and development of the local level capacity which ensured universal access to basic health and education.

India could not accelerate the process of population transition mainly because of the above factors. First, the efforts initiated immediately after Independence to organize the community at the local level through the institutions of Panchayat failed miserably. The community in India, either in the rural or in the urban areas, remains an unorganised lot with little internal yet coherent driving force. Second, the control of the government on the work and life of the people remains minimal; it is regarded as interference in the individual freedom. Third, the political system in the country is in a total mess. There has never been a political consensus in India about the role and need for population control in the context of social and economic development and after the political debacle of 1977, population control and family planning in India turned into a highly politically sensitive issue. Over the years, polity in India, has increasingly turned indifferent to the issues related to population as it affects development and welfare of the people. Last but

not the least, it is the bureaucracy not the polity and the society that drives the fertility reduction efforts and so their impact remains minimal.

To conclude, China has always been an early achiever in all aspects of population transition. It has been able to reduce mortality early and rapidly despite nearly similar social and economic conditions as prevailed in India at that time. Similarly, fertility also declined in China much more rapidly and earlier in the development process than in India. Such a compressed demographic transition resulted in a relatively large demographic dividend that contributed very favourably to China's rapid economic growth during the last quarter century. By contrast, India's demographic achievements have always been small and not comprehensive. As a result, their impact on social and economic development processes have always been minimal. This has also been a reason for the political indifference towards addressing population related issues.

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Table 1: Demographic indicators for China and India: 1950-2005.

Period	Crude Birth Rate	Crude Death Rate	Total Fertility Rate	Expectation of Life at Birth	Average Fertility per Woman	Life Table Death Rate
	b	d	f	e	a	l
			China			
1950-55	43.81	25.08	6.22	40.80	177.71	24.51
1955-60	36.13	20.66	5.59	44.60	159.71	22.42
1960-65	38.00	17.10	5.72	49.50	163.43	20.20
1965-70	36.63	10.91	6.06	59.60	173.14	16.78
1970-75	28.61	6.30	4.86	63.20	138.86	15.82
1975-80	21.52	6.68	3.32	65.30	94.86	15.31
1980-85	20.43	6.62	2.55	66.60	72.86	15.02
1985-90	22.06	6.68	2.46	67.10	70.29	14.90
1990-95	18.28	7.30	1.92	68.10	54.86	14.68
1995-2000	15.98	6.93	1.78	69.70	50.86	14.35
2000-05	13.49	6.76	1.70	71.50	48.57	13.99
			India			
1950-55	45.41	25.43	5.97	38.70	170.57	25.84
1955-60	44.84	22.24	5.92	42.60	169.14	23.47
1960-65	42.43	19.83	5.81	45.50	166.00	21.98
1965-70	40.62	17.72	5.69	48.00	162.57	20.83
1970-75	38.39	15.91	5.43	50.30	155.14	19.88
1975-80	34.81	13.90	4.83	52.90	138.00	18.90
1980-85	34.23	12.92	4.48	54.80	128.00	18.25
1985-90	32.40	11.63	4.15	57.20	118.57	17.48
1990-95	30.02	10.43	3.81	59.50	108.86	16.81
1995-2000	27.10	9.38	3.43	61.50	98.00	16.26
2000-05	24.47	8.78	3.07	63.10	87.71	15.85

Table 3: Components of change in the rate of natural increase.
Per 100 thousand population

Period	▵r	Contribution of			
		f	ab	l	ad
			China		
1950-55/1955-60	-325	-425	-342	-203	-239
1955-60/1960-65	543	85	102	-196	-160
1960-65/1965-70	481	216	-353	-256	-362
1965-70/1970-75	-342	-716	-87	-50	-410
1970-75/1975-80	-746	-952	244	-21	58
1975-80/1980-85	-104	-558	449	-13	8
1980-85/1985-90	157	-76	240	-5	11
1985-90/1990-95	-440	-499	120	-10	72
1990-95/1995-2000	-193	-129	-100	-17	-20
1995-2000/2000-05	-231	-68	-181	-17	0
1950-55/2000-05	*-1200*	*-3123*	*92*	*-789*	*-1043*
			India		
1950-55/1955-60	263	-38	-18	-228	-91
1955-60/1960-65	-0	-82	-159	-138	-102
1960-65/1965-70	30	-87	-94	-100	-111
1965-70/1970-75	-43	-185	-39	-79	-102
1970-75/1975-80	-157	-428	70	-75	-126
1975-80/1980-85	41	-260	202	-47	-51
1980-85/'1985-90	-55	-255	71	-53	-76
1985-90/'1990-95	-117	-267	29	-43	-77
1990-95/1995-2000	-188	-300	7	-33	-72
1995-2000/2000-05	-202	-286	23	-23	-37
1950-55/2000-05	*-428*	*-2186*	*93*	*-820*	*-845*

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