Consequences of the Changing Demographic Trends in India

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Abstract

The main purpose of this research paper is to investigate the implications of changing demographic trends in India on its economy and the standards of living (SOL). The study used the bound testing approach to co-integration ARDL for analyzing the relationship between the variables. Because of the changing demographic trends, India will face changes in sex ratio, dependency ratio (both young and old-age), increasing aging population and deterioration in the standard of living due to rising inflation rate and population growth. In the coming decades, there will be growing number of senior citizens, a shrinking number of young people and feminization of the society. More population leads to more production of goods which in turn leads to more pollution, therefore, environment friendly policies should be formulated and implemented to reduce the negative externalities in the country.
Keywords: Demographic trends, dependency ratio, aging population
JEL Classification: J11, J10, J14

1. Introduction

The human population was 1 billion around 1810, it doubled to 2 billion in 1930, it was 4 billion in1975, it was 4.4 billion in 1980 and reached 7 billion on October 31, 2011. In fact, both birth rates and death rates have decreased but the death rates have fallen faster than the birth rates which is the main cause of rapid population growth especially in least developed countries (LDCs).

Population grows faster in LDCs than more developed countries (MDCs). High fertility rates are strongly correlated with poverty, high infant and child mortality rate.

Declining fertility rates are linked with improved standards of living, increased life expectancy and lower infant mortality rates. It is expected that population of MDCs will double in 120 years, while in LDCs it would double in just 33 years. In LDCs massive efforts are needed to put an halt on further deteriorations of the existing quality of life and degree of human suffering.

It has been established that formal education achieved by women is the single most important determinant of population growth. Educated women tend to have fewer children, better general health and less infant mortality rate. It has also been proven that education role is more important than household income and wealth. Therefore, the government should improve both the quality and quantity of education in general and for female in particular.

Population of India, like those in the rest of the world is undergoing demographic transition. Ageing of the population in the more developed countries has been one of the most hotly discussed topics during the last century. It is rightly so because there are many social and economic implications of this trend.

During the twentieth century, there has been a gradual change in the age structures of the populations of not only developed but also of many developing countries including India

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also. As the size of young cohorts has decreased, and the size of old cohorts has increased, the age of the national population has been increasing at a decreasing rate, resulting in a rise in the aged population of India (Figure 1). A direct impact of this change is an increasing old-age dependency ratio and a fall in the young dependency ratio. Owing to this change, the total dependency ratio (young and old people combined relative to people in the working age group) has significantly declined (23.4 per cent from 79.4 in 1971 to 60.8 in 2001), and it is estimated that the same trend will continue in the future also. It is projected to decline by almost 21 per cent between 2001 and 2021 (from 60.8 in 2001 to 48.2 in 2021) and increase by 10 per cent between 2021 and 2050 (from 48.2 in 2021 to 53.0 in 2050). The composite effect of a decline in young dependency ratio and a rise in old dependency ratio has caused a considerable change in the composition of the total dependency ratio.

The ageing population trend has been observed in India due to her relatively successful family planning programme. The fertility level is low and the cohorts of children aged 0 to 14 years are relatively small.

2. Correlation between population and poverty

The population growth results from difference between the birth rate and the death rate and net migration. The population growth affects all people through its impact on the economy, society, standards of living and environment.

Population has the potential to impact all aspects of poverty and the standards of living. Population is influenced by and influences population dynamics, population growth, age-structure, shape of the population-pyramid of the country under consideration and rural-urban distribution. Population leads to high fertility which means more children, more children means more child-dependency ratio and hence more poverty. Unfortunately, poor people believe that more children means more wealth and cheap household labour. Also, more children means more social security to their parents in their old age. It is to be noted that demographic dividend can only be achieved when fertility rates starts falling.

It has also been argued that high birth rates lead to large number of children relative to the number of working adults. This leads to less savings, thus, less money available for investment in the country's infrastructure and development. Less savings means less money available for food, health, housing and education needs of growing children and adolescents. This prevents countries and families to invest to break the vicious circle of poverty.

3. Past, current and future changes in population of India

The population of India was 563,214,000 persons, 699,075,520 persons, 857,374,818 persons, 1071374264 persons and 1252000000 persons in 1971, 1981, 1991, 2001 and 2013, respectively (Table 2,3). These numbers reflect a decadal growth rate of 2.19 per cent, 2.06 per cent, 2.25 per cent and 1.57 per cent for 1971-81, 1981-91, 1991-2001 and 2001-2013, respectively. It can be seen from this trend that the population of the country increased by more than 100 percent between 1971 and 2013. It increased at a decreasing rate. It is projected to be 1,532,674,000 by the year 2050 (medium variant) as shown in Figure 1.

The reduction in the rate of population growth is mainly due to the declining fertility rate. In early days, parents had to give birth to more children in order to compensate for the easy loss of children. Furthermore, educational background of parents in general and those of females in particular is also one of the main causes of a fall in fertility rate. Total fertility rates as well as the age-specific fertility rates were noted to be declining at a decreasing rate (Table 10). More educated females caused a considerable rise in the female labour force participation rate and marrying at later age. The composite effect of these factors caused a reduction in birth rates, which are illustrated by the gradual shrinkage of the base of the

respective population pyramids of India (Figure2). Figure 1 depicts the population rising trend in India from 1971 to 2050.

Figure 1. Population of India, 1971-2050 (Medium Variant Projections)
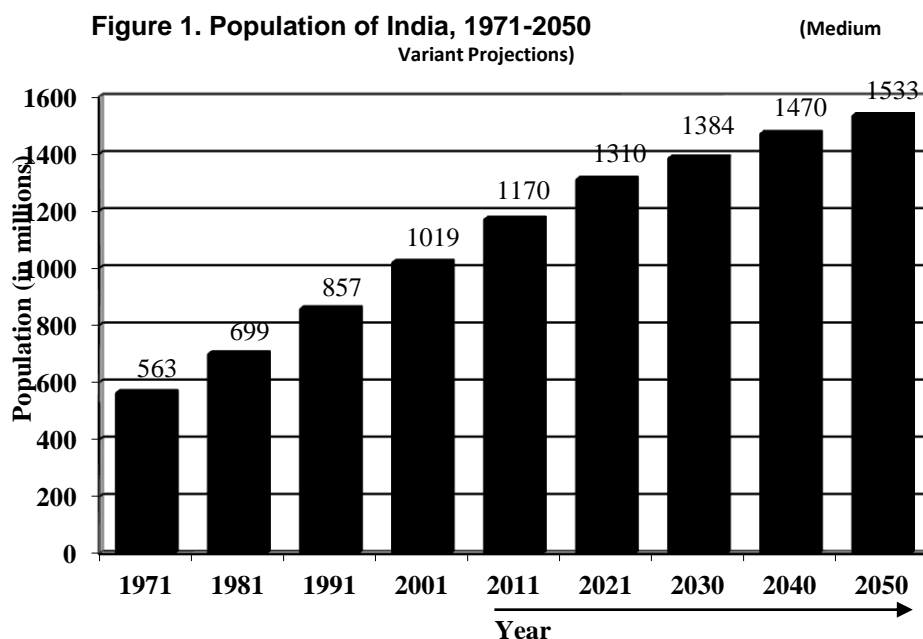
The population pyramids of India for 1971 through 2050 (Figure 2) clearly show the changes in the country's age structure. The proportions of people aged 0-14 decreased, the proportion of people aged 15-59 increased and the proportion of people aged 65 and older expanded. The aged population (65 +) was 2.9 per cent of the entire population of the country in 1971, 3.2 per cent in 1981, 4.3 per cent in 1991, 6.9 per cent in 2021 and 15.2 per cent in 2050 as shown in Table 2. The population 0-14 years comprised 41.3 per cent of the population in 1971, 39.4 per cent in 1981, 36.9 per cent in 1991, 25.6 per cent in 2021 and 19.5 per cent in 2050, a clear downward trend in the young dependents, while the percentage of the 15-64 year age group (economically active people) increased from 55.7 per cent in 1971 to 57.4 per cent in 1981, 58.8 per cent in 1991, 67.5 per cent in 2021 and a marginal fall to 65.4 per cent in 2050.

Table 1: Actual and projected population, growth rate and sex ratio of India, 1971-2050

Year	Population (in millions)	Average Annual Decadal Growth Rate	Sex Ratio
1971	563	-	109
1981	699	2.19	108
1991	857	2.06	108
2001	1,019	1.75	107
2011	1,170	1.39	106
2021	1,310	1.14	105
2030	1,384	0.55	104
2040	1,470	0.60	103
2050	1,533	0.42	102
% change (1971-2050)	172.3%		- 6.4%

Source: U.S. Bureau of the Census, International Data Base, and the authors' own calculations.

4. Effects of over population

● Over population leads to unemployment, under-employment, disguised unemployment in agriculture sector and regional unemployment. Over population increases the dependency ratio (both young and old-age dependency ratio).

● It leads to scarcity of resources such as land, water, forests and the like. It also causes over utilization of scarce resources.

● It exerts pressure on infrastructure. Development of infrastructure does not keep pace with population growth rate which causes problems of transportation, communication, housing, education and sanitation.

● It leads to rural to urban migration which is also a major problem of over populated countries of the world. India is projected to pass China in population size in about 15 years, thus becoming the world's most populous country with population of 1.5 billion people..

● High population growth rate leads to inflation, because growth of food and goods and services does not keep pace with growth rate of population which causes demand pull inflation. The current account component of the balance of payments deteriorates owing to more expenses on imported goods than revenue from the exports of the country.

More exports than imports means depreciation of the currency. More depreciation of a currency means a rising inflation rate. High inflation decreases the real GDP. Higher inflation rate and higher population growth rate adversely affect the real per capita income (which is also termed as standard of living) of the country.

5. Population aging

According to United Nations definition of aging, a country is said to be ageing if 7 per cent or more of its entire population is 60 or over. India exceeded that proportion in 1995 (7.2 per cent) and is projected to reach 11.1 per cent in 2020 and 21.3 per cent in 2050 (Table 7).

Population statistics of India reveal that there has been a continuous decline in fertility and a rise in the life expectancy at birth (Table 11). As a consequence, there has been a rise in the average age of the population, with a subsequent trend towards an ageing population (Table 7). The number of aged people, both in absolute and percentage terms, is larger in rural areas of India than in urban areas, the reason being that 75 per cent of India's population is living in rural areas.

Figure 2. Population pyramids for India
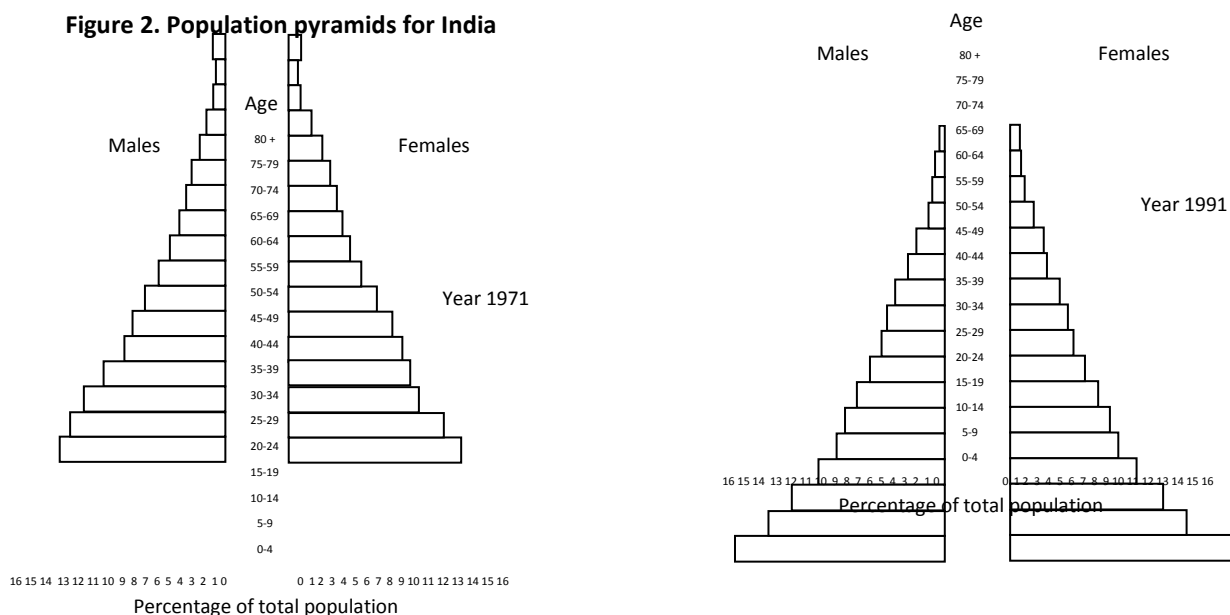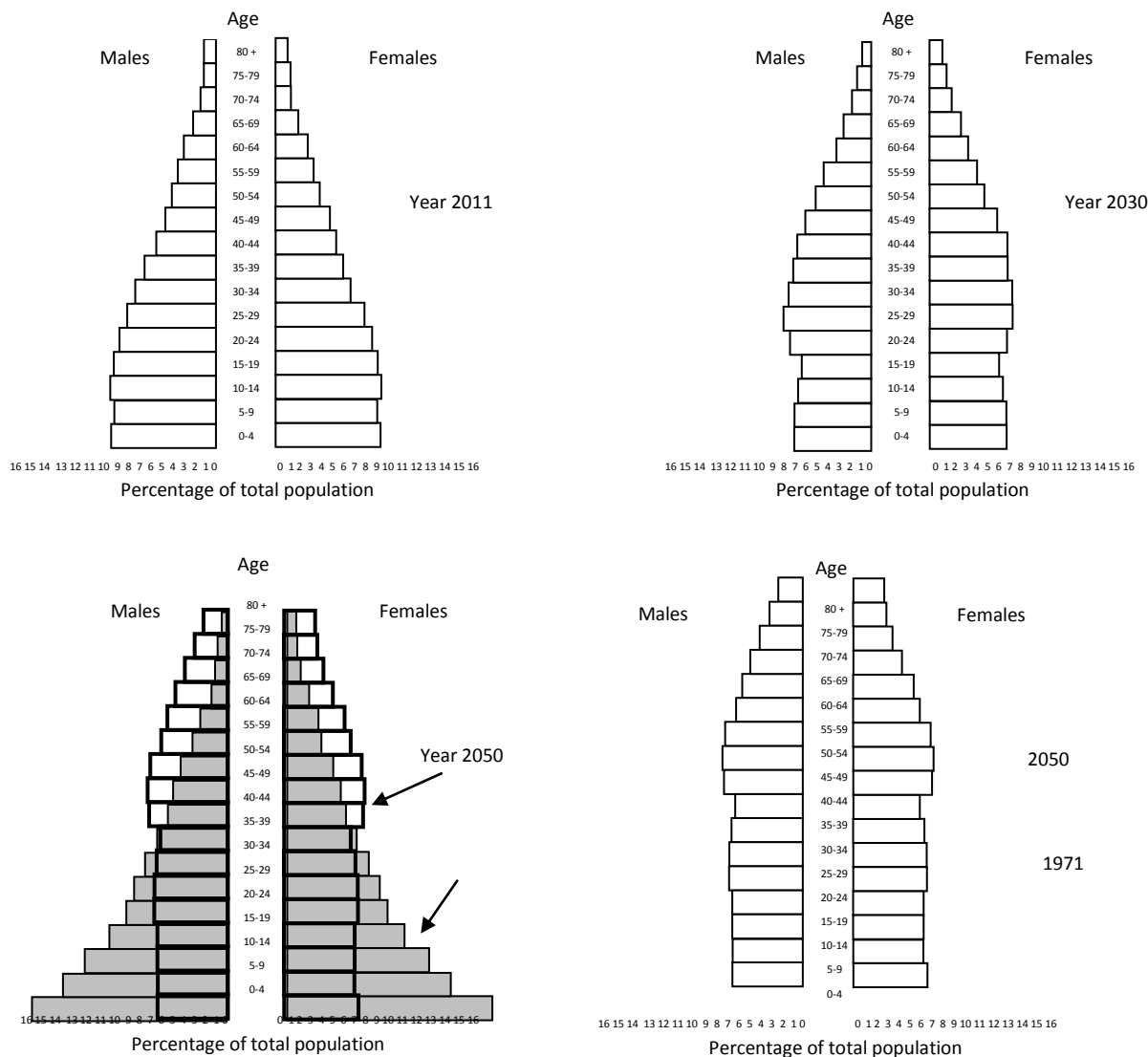
Besides, it has also been observed that the rate of growth of elderly population has been greater than the general population. Owing to continually rising trend of index of ageing (Table 7), the young dependency ratio (under age 15) fell and the old-age dependency ratio increased, and the same trend is expected to continue in the future also. In future, the number of very old (those 75 years and older) is expected to rise sharply as life expectancy continues to go up.

Figure 2 shows the distribution of the population by age for the period 1971 to 2050. In the late nineteenth century, the shape of the population structure was that of a pyramid, with a large proportion of younger people at the base and a small proportion of older people toward the top. With the passage of time the age composition of the population has changed quite dramatically and so the shape has gradually transformed, from a concave slope pyramid (1971) to a bottle-shaped form (2050). During this period, there has been an expansion in the proportion of working age group (15-64) from 55.7 per cent to 65.4 per cent (a rise by 17 per cent) and older people (65 +) from 2.9 per cent to 15.2 per cent (a rise by 424 per cent), and a reduction in the proportion of younger people (below 15 years) from 41.3 per cent to 19.5 per cent (a fall by 53 per cent). This change is due primarily to a falling fertility rates in recent decades (Table 11). As a result, India is described as having undergone an 'ageing of the population'.

1. Methodology

Following is the econometric models used for India.

$RPCI = \beta_0 + \beta_1 LNGDP + \beta_2 LNCPI + \beta_3 LNPOP + \beta_4 PR + \beta_5 LNCO_2 PC + ut$

RPCI, LNGDP, LNCPI, LNPOP, PR, LNCO$_2$PC and μt respectively, represent real per capita income, Natural Log of GDP, Natural Log of consumer price index, Natural Log of Population, Political rights, natural Log of CO$_2$ Emission per capita and the error term.

The variables included in the study are time series and each variable could be I (0), I (1) or I (2). If ordinary least square (OLS) technique applied on non-stationary series then result could be spurious and in this situation the appropriate methodology is ARDL co-integration approach. This is the attractiveness of ARDL that it can be used without inspection the integrated order but it is compulsory to check the existence of co-integration relationship among variables before applying the ARDL. The bound F-test was used to check the long run relationship among the variable and compared with the F statistics value provided by Pesaran et al. (2001).

i. Autoregressive Distributed Lag (ARDL) Approach

The ARDL approach consists of estimating the following equation:-

$\Delta(RPCI)_t = \alpha + \sum \partial ni = 1 (RPCI)_{t-1} + + \sum \beta ni = 1 \Delta(LnGDP)_{t-1} + \sum \Psi ni = 1 \Delta (LnCPI)_{t-1} + \sum \eta ni = 1 \Delta (LnPOP)_{t-1} + \sum \delta ni = 1 \Delta (PR)_{t-1} + \sum \Omega ni = 1 \Delta (LnCO2PC)_{t-1} + \lambda_1 (RPCI)_{t-1} + \lambda_2 (LnGDP)_{t-1} + \lambda_3 (LnCPI)_{t-1} + \lambda_4 (LnPOP)_{t-1} + \lambda_5 (LnPR)_{t-1} + \lambda_6 (LnCO2PC)_{t-1} + \epsilon i$

The ∂,,, η δ, and Ω show the short-run dynamics of the model and λ_1, λ_2, λ_3, λ_4, λ_5, λ_6 show the long-run relationship.

Firstly, bound test was constructed. The Bound F-test was applied to check the existence of long run relationship. Null hypothesis supposed that the long run coefficients are equal to zero and F-calculate was attained to compare with critical bound values presents by Pesaran et al. (2001). The null and alternative hypotheses are:

$H_0: \lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = \lambda_5 = \lambda_6 = 0$, $H_1: \lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq \lambda_5 \neq \lambda_6 \neq 0$

Table 2 Basic Statistics of India (2013)

Indicator	India
Population	1,25,200,0000
GDP (PPP)	$6783 billion
Per Capita GDP (PPP)	$5,456
GDP (Nominal)	$1875.157 billion
Per Capita GDP (Nominal)	$1,508
Gini	33.9
HDI	0.586
Inflation Rate	10.9

Sources: World Population Prospects United Nations Population Division (2013), International Monetary Fund, World Bank, United States Census Bureau, Human Development Report, 2013, Ministry of Statistics and Programme Implementation, India
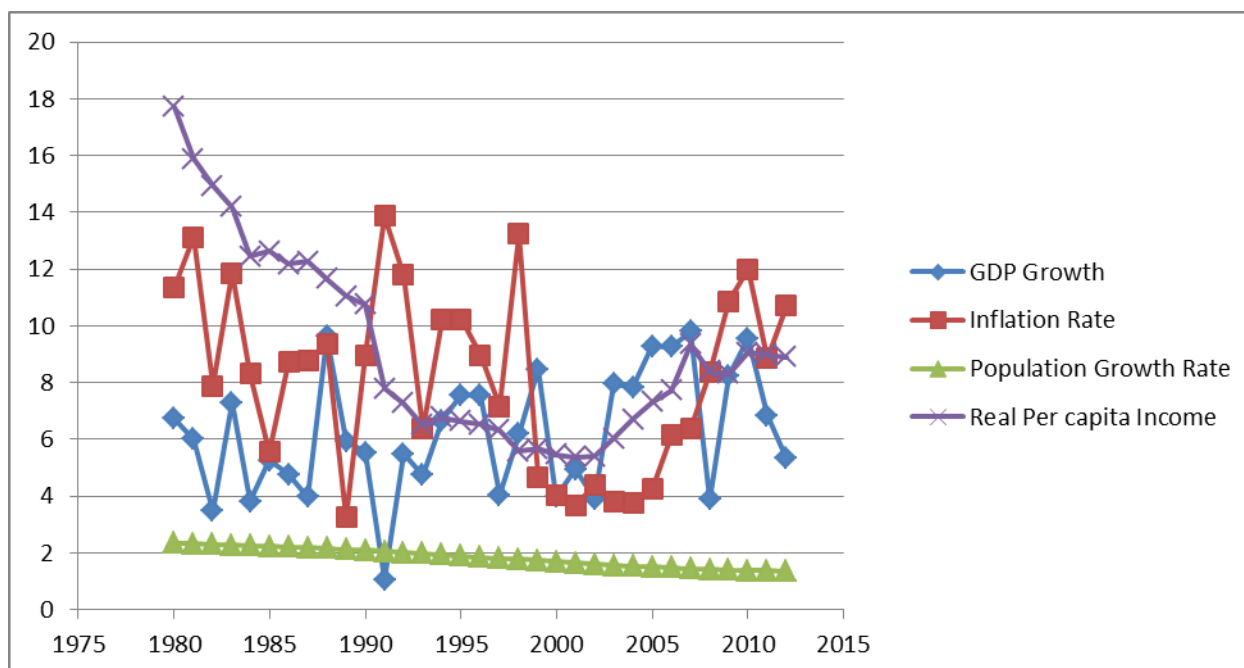
Fig.3 Trend of GDP Growth rate, Inflation rate, Population Growth rate, and Real Per Capita Income in India (1980-2012)

Figure 3 shows the composite impact of inflation and population growth on the real per capita income (SOL) in India. It is evident that the SOL registered a downward trend in India. The rate of decrease in the SOL of India during (1980-2012) was -2.18 per cent. The decrease in SOL of India was due to less GDP growth rate than the combined growth rates of inflation and population.

2. Findings

The result of bound F-test (Table 4) displays that the lower bound is 2.45 and the upper bound is 3.61 at 95% significance level. The calculated F-test value of India with the bound is 5.76, using intercept and no trend as presented by Pesaran et al. (2001). So null hypothesis of no co-integration is rejected and alternative hypothesis is accepted according to the F-Calculated value. So, the calculated result indicates that there is existence of co-integration among the variables and long run relation exists.

Table 3: Result of bound F-testing

Critical values at 95% level of significance		F-calculated
Lower bound I(0)	**Upper bound I(1)**	
2.45	3.61	5.76

Table 4: Estimated Long Run Coefficients by using the ARDL approach

Variables	Coefficient	Standard Error	T-Ratio [Prob]
L_NGDP	10.26*	.7635	15.45[000]
L_NCPI	- 12.40	.8732	-1.378[.000]
L_NPOP	-20.502*	.7332	-24.31[.000]
PR	.02178*	.3221	2.379[.000]
$L_N CO_2$ PC	-2.463	1.7532	-1.473[.000]

*Shows the 1% significance of coefficients

Table 5: Estimated Result of ECM

Variable	Coefficient	Standard Error	T-Ratio [Prob]
Ecm(-1)	-.54729	.078351	-6.2347[.000]

Long run results (Table 5) by ARDL indicate that GDP, CPI and population have high and significant impact on real per capita income in India. GDP growth rate had positive impact on SOL while CPI and population have negative impact on real per capita income in India. The coefficient value of India L_NGDP shows that 1% increase in GDP brings 0.10 unit expansion in real per capita income. The coefficient values of L_NCPI , L_NPOP and L_NCO$_2$PC indicate that 1% increase in consumer price index (CPI), population and carbon dioxide emission per capita brings 0.02 unit decline in SOL in India real per capita income. Political freedom has insignificant impact in India. According to estimated coefficient of India political right shows that one unit increase in political rights leads to 0.02 unit expansion in real per capita income in India. The adverse impact of CO_2 emission was noted to be much less in India, it could be due to more effective pollution controlling policies. Carbon emission per capita has negative but insignificant impact in India. So, increase of CO_2 emission is a source of main concern regarding environment pollution in both countries.

The ECM (Error correction Term) value (Table 6) of India is -0.54729, which shows 54% convergence in short run to long run within a year.

Table 7: Indices of the age structure of India's population , 1971-2050

Items	1971	1981	1991	2001	2011	2021	2050
Total (thousands)	563,214	699,076	857,375	1,018,505	1,169,692	1,310,205	1,532,674
0-14 (%)	41.3	39.4	36.9	33.1	28.8	25.6	19.5
15-64 (%)	55.7	57.4	58.8	62.2	65.8	67.5	65.4
65+ (%)	2.9	3.2	4.3	4.7	5.4	6.9	15.2
75+ (%)	0.7	0.8	1.3	1.5	1.7	2.2	5.9
75+ /65+ (%)	24.1	25.0	30.2	31.9	31.5	31.9	38.8
Young age dependency ratio [a]	74.2	68.8	62.8	53.2	43.8	37.9	29.8
Old age dependency ratio [b]	5.2	5.6	7.3	7.6	8.2	10.2	23.2
Total dependency ratio [c]	79.4	74.4	70.1	60.8	52.0	48.2	53.0
Index of ageing [d]	7.0	8.1	11.7	14.2	18.8	27.0	77.9
Mean age (years)	23.0	23.8	25.2	26.7	28.8	31.2	38.2
Median age (years)	19.4	20.1	21.6	23.6	26.4	26.9	38.3

Source: U.S. Bureau of the Census, International Data Base, and the authors' own calculations
a: Number of persons aged 0-14 per 100 aged 15-64
b: Number of persons aged 65 + per 100 aged 15-64
c: Number of persons aged 0-14 and 65 + per 100 aged 15-64
d: Number of persons aged 65 + per 100 aged 0-14

It is clear from Table 7 that the median average age of the population of India in 1971 was 19.4 whilst in 1981 it was 20.1. In 1991, it was calculated to have risen to 21.6. It is projected that the same trend will continue and will be 26.9 and 38.3 in 2021 and 2050, respectively. The index of ageing will rise from 7.0 in 1971 to 27.0 in 2021, a rise by 286 per cent during 1971-2021. Similarly, it will rise from 27.0 in 2021 to 77.9 in 2050.

3. An aging future

Regarding the age structure of India's population in the future, it is predicted that by the year 2050, the number of children under 15 will decrease from 41.3 per cent of the total

population in 1971 to 25.6 per cent in 2021 (Table 7), and it will fall further to 19.5 in 2050. Secondly, the population of working age 15-64 was 55.7 per cent in 1971 and is projected to a peak of 67.5 per cent in 2021, and then fall to 65.4 per cent in 2050. The number of adults between 15-24 years of age is projected to decline from 18.9 per cent in 1971 to 16.9 per cent in 2021 and continue to fall to 13.2 per cent in 2050. Thirdly, the number of people over the present pensionable age of 60 is projected to increase from 4.9 per cent in 1971 to 11.7 per cent in 2021. It is then set to rise to 21.3 per cent by 2050. This represents an increase of 82 per cent in just 30 years. The aging factor is expected to rise from 7 to 27 during 1971 to 2021 and 77.9 in 2050 (Table 7).

Table 7: Percentage change in the general population and population in India

Year	General population	Population 60 +
1970-1980	24.13	34.48
1980-1990	23.50	29.20
1990-2000	18.33	32.25
2000-2010	14.45	31.01
2010-2020	10.35	40.79
2020-2030	8.85	40.23
2030-2040	6.21	29.98
2040-2050	4.24	26.88
% change (1970-2050)	-82.42	-22.04

Source: the authors' own calculations.

Table 8 shows that percentage decadal change from 1970 – 2050 in both the general population and population aged 60 plus was negative. It is noted that the declining trend for the general population is almost four times steeper than the population 60+. It is also to be noted that the figures for each decade for aged population were greater than the general population. The decadal percentage of the aged population is projected to reach its peak in 2010-2020 and would decline thereafter. It would be about 27 per cent during 2040-2050, more than six times the rate for the general population. Overall, this trend of an ageing population is set to continue throughout the twenty-first century. Over the period 1991 to 2050, while the total population of India is projected to rise by 79 per cent, the population aged 45-59 by 191 per cent and that aged 60-64 by 339 per cent. The proportions of people aged 75-79 and 80+ are predicted to rise by 621 per cent and 1006 per cent respectively. These projected changes in the age structure of the population are largely the result of past fluctuations in the numbers of births, although dwindling mortality rates are also important. In fact, longevity at older ages can contribute considerably to the ageing of the elderly population itself. In addition to these changes over the time, the distribution of population by age within the Indian population varies by factors such as region and geographical location, gender and ethnicity.

Population of India, like those in the rest of the world is undergoing demographic transition. The population is increasing mainly due to a fall in the infant mortality rate and the death rate (Table 9 and 11). The shape of her population pyramid is changing from progressive (youthful) with broad base, concave slope and narrow top to regressive (ageing) one with shrinked base. The combined effect of the falling birth rate and death rate has caused a narrowing of the base and flattening of the peak, leaving a bulge higher up, with a maximum width in the 40-54 age group (Figure 2, 2050). Superimposition of population pyramid of 1971 and that of 2050 clearly shows compositional changes in the population

structure of the country. Compared with 1971, the pyramid for 2050 shows higher life expectancy, more elderly females than males, and more young males than females. There is a noticeable sort of 'beehive' effect in the age groups 0-30, the base of the population pyramid will narrow down and number of people over age 65 will increase. It can be predicted that India will be completing the third stages of demographic transitional growth in the coming decades. The changing relationship between births and deaths is portrayed as proceeding through four distinct stages. India is in stage 3 termed *the late expanding stage*, which is characterized with the slackening of the rate of population growth as the death rate stabilizes and the birth rate declines because traditional taboos weaken and more people practice birth control. During this stage, society becomes significantly industrialized and urbanized. India entered stage 3 around 2003 because her death rate stabilized at about 8 per cent (and is projected to remain almost the same till 2040) and birth rate declined rapidly from 22.9 in 2000-2005 to 14.5 in 2030-2040 (about 37 per cent - Table 11). Consequently, population is increasing at a decelerating rate, thus causing a small net increase in its population. It is highly encouraging to notice that the indentations of the sides of the population pyramids of year 2030 and 2050 show the typical characteristics of many developed countries of Europe; that is, ageing of population at the apex and ageing at the base. Aging of population at the apex (top) means the increasing percentage of old people in a country due to a decline in mortality rate among the aged ones. At the same time there is aging at the base, i.e. decreasing number of young people (the bottom of population pyramid) owing to a decline in fertility rate. This demographic transition will affect development prospects of India in the twenty-first century. Furthermore, young-dependency ratio (the ratio of the young dependent population under 15 years of age to the population in the working ages of 15-60 years) will decline, while that of old age dependency will rise (Table 7). Currently, the share of the under 15 years age group in the total population exceeds one third, every 100 persons in the working age group must support 50 or more dependents, i.e. those aged under 15 and those 60 and older.

4. Ethnicity

The age structure of India also varies by ethnic groups. For example, the ethnic minority population of Muslims has been noted to have more young population than others because of their religious belief in not using contraceptive devices to control birth rate. Thus, the age structure would look more like a concave shape pyramid rather than a beehive or bottle shape. Percentage of Hindus in the total population of India decreased from 82.7 per cent in 1971 to 82.4 per cent in 1991; while that of Muslims increased from 11.2 per cent to 11.7 per cent for the same period. This trend was noted to be more prominent in the latest population census of India.

5. Sex ratio

The sex ratio (the number of males against 100 females) was 109 in 1971, which is projected to decline to 102 in 2050 (Table 1). As age proceeds to 40, the sex ratio becomes imbalanced. The tendency favours females. The reason for that is genetic one. More sons are born than daughters, but sons die more readily especially at early age because young boys are more vulnerable to diseases than girls. The decadal average annual growth rate of the sex ratio has been declining throughout the period under consideration (Table 1). Infant mortality rate has been declining of both sexes, but the rate of decline is higher of females than males, which is expected to cause feminization of the society.

The population of India was growing at about 1.8 per cent per annum during 1991-2001. The population in 2001 was 1,019 million allowing for a gradual decline in the annual

percentage growth rate it will be about 1200 million in 2011 (Table 1). The population balance is lopsided in India. In 2001, for every 100 girls, 107 boys were born. This statistics is very telling as it highlights the social and economic pressures on parents. Indian women have a high fertility rate of 4.3 (Witherick and others, 1995). With the huge overall numbers involved, it might be expected that the ratio of men to women would tend to be in balance. The main reason for the imbalance is that girls are seen to be very much as 'second best' in India. They are considered to be expensive because of expensive dowries, and having girls does not carry the social kudos. It has been projected that female infant mortality rate which were higher than amongst their male counterparts in 1971 and 1981 will reverse in the future (Table 4).

The differences in the age distribution of men and women, however, only become significant in the later half of the life course. In 1971, the ratio of men to women in the 60-64 age group was 50:50. However, at ages 65-69, there were 47 males to 53 females, whilst at age 70-74 the ratio was 44:56. At age 75 and over, the ratio of males to females decreased still further to 38:62. This process has been termed as 'feminization of later life'. It is prevalent not only in developed countries but also in India.

The number of persons aged 65 years or older was estimated to be nearly 3.0 per cent in 1971. This age-group is projected to be 5.4 per cent by 2011 and 15.2 by 2050. The aged (65 years and older) female population of 8.5 million was in excess of male population of 8.0 million in 1971. This gap is projected to increase to 123 million females and 109 million males in 2050 (medium variant).

Table 8: Infant mortality rates and life expectancy at birth by sex in India

Year	Infant mortality rate			Life expectancy		
	Both sexes	Male	Female	Both sexes	Male	Female
1971	133.50	130.40	136.70	48.72	49.72	47.67
1981	112.50	110.40	114.80	52.90	53.19	52.59
1991	81.85	82.88	80.77	59.08	58.82	59.35
2001	63.08	63.79	62.34	62.88	62.24	63.55
2011	46.96	47.45	46.45	66.47	65.49	67.51
2021	34.08	34.56	33.57	69.72	68.41	71.11
2031	24.33	24.88	23.74	72.60	70.98	74.30
2041	17.38	18.00	16.74	75.07	73.18	77.04
Percentage change (1971-2041)	- 86.98	- 86.19	- 87.53	54.08	47.18	61.61

Source: U.S. Bureau of the Census, International Data Base, and the authors' own calculations.

Table 9: Age-Specific Fertility Rates (ASFR) and Average Annual Growth Rate

Year	1971	1981	1991	2001	2011	2021
ASFR 15-19	118.5	93.9 (-2.4%)	76.1 (-2.2%)	53.6 (-3.6%)	36.5 (-3.9%)	27.6 (-2.8%)
ASFR 20-24	290.6	256.5 (-1.3%)	234.0 (-0.9%)	188.3 (-2.2%)	139.1 (-3.1%)	113.5 (-2.1%)
ASFR 25-29	287.9	241.1 (-1.8%)	191.3 (-2.3%)	170.4 (-1.2%)	149.8 (-1.3%)	139.1 (-0.7%)
ASFR 30-34	227.4	174.2 (-2.7%)	117.0 (-4.0%)	109.4 (-0.7%)	104.1 (-0.5%)	101.4 (-0.3%)
ASFR 35-39	151.6	106.5 (-3.4%)	66.8 (-4.8%)	54.9 (-2.0%)	48.3 (-1.3%)	44.8 (-0.8%)
ASFR 40-44	69.0	45.7 (-4.2%)	30.6 (-4.1%)	24.3 (-2.3%)	19.9 (-2.0%)	17.6 (-1.2%)
ASFR 45-49	32.6	20.4 (-4.8%)	12.1 (-5.4%)	7.9 (-4.4%)	5.6 (-3.5%)	4.4 (-2.4%)
Total fertility rate	5.8880	4.6916 (-2.3%)	3.6395 (-2.6%)	3.0440 (-1.8%)	2.5160 (-1.9%)	2.2420 (-1.2%)

per woman					
Gross reproduction rate per woman	2.8722	2.2886 (-2.3%)	1.7754 (-2.6%)	1.4849 (-1.8%)	1.2273 (-1.9%)	1.0937 (-1.1%)

Source: U.S. Bureau of the Census, International Data Base, and the authors' own calculations.
Note: Figures in brackets represent decadal per cent growth rate.

When it comes to the ageing population of a country, it is also imperative to shed light on life expectancy at age 60. The world has experienced dramatic improvements in longevity. Life expectancy at birth has increased about 14 years from 1971 to 2001. It is projected that life expectancy at birth will increase from 66.47 in 2011 to a dramatic level of 75.07 in 2041 (Table 9). Female life expectancy has been projected to rise from 63.55 in 2001 to 77.04 in 2041, while that of males from 62.24 years to 73.18 years for the same period. It shows that female life expectancy will be greater than that of males by a margin of about 4 years (Table 8).

6. Changing dependency ratios

The proportion of population which is economically inactive (children below 15 years of age and adults above the age of 64) are classified as the dependent population. This ratio indicates roughly how many dependents must be supported by every 100 people in the economically active group (15-64). It can only be approximate, as some people younger than 15 or older than 64 may be in full-time employment; furthermore, some people older than 15 may be pursuing full-time education. The dependency ratio is considered to be one of the most important measurements of population structure, because the revenue obtained from the active population has to support the non-economically active sector for facilities such as schooling, pensions, food, clothing and shelter, health care and housing. Many of these services have to be provided by the government and are the subject of planning.

Between 1971 and 2021 the total dependency ratio will gradually decline from 79.4 in 1971 to 48.2 in 2021 and will take an upturn to 53 in 2050. It implies that there were 79.4 dependents per 100 persons of working age (15-64 years) in 1971. Out of these 79.4 dependents, 74.2 were young dependents and only 5.2 were elderly. However, the percentage of young dependents has been falling, while that of elderly dependents has been rising throughout the period under consideration. The young dependency ratio is projected to decline by more than half (from 74.2 in 1971 to 29.8 in 2050) and the old age dependency ratio will increase by five fold from 5.2 in 1971 to 23.2 in 2050 (Table 7). Since the former outweighs the later, the total dependency ratio will decline from 79.4 in 1971 to 53 in 2050.

Table 10: Infant mortality, birth and death rate and life expectancy in India, 1950-2050

Year	Infant mortality rate	Birth rate	Death rate	Life expectancy at birth (years)		
				Males	Females	Both Sexes
1950-1955	190	44.1	25.0	39.4	38.0	38.7
1955-1960	173	43.6	21.7	43.5	41.7	42.6
1960-1965	157	42.0	19.4	46.2	44.7	45.4
1965-1970	145	40.2	17.5	48.7	47.3	48.0
1970-1975	132	38.2	15.8	51.2	49.3	50.3
1975-1980	129	34.7	13.9	53.3	52.4	52.9
1980-1985	106	33.8	12.7	55.3	55.1	55.2
1985-1990	93	31.4	11.3	57.7	57.9	57.8
1990-1995	78	27.5	9.8	60.3	60.6	60.5
1995-2000	72	25.2	9.0	62.1	62.7	62.4
2000-2005	65	22.9	8.5	63.4	64.8	64.1

2005-2010	57	20.6	8.0	65.1	66.9	66.0
2010-2015	50	17.7	7.6	66.7	68.9	67.7
2015-2020	45	17.3	7.6	67.9	70.7	69.2
2020-2025	40	16.6	7.6	69.3	72.4	70.8
2025-2030	37	15.8	7.9	70.3	73.6	71.9
2030-2040	32	14.5	8.5	71.7	75.2	73.4
2040-2050	27	13.7	9.6	73.1	76.9	75.0

Source: World Population Prospects: The 1996 Revision, Population Division, Department of Economic and Social Affairs of the United Nations.

The standard of living is calculated using the following formula.

Real per capita income=Standard of living= (Real National Income)/Population

Where

Real national income= Money national income × (Base year price index)/(Current year price index)

In order to determine the rate of change in the standard of living, the following symbols are used.

S = (G/C)/P where, S = Standard of living (= average real per capita income)

R = Real income = Nominal GDP/CPI = G/C, G = Gross Domestic Product (GDP)

C = Consumer Price Index, P = Population, R/P = Real per capita income

Standard of Living = (G/CPI)/Population =(Real GDP)/Population

R/P = Real per capita income

Standard of Living = (G/CPI)/Population =(Real GDP)/Population

Taking the natural logarithm of the above expression we get:

$$LnS = LnG - LnC - LnP$$

Differentiating it with respect to time we get:

$$\frac{1}{S}\frac{dS}{dt} = \frac{1}{G}\frac{dG}{dt} - \frac{1}{C}\frac{dC}{dt} - \frac{1}{P}\frac{dP}{dt} \quad where$$

$$\dot{S} = \frac{1}{S}\frac{dS}{dt} = rate \ of \ growth \ of \ the \ satndard \ of \ living$$

$$\dot{G} = \frac{1}{G}\frac{dG}{dt} = rate \ of \ growth \ of \ nominal \ GDP$$

$$\dot{C} = \frac{1}{C}\frac{dC}{dt} = rate \ of \ growth \ of \ inflation$$

$$\dot{P} = \frac{1}{G}\frac{dP}{dt} = rate \ of \ growth \ of \ population$$

$$\dot{S} = \dot{G} - \dot{C} - \dot{P} \quad putting \ the \ respective \ values, \ we \ get \ the \ desired \ result.$$

The growth rates of the variables were calculated using the following formula. For example, population growth rate $\overset{\bullet}{P}$ of India was calculated as shown here.

$$\overset{\bullet}{P} = \left\{ \left[\frac{V_n}{V_0} \right]^{\frac{1}{N}} - 1 \right\} 100 \quad where$$

$V_0 = initial\ value\ (700058589),\ V_N = last\ value\ (1258373794)$

$N = number\ of\ years\ (in\ our\ case\ N = 32),\ which\ gives\ \overset{\bullet}{P} = 1.84$

7.   Population, inflation and the standard of living

In fact, there is a direct link among GDP growth, population growth, inflation rate and the standard of living in a country. Population growth and the rate of inflation need to be discussed with reference to living standards. India is an overpopulated country. Given this society as a whole and the poor in particular, are seen as likely to be worse off if population growth is rapid. The decadal average annual growth rate of the Indian economy (GDP) in the 1980s was 5.65 per cent after hovering around 3.5 per cent in the previous three decades. During 2001-02, the economy grew by 5.6 per cent. The population growth was about 2 per cent in the last decade, the average inflation rate since 1992 comes out to be about 4 per cent (primary product prices). The standard of living (SOL) of a country is to be based, *inter alia,* mainly on the growth rate of per capita real income which is obtained by subtracting the growth rate of inflation and population from the growth rate of GDP. The data given above in Table 3 gives us – 2.18 per cent (i.e. 7.51 – 7.85 – 1.84= -2.18) growth rate in per capita real income ; showing a downward trend in the SOL of India Sometime it becomes a controversial issue as to what rate of GDP, population and inflation growth need be considered for planning or forecasting purposes. In our view, past trends of these determinants would be a realistic approach. So to achieve the desired result of a sustained improvement in the SOL of the country, alignment of population growth rate and the rate of inflation with economic growth rate is essential.

In fact rapid population growth per se is not a cause for concern if accompanied by commensurate levels of economic growth, with low economic growth rates and less than dynamic economy, high population growth rates may result in even further declining of real gross domestic product. In reality, the explosive growth rate of population is neutralizing whatever economic growth and development is being made by the country. It is not per capita GDP that matters; it is the per capita real GDP that truly indicates the standard of living of a country. Indeed, there is evidence of growing poverty, rising old-age dependency ratio, environmental degradation, rapid urbanization and rising social problems that all reflect the consequences of high population growth.

8. Social implications of ageing population

There are many aspects in which ageing is an important issue: for example, the growth of the older segment of the population will lead to a reduction in the size of the work force and a simultaneous growth in the percentage of the population over retirement age.

The changing composition of the population has major implications for both the government and society. The old-age dependents tend to have very low incomes and therefore need income support. They will have to look to their families for care in a way that has not changed in India for centuries. The greying population may not only slow economic

growth, but also heighten social tension and weaken cohesion in the community. Many elderly people are unable to look after themselves and therefore need care in the community. The joint family system, which used to provide a form of social security, is disintegrating. Even in villages where approximately three-fourths of India's population live and where the process of change has been slow, changes have been taking place, which are not favourable to the elderly (Chanana and Talwar,1987). In the absence or reduction of support from their relatives, they would have to look towards the government for support. They are particularly expensive for the government in terms of pension and social benefits budgets, imposing strains upon government finance. It is explicitly mentioned in the 'State of World Population 2000' issued by the United Nations that more than half of all elderly people in India are on the verge of poverty. The higher the old age dependency ratio, the lower will be the incomes of workers if dependents are to receive a given income. Workers will see their share of national income fall over the next 40 years if pensioners are to increase their incomes at the same rate as that of workers. A sharp increase in the proportion of pensioners will cause a rise in net financial liabilities of public pension and health schemes. A rising percentage of this expenditure in gross domestic product (GDP) will leave less money with the government to spend on other projects. Tough decisions will have to be made in order to deal with an ageing society.

9.   Conclusion and policy recommendations

In the new century, India will be facing an aging population problem: a growing number of senior citizens, a shrinking number of young people and feminization of the society. The aging of India's population may have serious social and economic implications in the future unless they are addressed now with appropriate population, health and economic policies. Furthermore, females are becoming more educated and independent, they are marrying later and are more conscientious about family planning. Thus, a liberal well structured economic policy can do a lot of good for the economy of India because more workers will be needed in the future at the high and lower ends of the skills scale.

To respond to this mounting demographic pressure, the government must come up with the new policies, which could, for example, limit salary-related benefits for new retirees by a certain percentage, and may gradually raise the pensionable age from 60 at present to 65 years. Unless something is done urgently, the pension fund will go into red within a decade or so. With a fast greying population, the issue is of more than mere academic interest. To establish a healthy ageing society, formal investments by the government will be needed to care for elderly people, including rapid development of pension schemes and establishment of a medical insurance system; otherwise huge social problems with significant economic consequences are both inevitable and imminent.

Over population in India could be attributed to the following factors.

● The birth rate is higher than the death rate. The death rates have declined considerably, but the birth rates have not declined enough, resulting into an increase in population growth rate.

● The total fertility rate (TFR) has decreased quite impressively, from 5.5 children in 1970 to 2.4 today. The maternal mortality rate has decreased by 66%   from 560 in 1990 to 190 in 2013 . Early marriage is very common in India, consequently, it prolongs the child bearing age.

● Poverty and illiteracy is an other reason for over population. Impoverished families believe that bigger families are better because more family members mean more earning hands, more and cheaper farm workers in the field, more children means more people to take care of their parents in their old age.

It must be remembered that development and population are interacting variables, each affecting the other. Appropriate economic and population policies that are culturally relevant to deal with the multiple issues such as economic security, healthcare and quality research in ageing population are to be formulated and implemented to ward off the adverse socio-economic consequences of the ageing population in India.

Following actions are recommended to tackle this problem of population explosion and to improve the standard of living in the country.

- People should be informed via media and through education of the benefits of smaller family size. Use of contraceptive devices should also be encouraged.
- Due emphasis should be given to build human capital (education and health).
- Creating jobs to match the population growth rate in general and to end youth unemployment rate in particular to gain the full advantage of population dividend.
- Reduction in income inequality to bridge up the gap between the haves and have nots.
- Incentives should be given to increase birth spacing along with birth reduction.
- Improve female education to reduce fertility rate.
- Legal marriage age should be increased to reduce strain on existing infrastructure and natural resources.
- Investment in education of youthful population to achieve demographic dividend in future.
- Both formal and informal sectors must be tapped to increase employment as well as to improve productivity, efficiency and competitiveness.
- Reduction of population growth rate and inflation will increase the real per capita income (standard of living). Tight monetary policy is needed to combat inflation.
- Population control policies should be formulated and effectively implemented.
- The authorities concerned should come up with appropriate fiscal and monetary policies to improve the balance of payments position by making the current account and capital account component of balance of payments positive.

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